

Project: FOTONIKA-LV

Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research Area

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Final collection of reports on repatriation and recruitment

WP2- Repatriation and Recruitment of Experienced Researchers

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Release Approval

| Name | Role | Date |
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| Kalvis Salmins | WP Leader | |
| Sandra Smalina | Quality Manager | |
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Table of Contents

| | |
|--|-----------|
| 1. Introduction..... | 4 |
| 2. List of recruited persons..... | 5 |
| 3. Repatriation and recruitment reports | 7 |
| 3.1. Dr.hab. Uldis Berzins..... | 7 |
| 3.2. Dr. Aigars Ekers..... | 10 |
| 3.3. Dr.Phys. Janis Alnis | 15 |
| 3.4. PhD cand. Janis Blahins..... | 23 |
| 3.5. Dr.Phys. Roman Viter | 26 |
| 3.6. Dr.Phys. Nikolai Bezuglov | 29 |
| 3.7. Dr.Phys. Teodora Velcheva | 33 |
| 3.8. Dr. Christina Andreeva Markovska | 37 |
| 3.9. Dr.Phys. Asparuh Georgiev Markovski | 40 |
| 3.10. Dr. Uldis Gross | 41 |
| 3.11. Dr. Arvind Kumar Saxena..... | 42 |
| 3.12. Dr. Justas Zdavicius | 44 |
| 3.13. Dr. Vygandas Laugalys..... | 46 |
| 3.14. Dr. Jorge del Pino..... | 48 |
| 3.15. Dr.Phys. Ilja Fescenko | 50 |
| 3.16. Dr.Phys. Mikelis Svilans..... | 53 |
| 3.17. Dr.Alexander Narbut..... | 55 |
| 3.18. Dr. Amara Linna Grapa..... | 58 |
| 3.19. Vidvuds Beldavs | 60 |
| Conclusions | 65 |
| Annexes..... | 66 |
| Annex 1: CV Teodora Velcheva Kirova..... | 66 |
| 3.Annex . CV Justas Zdanavicius..... | 79 |
| 4.Annex . CV Vygandas Laugalis..... | 81 |
| 5.Annex. Arvind Kumar Saxena | 82 |
| 6.Annex. Alexander Narbut..... | 85 |
| Annex. 7 Abbreviations..... | 88 |

1. Introduction

During planning process following objectives were set for the Work package 2:

Objectives:

1. To strengthen photonics research capacity at the University of Latvia and promote transfer of knowledge by: the repatriation of 6 identified Latvian scientists; recruitment of 4 identified incoming experienced researchers; recruitment further 4 researchers in the open competition for announced vacancies. The specification for two of the open competitions will be determined by the Management Committee on competitive basis based on proposals by laboratories of FOTONIKA-LV, while for the two other the specifications have already been identified as:
 - Researcher with specific experience in the Earth Geodynamic observatory for 3 years to meet increased demand for measurements from the networks forming such type of observatories;
 - Experienced researcher for one year for theoretical calculations and joint planning of research on night-time atmospheric chemistry and design of night-time remote sensing device (*WP3, task 1*).
2. To strengthen capacity for research training for MSc, PhD students and young researchers supported by European Structural fund fellowship grants;
3. To improve and intensify usage of photonics research infrastructure upgraded from EU Cohesion policy programs European Regional Development fund for (2004-2006) in Latvia and via the implementation of WP3 in this project;
4. To increase overall quality and quantity of scientific outcomes of research activities e.g. number and quality of publications, patents, and conference reports;

To increase capacity to raise new project in FP7 and Horizon 2020 as well as contributing to implementation of other programs on EU level e.g. joint technology initiatives, funding devoted for the applied science from industry, etc.

2. List of recruited persons

During planning process following scientists and technicians were planned to recruit

| | | Recruitment period | Contract | Planned |
|-----------|---|---|----------|---------|
| Task 2.1 | Repatriation of experienced researcher - Dr.hab.Uldis Berzins, Sweden, <i>(trained at the LU ASI)</i> . | 01.02.2012. – 30.06.2014. | 26 | 36 |
| Task 2.2 | Repatriation of experienced researcher Dr.Aigars Ekers, European Science Foundation, France <i>(trained at the LU ASI)</i> . | 01.02.2012. – 15.03.2014. | 25 | 36 |
| Task 2.3 | Repatriation of experienced researcher Dr.Jānis Alnis, Germany <i>(trained at the LU ASI)</i> . | 01.04.2013.- 31.04.2015. | 25 | 30 |
| Task 2.4 | Repatriation of experienced researcher Dr.Janis Pukite, Germany <i>(trained at the LU ASI)</i> . | Repatriation was not performed | 0 | 12 |
| Task 2.5 | Repatriation of experienced researcher Dr.Dimitrijs Docenko, Germany <i>(trained at the LU AI)</i> . | Repatriation was not performed | 0 | 36 |
| Task 2.6 | Repatriation of highly skilled and experienced technician - MsC Optoelectronics Janis Blahins Israel, <i>(worked in the LU ASI)</i> . | 01.02.2012. – 31.04.2015. | 39 | 36 |
| Task 2.7 | 3 year recruitment of incoming experienced researcher from Bremen, Priv.-Doz. Dr. Annette Ladstätter-Weissenmayer, Germany. | Repatriation was not performed | 0 | 36 |
| Task 2.8 | 1 year recruitment of incoming experienced researcher Dr. Roman Viter, Ukraine. | 01.02.2012.- 31.12.2012.° 01.05.2014.- 30.04.2015. | 23 | 12 |
| Task 2.9 | 3 year recruitment of incoming experienced researcher Dr. Nikolay Bezuglov, Russia | 01.02.12-31.08.12 ; 01.01.13.-31.01.15 | 25 | 33 |
| Task 2.10 | 3 year recruitment of incoming experienced researcher Dr. Christina Andreeva-Markovska, Bulgaria. | 01.06.12-31.07.12, 01.09.12-31.03.15. | 21 | 36 |
| Task 2.11 | Repatriation or recruitment of 4 - 5 experienced researchers in the field of photonics selected and recruited in open competition during the Project. | | | |
| | Asparuh Georgiev Markovski, Bulgaria | 01.09.2012-31.01.2013 | 15 | |
| | Teodora Velcheva Kirova, South Africa | 11.11.2012-30.04.2013 | 27 | |
| | Jorge del Pino, Cuba | 22.04.2013.- 30.04.2015. | 25 | |
| | Justas Zdanavičius, Lithuania | 20.06.2012.- 20.06.2013. | 12 | |
| | Vygandas Laugalys, Lithuania | 01.07.2013.- 31.07.2014. | 12 | |

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|--|---|---|-----|--|
| | Repatriated Dr. Phys.. Amara Lynna-Graps, United States | 20.08.2013 – 30.04.2015 | 21 | |
| | Repatriated Dr.Phys.Ilja Fescenko, Switzerland. | 16.06.2014.- 30.04.2015 | 13 | |
| | Dr.Phys. Arvind Kumar Saxena, India | 01.09.2014-31.04.2015 | 8 | |
| | Repatriated Vidvuds Beldavs (US) | 10.12.2013.- 30.04.2015. | 15 | |
| | Dr.Phys. Mikelis Svilans <i>Unfortunately Mikelis Svilans dyed in October 2014</i> | 01.04.2014.- 31.05.2014 01.08.2014-5.10.2014. | 4,5 | |
| | Maris Abele | 01.03.2012...- 30.04.2015. | 24 | |
| | Alexander Narbut | 01.02.2015.- 30.04.2015. | 3 | |
| | TECHNICIANS | | | |
| | Aigars Apsītis | | 10 | |
| | Āris Veispals | | 6 | |
| | Viesturs Silamikelis | | 11 | |

3. Repatriation and recruitment reports

3.1. Dr.hab. Uldis Berzins



„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.02.2012.-30.04.2014. |
| Repatriation period | 01.02.2012.-15.06.2014 |
| Scientist (name, surname, laboratory) | Uldis Berzins, Repatriated researcher, Laboratory of Atomic Physics, Atmosphere Physics and Photochemistry. Institute of Atomic Physics and Spectroscopy, Association FOTONIKA-LV. University of Latvia. uberzinsh@gmail.com |
| Science WP2, Task 2.1. | <p><u>Scientific topic:</u> Basic and applied research for photonics in nanoworld.</p> <p>The Project offered opportunity of return to my native university and my home research institute and to join the group of former colleagues. The following directions of research were planned for my return:</p> <ol style="list-style-type: none"> 1) Designing and building optical tweezers, and start experimental activities on biological objects in Riga. Possible cooperation partners could be Prof. Dag Hanstorp at Chalmers University of Technology and Mathias Ericsson in University of Luleå 2) Designing and building small transportable Negative Ion Beam accelerator for VUV region of Spectra. Expected cooperation with Dag Hanstorp at Chalmers University of Technology and Prof. Sune Svanberg at Lund Laser Centre. 3) Designing and building RF electrodeless atomic spectra light sources devices for VUV region of spectra to measure atomic transition probabilities and atomic lifetimes for SI, II, BrI, Cl. Expected cooperation with Prof. Sune Svanberg at Lund Laser Centre 4) Initiation of applied photonics research projects in cooperation with SMEs in the Baltic countries and the EU. <p><i>The following benefitting laboratories and departments of FOTONIKA-LV were foreseen:</i></p> <ul style="list-style-type: none"> ➤ Laboratory of Atomic and Atmosphere Physics and Photochemistry at LU ASI; ➤ Laboratory of Biooptics and Fiber-optics at LU ASI |
| Outcomes of implementation of above mentioned scientific tasks | “The experimental studies of molecular and atomic ions in beams” were determined as more detailed direction for my research activity during repatriation time. During the first year the scientific contacts were established and experimental work started. The work was organized in collaboration with Department of physics Gothenburg University professor Dag Hanstorp, and with Department of Physics |

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| | <p>Stockholm University professor Henrik Cederquist. The group of researchers from university of Latvia: A. Apsitis, J Blahins, J Klavins, A Rieba joined my project.</p> <p>The collaboration with Gothenburg group was conducted in two directions:</p> <ol style="list-style-type: none"> 1. The design and building of transportable Negative Ion Beam accelerator was completed in Gothenburg, and now the Gothenburg-Riga-Ion_Beam_Apparatus (Mobile) or GRIBA(M) is transported to Riga and ready for the first experimental tests. The GRIBA can be used for experimental studies of simple molecular ions of astrophysical interest, and for design and studies of ion sources for scientific and industrial applications. Possible collaboration with Baltic Scientific Instruments LTD dealing with sensing instrumentation for ionizing radiation. 2. The work on development of ion beam apparatus GUNILLA was performed. The High Voltage pulse source was designed for sputter ion source. It was implemented in apparatus and first experiments performed. The significant improvement of efficiency for number of ions was observed <p>The data will be published in Rew. Sci. Instr. and will be reported in 47 EGAS conference in year 2015.</p> <p>The studies of Polycyclic Aromatic Hydrocarbons in collisions with rare gases performed at Stockholm's university was very fruitful</p> <p>Polycyclic Aromatic Hydrocarbons (PAHs) are an important component of interstellar dust and gas and are probably responsible for the ubiquitous infrared emission bands present in the spectra of many galactic and extragalactic sources . The processes by which PAHs and other large molecules (e.g. fullerenes) are formed and destroyed in the interstellar medium are not yet understood. For example, collisions between PAHs and ions in interstellar shocks are thought to be important destruction mechanisms, but fragmentation cross-sections and the related dissociation energy barriers are mostly not known. Experiments on collisions between PAH ions and atoms, particularly in the 100 eV energy regime, may elucidate the role of such collisions in the processing of interstellar carbon. We have studied collision induced dissociation (CID) experiments between small (6 to 24 carbon atoms) PAH (or nitrogen substituted PAHN) ions and rare gases conducted at center-of-mass energies (for helium) of around 100 eV. The results differ qualitatively from previous work, particularly in the CH_x loss channel, which is much more prominent than is typically observed and here it even becomes dominant for the larger PAHs. In thermally driven processes such as photo-induced dissociation, evaporation of H-atoms and C₂H₂ units are typical results of the lowest energy decay pathways. For the present collisions, fragmentation is frequently initiated by prompt knock-outs of single carbon atoms, after which the excited fragment ion may decay further. The electrospray ion source used in this work, or a copy of it, may also be mounted at the DESIREE double electrostatic ion storage ring. This will enable collisions with a variety of ions at low (10 K) temperatures and with center-of-mass energies in the meV range.</p> <p>The results are published in 2 publications,</p> <ol style="list-style-type: none"> 1) M H Stockett, H Zettergren, L Adoui, J D Alexander, U Berzins, T Chen, M Gatchell, N Haag, B A Huber, P Hvelplund, A Johansson, H A B Johansson, K Kulyk, S Rosen, P Rousseau, K Stochkel, H T Schmidt and H Cederquist. Nonstatistical fragmentation of large molecules. <i>PHYSICAL REVIEW A</i> 89(3), 2014. 2) M. H. Stockett, M. Gatchell, J. D. Alexander, U. Bērziņš, T. Chen, K. Farid, A. Johansson, K. Kulyk, P. Rousseau, K. Støchkel, L. Adoui, P. Hvelplund, B. A. Huber, H. T. Schmidt, H. Zettergren and H. Cederquist Fragmentation of anthracene C₁₄H₁₀, acridine C₁₃H₉N and phenazine C₁₂H₈N₂ ions in collisions with atoms, <i>Phys. Chem. Chem. Phys.</i>, 2014,16, 21980-2198. OI: 10.1039/C4CP03293D. Received 24 Jul 2014, Accepted 02 Sep 2014. First published online 03 Sep 2014. |
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| | <p>3) And reported in ECAMP conference in Århus 2013. Mark H. Stockett, John D. Alexander, Uldis Bērziņš, Tao Chen, Khadijah Farid, Michael Gatchell, Anders Johansson, Kostiantyn Kulyk, Henning T. Schmidt, Henning Zettergren, and Henrik Cederquist; Polycyclic Aromatic Hydrocarbons in Collisions with Atoms. Tu-T2-20, ECAMP 11, 24-28 June 2013, Århus</p> <p>Unfortunately long-term support from Latvian National Science foundations was not granted for the repatriates', as well as faced health problems and therefore and I decided interrupt my active participation in repatriation project since June 2014.</p> |
| International and national cooperation | <p>Several long-term visits have been performed to the Department of Physics of Stockholm University and Department of Physics of Gothenburg University. Besides specific project was raised and visit to Freiburg University performed: Participation in Bilateral project University of Latvia and Freiburg University: "Experimental research dedicated to interactions of negative ions with femtosecond laser light beams".</p> |
| Colloquiums, conferences and publications | <p>1) Contributions in Colloquiums of FOTONIKA-LV</p> <ul style="list-style-type: none"> ➤ FOTONIKA-LV VII kolokvijs, 02.02.2012. <p><i>Uldis Bērziņš: Insight in the history of collaborations with colleagues in Lund and with guest Prof. Zhongshan Li.</i></p> <ul style="list-style-type: none"> ➤ FOTONIKA-LV IX kolokvijs, 03.04.2012. <p><i>Dag Hanstorp, Uldis Bērziņš: Insight in Science activities at Gothenburg University and Spectroscopy of Negative Ions - Fundamental Processes, Femtosecond Spectroscopy and Applications in Astrophysics</i></p> <ul style="list-style-type: none"> ➤ FOTONIKA-LV XII kolokvijs, 20.12.2012. <p>Dr.Hab.Uldis Berziņš <i>Contribution of FOTONIKA-LV in the domain of negative ions</i></p> <p>2) Conferencies:</p> <ul style="list-style-type: none"> ➤ <i>Participation in 44th Conference of the European Group on Atomic Systems, Gothenburg, 9-12.july 2012, Gothenburg</i> ➤ <i>The 1st International Conference "Photonics Technologies – Riga 2012", August 27-28, 2012. Lecture: Dr. Hab. Uldis Berzinsh., The Development of Laser Pattern Generators from Single Beam in Rectangular Coordinates to Stamps in Polar Coordinates</i> ➤ <i>Uldis Berzinsh, Janis Blahins, Aigars Apsītis, Dag Hanstorp. Ion beam instrument GRIBA success story of the Project The FOTONIKA-LV conference: "Achievements and Future prospects" Riga, 23-24 April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV.</i> <p>3) Papers</p> <p>Three more publications in progress</p> |
| National and International projects | <p>The project proposal to Latvian Research Council call for proposal was submitted: Dr.Hab. Uldis Bērziņš&Dr.Dag Hanstorp. Experimental Studies of Negative Ions: Design of Mobile Apparatus and Experiments Using various Radiation Sources, Getting marks 79 from 90 possible.</p> <p>Principal investigator in the following FP 7 Project proposals:</p> <p>1) FP7 project proposal was submitted on March 2013 Dr.h.Uldis Berziņš. Coordinator Spectroscopy of Ions Using Lasers and Synchrotron Radiation – a Global Scale Community. IONS SPECTRA, FP7-PEOPLES-IRSES-2013, Nr 612582. In consortia research teams from Gothenburg, Stockholm, Bekerley, Mexico, St.Peterburg and Minsk.</p> <p>Bilateral project at University of Latvia and Freiburg University : "Experimental research dedicated to interactions of negative ions with femtosecond laser light beams"</p> |
| Education | In year 2012/2013 a MSc student Marcis Sarma was involved in research activities. |
| Reporting date | May 2015 |

3.2.Dr. Aigars Ekers

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| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.02.2012.-30.04.2015. |
| Recruiting period | 01.02.2012.-15.03.2014. |
| Scientist (name, surname, laboratory) | <p><i>Dr. Aigars Ekers, DOB: 27.08.1971, ID: 270871-10544, e-mail: aigars.ekers@lu.lv</i></p> <p><i>University of Latvia, Institute of Atomic Physics and Spectroscopy and Molecular Beam Laboratory of the Laser Centre.</i></p> |
| Science | <p>As outlined in the initial FOTONIKA-LV REGPOT proposal, the aim of recruitment of Dr. Ekers was to repatriate him to the University of Latvia for re-opening of the Molecular Beam Laboratory and re-initiation of research on quantum state manipulation. The Molecular Beam Laboratory is now in operation, and a number of research activities are taking place.</p> <p>The research work included:</p> <ol style="list-style-type: none"> 1. studies of the Autler-Townes effect in hyperfine level systems, whereby the most interesting result is the formation of dark states for some combinations of hyperfine levels but not for others; 2. demonstration of novel effects of transit time broadening on spectral lineshapes, whereby it was demonstrated that two effects known to affect line broadening upon interaction of molecules with tightly focused Gaussian laser beams - curvature of electromagnetic field wavefronts and increasing transit time of molecules with increasing distance from the laser beam waist – compensate each other exactly, such that only the waist size of the laser beam determines the transit time broadening; 3. indications for Ramsey interference have been observed in a three-level ladder scheme with hyperfine structure coupled by two laser fields. It opens interesting perspectives for applications to coherent population switching of excited states; 4. collisional ionization of Rydberg atoms has been studied under the conditions of diffusion ionization. These studies have further relevance to the studies of cold Rydberg gases that shall be initiated after building a magneto-optical trap. The research has already yielded two published papers, one accepted publication, another manuscript close to submission, and a number of contributions at international conferences. |
| International and national cooperation | <p>Dr. Ekers has engaged in international collaboration with a number of scientists from different countries. This includes collaboration with:</p> <ul style="list-style-type: none"> ➤ Prof. Bergmann from the Technical University of Kaiserslautern on quantum |

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| | <p>state manipulation (Bergmann is a strategic partner of FORONIKA-LV);</p> <ul style="list-style-type: none"> ➤ Prof. Harold Metcalf from Stony Brook University on coherent population transfer schemes to Rydberg states; ➤ Dr. Igor Ryabtsev from Novosibirsk Institute of Semiconductor Physics on Rydberg atom ionization; ➤ Prof. Ite Yu from the National Tsing Hua University; ➤ Prof. Gediminas Juzeliunas from Vilnius University on coherent phenomena in light-matter interactions; ➤ there are further emerging collaborations such as that with Prof. Guido Pupillo from Strasbourg University on collective phenomena in Rydberg gases. |
| Papers and conferences | <p>Papers in journals</p> <ol style="list-style-type: none"> 1. M. Bruvelis, J. Ulmanis, N.N. Bezuglov, K. Miculis, C. Andreeva, B. Mahrov, D. Tretyakov, and A. Ekers. <i>Analytical model of transit time broadening for two-photon excitation in a three-level ladder and its experimental validation</i>. Phys. Rev. A 86, 012501 (2012). 2. M. Arndt, A. Ekers, W. von Klitzing, and H. Ulbricht, <i>Editorial: Focus on modern frontiers of matter wave optics and interferometry</i>, New Journal of Physics 14, 125006 (2012). 3. D.K. Efimov, N.N. Bezuglov, A.N. Klyucharev, Y.N. Gnedin, K. Miculis, A. Ekers. <i>Analyses of light-induced diffusion ionization of three dimensional Hydrogen atom based on Floque technics and split propagation method</i>. Optics and Spectroscopy (2013) accepted for publication. 4. V. Kudriašov, J. Ruseckas, A. Mekys, A. Ekers, N. Bezuglov, and G. Juzeliunas. <i>Superluminal two-color light in a multiple Raman gain medium</i>. Phys. Rev. A, v. 90, 033827 (2014) 5. Weilun Hung, Panpan Huang, Feng-Chuan Wu, Martins Bruvelis, Hau-Yi Xiao, Aigars Ekers, Ite A. Yu, "Storage time of cold Rb atoms in an optical dipole trap formed by a multimode fiber laser", J. Opt. Soc. Am. B, doc. ID 231992 [1] (posted 12 February 2015, in press).[1] http://www.opticsinfobase.org/josab/upcoming_pdf.cfm?id=231992 6. Formation of Multiple Bright and Dark States in Hyperfine Levels of Na via Autler-Townes Effect", T. Kirova, M. Bruvelis, A. Cinins, K. Miculis, A. Ekers, D. Efimov, N. N. Bezuglov, I. I. Ryabtsev, and M. Auzinsh, to be submitted to European Journal Physics D 7. M. Bruvelis, A. Cinins, A. Leitis, D. K. Efimov, N. N. Bezuglov, A. S. Chirtsov, F. Fuso, A. Ekers. <i>Specificity of the optical pumping upon excitation of cyclic transitions of Na and Cs in ultra-slow cold beam</i>. Optics and Spectroscopy, submitted. http://link.springer.com/journal/11449 [1] 20.03.2015 8. M. Bruvelis, T. Kirova, K. Miculis, A. Ekers, Visualization of dark states in Hyperfine Levels of Na via dynamic excitation of a three-level ladder, Phys. Rev. (in preparation). 9. T. Kirova, M. Bruvelis, K. Miculis, A. Ekers, L. Kalvans, and M. Auzinsh, Evolution of Dark and Bright States in Hyperfine Levels of Na via Autler-Townes Effect, Phys. rev. (In preparation). 10. N. N. Bezuglov, T. Kirova, D. Efimov, K. Miculis, M. Bruvelis, A. Cinins, A. Ekers, L. Kalvans and M. Auzinsh, "Manipulation of Selection Rules via Autler-Townes Effect in Hyperfine Levels of Na", in preparation for Phys. Rev. A. 11. N. Porfido, S. Birindelli, F. Tantussi, F. Fuso, M. Bruvilis, N. N. Bezuglov, A. Ekers. Nonlinear effects combinations in optical pumping of a cold and slow atom beam. Prepared for publication in Phys. Rev. A. 12. T. Kirova, A. Cinins, M. Bruvelis, D.K. Efimov, K. Miculis, N.N. Bezuglov, A. Ekers, M. Auzinsh and I.I. Ryabtsev. Consequences of Multiple Dressed |

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| | <p>States formation in atomic nondegenerate Hyperfine Levels I: the Death of Dark and Bright Components in Autler-Townes Spectra. Prepared for publication in Phys. Rev. A.</p> <p>13. N. Bezuglov, D. Efimov, K. Miculis, A. Ekers, Stirap under a pressure of strong control field, Phys. Rev. Letters (in preparation).</p> <p>14. D K Efimov, N N Bezuglov, K Miculis and A. Ekers. Penning ionization of a non-symmetrical atomic pair in a cold Rydberg gas: the Tom and Jerry effect. Prepared for publication in Phys. Rev. Lett.</p> <p>Conference contributions</p> <p>1. <i>"Dark State Formation in Three-Level Ladder System in Na Supersonic Atomic Beam"</i>, D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, T. Kirova, C. Andreeva, and A. Ekers, 17th International School on Quantum Electronics: Laser Physics and Applications", 24-28 September 2012, Nessebar, Bulgaria.</p> <p>2. <i>"Manifestation of Dark State Formation in Na Hyperfine Level System"</i>, D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, T. Kirova, and A. Ekers, "Quantum Africa 2", p.54, 3-7 September 2012, Drakensberg, South Africa.</p> <p>3. <i>"Effects of Dark State Formation in the Hyperfine Excitation Spectra of Na atoms"</i>, D. Efimov, M. Bruvelis, J. Ulmanis, K. Miculis, N. N. Bezuglov, T. Kirova, and A. Ekers, The 23rd International Conference on Atomic Physics ICAP 2012, p. 268, 23-27 July 2012, Paris, France.</p> <p>4. <i>"Two Component Superluminal Light"</i>, N. N. Bezuglov, A. Ekers, J. Ruseckas, V. Kudriasov, and G. Juzeliunas, The 23rd International Conference on Atomic Physics ICAP 2012, p. 347, 23-27 July 2012, Paris, France.</p> <p>5. <i>"Manifestation of Dark State Formation in Na Hyperfine Level System"</i>, D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, T. Kirova, and A. Ekers, 44th meeting of EGAS, Volume number 36C, p.205, 9-13 July 2012, Gotheborg, Sweden.</p> <p>6. <i>"Applications of Laser Manipulation of Adiabatic States"</i>, A. Ekers, N. N. Bezuglov, K. Miculis, T. Kirova, M. Bruvelis, D. Efimov, C. Andreeva, A. Cinins, L. Kalvans, M. Auzinsh, 1st TLL/COLIMA Joint Workshop on manipulation of light by matter and matter by light, p. 7, 18-19 July, 2012, University of Latvia, Riga, Latvia.</p> <p>7. <i>"Analytical Model of Transit Time Broadening and Numerical Model of Residual Doppler Broadening for Two-Photon Excitation in a Three-Level Ladder and its Experimental Validation"</i>, M. Bruvelis, J. Ulmanis, A. Cininsh, N. N. Bezuglov, K. Miculis, C. Andreeva, B. Mahrov, D. Tretyakov, A. Ekers, 1st TLL/COLIMA Joint Workshop on manipulation of light by matter and matter by light, p.10, 18-19 July, 2012, University of Latvia, Riga, Latvia.</p> <p>8. <i>"Assymetric Penning Ionization of Two Rydberg Atoms"</i>, D. Efimov, N. N. Bezuglov, K. Miculis, A. Ekers, I. Beterov, 1st TLL/COLIMA Joint Workshop on manipulation of light by matter and matter by light, p.11, 18-19 July, 2012, University of Latvia, Riga, Latvia.</p> <p>9. <i>"Formation of multiple dressed states in hyperfine level systems of Na"</i> A. Cinins, T. Kirova, N. Bezuglov, M. Bruvelis, K. Miculis, A. Ekers, L. Kalvans, M. Auzinsh, D. K. Efimov and I. I. Ryabtsev, ECAMP11, University of Aarhus, Denmark, June 2013.</p> <p>10. <i>"Many-mode Floquet technique for two component superluminal light."</i> J. Ruseckas, V. Kudriašov, G. Juzeliūnas, A. Cinins, M. Bruvelis, N. Bezuglov and A. Ekers, ECAMP11, University of Aarhus, Denmark, June 2013.</p> <p>11. <i>"Nonlinear optical pumping of a slow and cold Cs beam"</i> N. Porfido, S.</p> |
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| | <p>Birindelli, F. Tantussi, F. Fuso, A. Ekers, N. N. Bezuglov, T. Kirova, CAMEL_2013, Bulgaria, June 2013.</p> <p>12. "Formation of Multiple Dressed States in Hyperfine Level Systems of Na", T. Kirova, N. Bezuglov, K. Miculis, D. K. Efimov, M. Bruvelis, A. Cinins, A. Ekers, L. Kalvans, M. Auzinsh, and I. I. Ryabtsev, poster presentation, International Workshop on Atomic Physics, focus days on "Quantum Dynamics in bbbbbb Intense Fields", November 25-29, 2013, Dresden, Germany</p> <p>13. "Experimental Observation of the Formation of Multiple Dressed States in Sodium Hyperfine Level Systems", E. Stegenburgs, A. Leitis, A. Cinins, M. Bruvelis, D. K. Efimov, N. N. Bezuglov, A. Ekers, T. Kirova, poster presentation, 72-nd Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 7 February 2014, Riga Photonics Centre, Institute of Atomic Spectroscopy, Riga, Latvia, book of abstracts, p. 33.</p> <p>14. "Study of STIRAP efficiency of helium Rydberg atoms in supersonic beams", N. Bezuglov, K. Michulis, M. Bruvelis, A. Ekers, H. Metcalf, poster presentation, 72-nd Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 7 February 2014, Riga Photonics Centre, Institute of Atomic Spectroscopy, Riga, Latvia, book of abstracts, p. 45.</p> <p>15. "Quiet STIRAP: High-Efficiency Method of Selective HF Rydberg Sublevels Excitation", D. K. Efimov, N. N. Bezuglov, A. Ekers, International Conference on Problems of Strongly Correlated and Interacting Systems, 28-13 May, 2014 - Saint-Petersburg, Russia, book of abstracts, p.58.</p> <p>16. "Nonlinear effects of optical pumping in spectroscopy of a cold Cs beam", A. Leitis, A. Cinins, M. Bruvelis, N. Bezuglov, D. Efimov, N. Porfido, F. Fuso, poster presentation, 10th International Young Scientist Conference "Developments in Optics and Communications", 9-12 April 2014, University of Latvia, Riga, Latvia, book of abstracts, p.76.</p> <p>17. C. Andreeva, Cinins A., Ekers A., Tretyakov D., Entin V., Yakshina E., Beterov I., Markovski A., Ryabtsev I., <i>Radio-frequency-induced Förster resonances in a few cold Rb Rydberg atoms</i>, 8 International conference "Basic Problems of Optics" BPO'2014, Saint Petersburg 20-24. 10. 2014</p> <p>18. "Manipulation of Hyperfine State Populations via the Autler-Townes Effect", A. Ekers, N. Bezuglov, K. Miculis, T. Kirova, M. Bruvelis, D. Efimov, A. Cinins, C. Andreeva, M. Auzinsh, 2nd International Symposium on Optics and its Applications, 1-5 September 2014, Yerevan, Armenia.</p> <p>19. D.B.Tretyakov, V.M.Entin, E.A.Yakshina, I.I.Beterov, Ch.Andreeva, I.I.Ryabtsev, "Controlling the interactions of a few cold Rb Rydberg atoms by radiofrequency-assisted Förster resonances", Abstracts of the Second International Workshop on Ultracold Rydberg Physics, Recife, Brasil, 5-8 October 2014, p.66</p> <p>20. D.B.Tretyakov, V.M.Entin, E.A.Yakshina, I.I.Beterov, C.Andreeva, and I.I.Ryabtsev, "Using radio-frequency electric field to enhance Rydberg atom interaction", Abstracts of the International Conference "Micro- and Nanoelectronics – 2014" (Extended session "Quantum Informatics - 2014"), 6-10 October 2014, Moscow-Zvenigorod, Russia, p.q1-03 (oral presentation).</p> <p>21. "Peculiarities of Bright and Dark States Formation in Three-level Ladders of Na Hyperfine Levels", T. Kirova, N. N. Bezuglov, D. K. Efimov, K. Miculis, M. Bruvelis, A. Cinins, E. Stegenburgs, A. Ekers, M. Auzinsh, and I. I. Ryabtsev, 3rd TLL/COLIMA Workshop on manipulation of light by matter and matter by light, 18-19 October 2014, Hsinchu, Taiwan</p> <p>22. "Nonlinear Effects in Optical Pumping upon Resonant Excitation of Ultra-Slow Beam of Cold Cs Atoms", N. Porfido, S. Birindelli, F. Tantussi, F. Fuso, N.N.Bezuglov, M. Bruvelis, and A. Ekers, D. Efimov, N. Bezuglov, K.</p> |
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| | <p>Michulis, and A. Ekers, 3rd TLL/COLIMA Workshop on manipulation of light by matter and matter by light, 18-19 October 2014, Hsinchu, Taiwan.</p> <p>23. N. N. Bezuglov, T. Kirova, A. Ekers, N. Porfido, S. Birindelli, F. Tantussi, "Nonlinear optical pumping of a slow and cold Cs beam". 73rd Annual Conference of the University of Latvia, Riga, Latvia, 6 February 2015.</p> <p>24. D.K. Efimov, N.N. Bezuglov, K. Miculis, A. Ekers. "Penning Ionization of Symmetrical Atomic Pair in a Rydberg Gas". 73rd Annual Scientific Conference of the University of Latvia, Riga, Latvia, 6 February 2015</p> <p>25. A. Cinins, M. Bruvelis, T. Kirova, N.N. Bezuglov, A. Ekers. "Coherent population switching in cold sodium atoms". 73rd Annual Scientific Conference of the University of Latvia, Riga, Latvia, 6 February 2015.</p> <p>26. N. Porfido, S. Birindelli, F. Tantussi, F. Fuso, Nikolay Bezuglov, Martins Bruvelis, and Aigars Ekers. Nonlinear effects in optical pumping upon resonant excitation of ultra-slow beam of cold Cs atoms. <i>The FOTONIKA-LV conference: "Achievements and Future prospects" Riga, 23-24 April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV</i></p> <p>27. Teodora KIROVA, Arturs CININS, Martins BRUVELIS, D. K. EFIMOV, Kaspars MICULIS, Nikolay BEZUGLOV, Aigars EKKERS, Marcis AUZINS AND I. I. RYABTSEV. Consequences of Multiple Dressed States Formation in Atomic Nondegenerate Hyperfine Levels. <i>The FOTONIKA-LV conference: "Achievements and Future prospects" Riga, 23-24 April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV</i></p> |
| International projects | <ul style="list-style-type: none"> • 2012-2014 – PI, US Office of Naval Research Grant No. N00014-12-1-0514, <i>Electromagnetic Field Mapping and Population Switching by Coherent Manipulation of Laser-Dressed Rydberg States</i>. • 2012-2014 - Co-PI in the trilateral Taiwan-Lithuania-Latvia project <i>Coherent manipulation of matter by light and light by matter</i>; • 2011-2015 – Co-PI (coordinator in the project application stage) EU FP7 International Research Staff Exchange Scheme project COLIMA, <i>Coherent manipulation of light and matter via interferences of laser-dressed states</i>, Contract PIRSES-GA-2009-247475. |
| Additional information | <p>This has been a very successful recruitment. Apart from a very successful scientific performance, Dr. Ekers closely collaborates with, and coordinates the work of, four other recruits of the FOTONIKA-LV project: Prof. N. Bezuglov, Dr. T. Kirova, Dr. C. Andreeva, and Dr. A. Markovski. He has re-opened the Molecular Beam Laboratory, in which new frequency doubled laser system acquired via the FOTONIKA-LV project has been installed and is being used for experiments. Two PhD students and two undergraduate students are working in the laboratory. Since July 2012 Dr. Ekers was elected as a Director of the Institute of Atomic Physics and Spectroscopy, bringing his European science administration experience and expertise to management practices of the Institute. Dr. Ekers was also involved in public outreach, having organized a TV programme on photonics and given interviews to national newspapers on several occasions.</p> <p>Unfortunately longterm sustainable support from Latvian National authorities was not granted for the repatriants and to save my family life and the future of my 5 children, I accepted the offer from Saudi Arabia university with very attractive salary and stability in recruitment in the April 2014.</p> <p>Nevertheless I am trying to sustain contacts with my team in Riga and to advice and moderate young researchers.</p> |

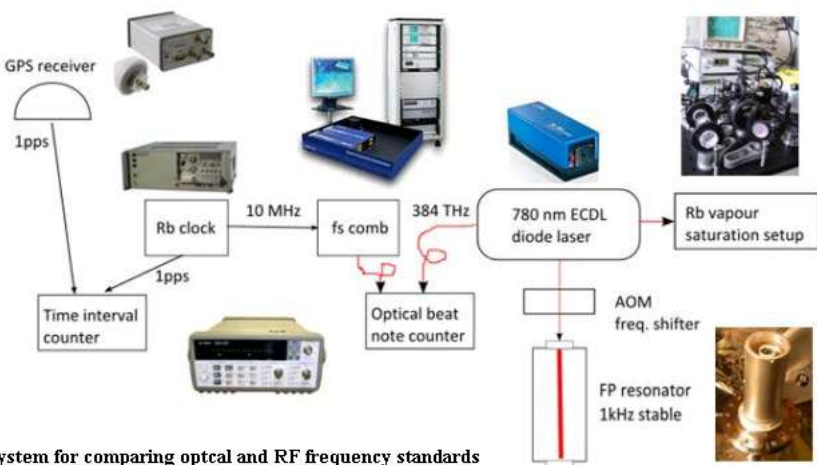
3.3. Dr.Phys. Janis Alnis

„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.04.2013.-30.04.2015. |
| Repatriation period | 01.04.2013-30.04.2015 |
| Scientist (name, surname, laboratory) | <p><i>Janis Alnis 160574-12759</i> <i>Repatriated researcher,</i> <i>Laboratory of Atomic Physics, Atmosphere Physics and Photochemistry</i> <i>Institute of Atomic Physics and Spectroscopy</i> <i>Association FOTONIKA-LV</i> <i>University of Latvia</i> <i>alnis@latnet.lv</i></p> |
| Science WP2, Task 2.3. | <p>Fotonika-LV project allowed the repatriated scientist Dr. Janis Alnis to establish a modern Laboratory of Quantum Optics at the Institute of Quantum Optics and Spectroscopy in Riga. This allows becoming a serious partner for collaboration with MPQ in Munich and ETH Zurich on precision optical frequency measurements. Visits to partners allow to participate in top-class experiments and become a coauthor in publications. In Riga some part of equipment necessary for these complicated experiments can be developed and tested as well as young people trained on leading-edge equipment.</p> <p>Research directions of Riga Quantum Optics Laboratory:</p> <ul style="list-style-type: none"> • Optical frequency metrology with a femtosecond optical frequency comb. • Development of optical frequency standards and comparison with radio-frequency standards. • Development of ultra-stable resonators for laser stabilization. • Free-space optical frequency transfer and distance measurements. • Global network of sensors, Internet of Things. <p>Webpage: http://www.asi.lv/New/Quantum%20Optics%20Lab%20Riga.pdf</p> <p>Optical frequency comb allows to precisely count the frequency of light. Below is a schematic view of the system that has been set up at ASI.</p> |

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| |  <p>System for comparing optical and RF frequency standards</p> <p><u>Scientific topic:</u> Femto second (fs) lasers in basic research and in applications from nanoscale to Space The Project offered opportunity of return to my native university and my home research institute and to join the group of former colleagues. The following directions of research were planned for my return:</p> <p><u>Description of work:</u> The objective of this task is to repatriate Dr. Janis Alnis, a research associate and individual Marie-Curie Fellow (<i>Hydrogen 1S - 2S, Nr. 41173, FP6-EIF</i>) in the group of Nobel prize winner Prof. Theodor Hänsch at Max Planck Institute of Quantum Optics. His most significant work was devoted to <i>Precision Laser Spectroscopy of the 1S-2S Optical Clock Transition in Atomic Hydrogen.</i>)</p> <p>The mission of return includedes a new dimension in research in Riga laboratory by introducing fs comb technology, which , combined with existing techniques will open new possibilities for</p> <ol style="list-style-type: none"> 1) distance measurements to Satellites. fs light will allow for better correction for atmospheric delays; 2) white light continuum from Earth to GOME Satellites in nighttime that measure molecular absorptions in air using Sunlight; 3) Fourier spectroscopy with frequency combs to Satellites. Only a photodetector with fast Fourier transform procession algorithm would need to fly; 4) Frequency comb for laser locking and spectrometer calibration and white light for biomedical applications. <p>Benefiting labs and departments of FOTONIKA-LV:</p> <ol style="list-style-type: none"> A) Laboratory of Atomic and Atmospheric Physics and Photochemistry at LU ASI; B) Department of Optics and mechanics at LU AI; C) Laboratory of Biooptics and Fiber-optics at LU ASI; D) High-resolution Spectroscopy and Light Source Technology at LU ASI; a. E) Fundamental Geodynamical observatory at LU AI. |
| Outcomes of implementation of above mentioned scientific tasks | <p>The most important tool for realization of my experimental activities was custom-made optical frequency comb that was delivered in August 2013 and has been set-up in the beginning of September at ASI.</p> <p>First it will be used for biomedical studies together with the Laboratory of Biooptics and for precision distance measurements on a laboratory length scale. Below is a detailed description of the frequency comb.</p> <p>The FC1500-250-WG Optical Frequency Synthesizer is a compact, portable and flexible fiber-based femtosecond comb system intended for optical frequency metrology in the near-infrared spectral range centered at 1560 nm. With the</p> |

Extension Packages M-VIS and M-NIR the system is capable of providing at the same time a source for frequency metrology in both the visible (530-900 nm) and the near-IR regions (1050-2100 nm) of the spectrum.

Complete, fully automated metrology system ready for 24h/7d operation. Comb mode spacing 250 MHz, wavelength range 35 nm centered at 1560 nm +/- 20 nm.

The ready-to-use, fully complete comb system is capable of providing and measuring optical frequencies at any color within the spectral range of the system with uncertainties at the 10 to the minus 14 level for averaging times in excess of 1 second.

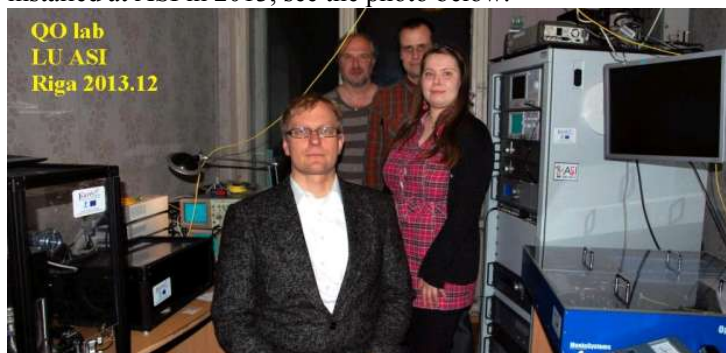
The system includes a mode locked femtosecond Er-doped fiber laser and an EDFA amplifier along with all optical, optoelectronic, and electronic components needed for stabilization of the carrier envelope offset frequency and stabilization of the repetition rate of the fs fiber laser. User software, PC, and displays for system control and data acquisition are included.

The mode locked fs Er-doped fiber laser in addition with the EDFA amplifier provides ultrashort pulses that are used as input for the f-2f interferometer for carrier envelope stabilization.


Center wavelength of the fiber laser is 1560 +/- 20 nm.

The output of an amplifier is spectrally broadened to cover an octave from approx. 1050 nm to 2100 nm (Extension Package M-NIR). The second harmonic generation with an additional EDFA amplifier (Extension Package M-VIS) provides a free space frequency doubled output in the visible, giving an output that covers the spectral range from 530 nm – 900 nm. High-power Measurement Port is available at 1064 nm +/- 3 nm wavelength that I the wavelength used in satellite laser ranging.

Optical frequency comb, diode lasers and Fabry-Perot resonator were installed at ASI in 2013, see the photo below.




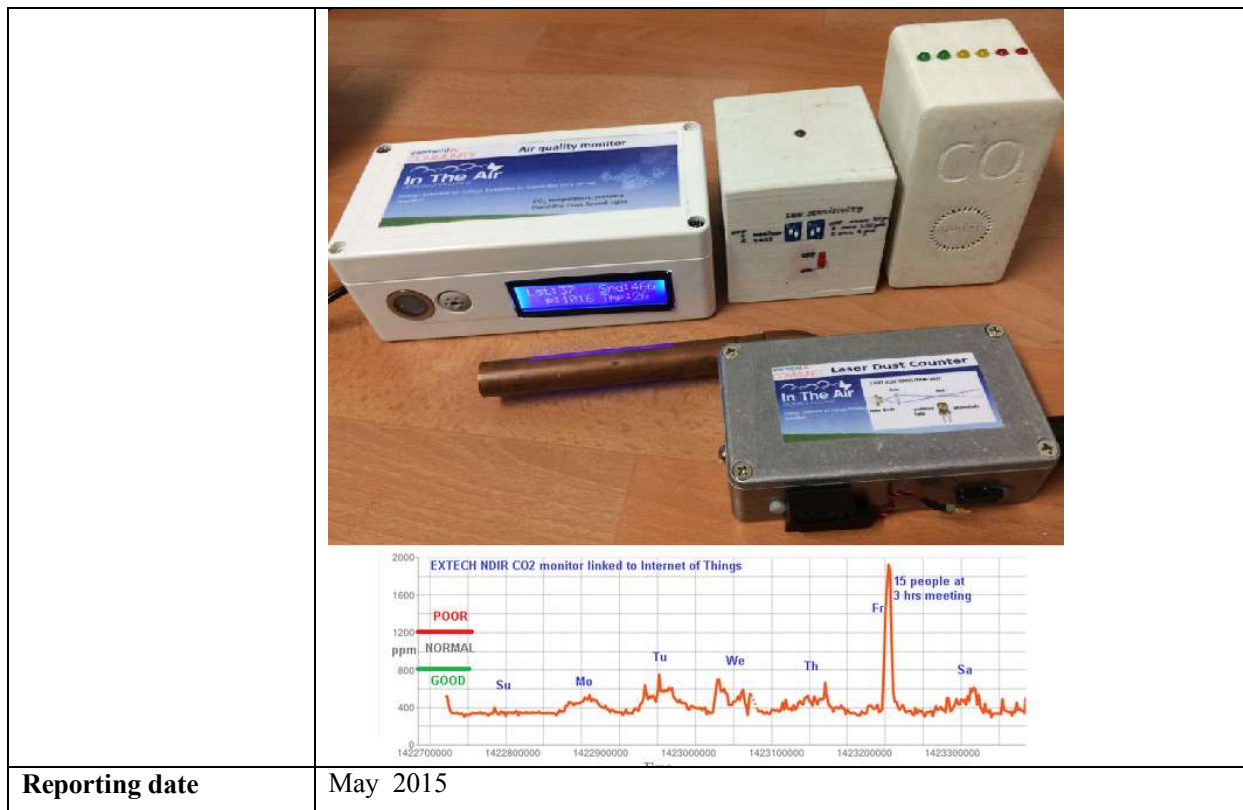
A free room on the 5th floor of ASI was renovated in September-December 2014 and turned into laser optics laboratory with air conditioning and HEPA class filtering. See the photo below.

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| |  <p>The setup for rubidium saturation spectroscopy was prepared and measurements of frequency of Rb D₂ transitions with frequency comb were carried out, presented in conferences and a publication is being prepared.</p> <p>We have made tellurium vapour cell and oven and observed fluorescence it using 532 nm Verdi laser. This cell will be used for laser referencing in positronium spectroscopy project at ETH Zurich.</p> |
| International and national cooperation | <p>1) The cooperation with prof. Stefan Kroll and prof. Sune Svanberg and secondment visits to Department of Physics Lund University in June and September 2015 to learn current developments. Prepared joint EU FET-Open project application that scored 4.3 of 5 points.</p> <p>Several long term visits have been performed.</p> <ol style="list-style-type: none"> 1) Max Planck Institute of Quantum Optics, Garching. Work on atomic Hydrogen spectroscopy. 2) ETH Zurich, work on positronium spectroscopy. 3) A specific project was raised and visit to Freiburg University was performed. |
| Colloquiums, conferences and publications | <p><i>Papers</i></p> <ol style="list-style-type: none"> 1. Precision Measurement of the Hydrogen 1S–2S Frequency via a 920 km Fiber Link. Matveev, C. G. Parthey, K. Predehl, J. Alnis, A. Beyer, R. Holzwarth, T. Udem, T. Wilken, N. Kolachevsky, M. Abgrall, D. Rovera, C. Salomon, P. Laurent, G. Grosche, T. Legero, H. Schnatz, S. Weyers, B. Altschul, T. Hansch. Phys. Rev. Lett. 2012 2. Precision spectroscopy of the 2S–4P transition in atomic hydrogen on a cryogenic beam of optically excited 2S atoms. Beyer, J. Alnis, K. Khabarova, A. Matveev, C. G. Parthey, D. C. Yost, R. Pohl, T. Udem, T. W. Hansch, N. Kolachevsky. Ann. Phys. (Berlin) 525, No. 8–9, 671–679 (2013) 3. Precision spectroscopy of the 2S–4P transition in atomic hydrogen on a cryogenic beam of optically excited 2S atoms. A. Beyer, J. Alnis, K. Khabarova, A. Matveev, C. Parthey, D. Yost, R. Pohl, T. Udem, T. Hänsch, N. Kolachevsky. Annalen der Physik, May, 2013 4. Optical diagnostic method for benzene detection in air. J. Alnis; G. Revalde; A. Vrublevskis; Z. Gavare. Proc. SPIE 9421, Eighth International Conference on Advanced Optical Materials and Devices (AOMD-8), 94210E (22 October 2014); doi: 10.1117/12.2083915 5. Observation of positronium annihilation in the 2S state. D. A. Cooke, P. Crivelli, A. Antognini, S. Friedreich, K. Kirch, A. Rubbia, B. Brown, J. Alnis, T. W. Hänsch. arxiv.org/abs/1503.05755 6. Broadband Zerodur FP resonator for laser stabilization below 1 kHz |

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| | <p>linewidth with <100 Hz/s drift and reduced sensitivity to vibrations K.Bluss, A.Atvars, I.Brice, J.Alnis. Latv. J. Phys. Submitted 2015</p> <p>7. Numerical 2D and 3D simulations of a spherical Fabry-Perot resonator for application as a reference cavity for laser frequency stabilization. E. Nitiss, K. Bluss, J. Alnis . Latv. J. Phys. Submitted 2015</p> <p><i>Conferences:</i></p> <ol style="list-style-type: none"> Optical pulse detection using laser light sources. J.Alnis talk at International conference BIOPHOTONICS IN DERMATOLOGY AND CARDIOLOGY, Riga , 30-31 March 2012 Presentation of ERC Advanced Grant Multidimensional laser frequency comb spectroscopy of molecules (MULTICOMB). 1st international conference Photonics Technologies - Riga 2012, University of Latvia 27-28.08.2012, Invited talk. Precision Laser Spectroscopy of the 1S-2S Transition in Positronium P. Crivelli, D. Cooke, A. Antognini, K. Kirch, J. Alnis, T.W.Hänsch Poster presented by J.Alnis. DPG-Frühjahrstagung 2013, Hannover, 18.-22.03.2013. Towards skin fluorescence diagnostics using femtosecond frequency comb laser I.Brice, I.Ferulova, J.Spigulis, J.Alnis. Poster, 1st International Conference, Biophotonics - Riga 2013 Riga, Latvia, 29 - 31 August 2013. Precision laser spectroscopy of positronium atoms. Janis Alnis, David Cooke, Paolo Crivelli 72-nd Annual scientific conference of the University of Latvia, 07.02.2014, Riga, Latvia, Book of abstracts p.17 “Properties of Atoms in the Negative Ion and Femtosecond Laser Radiation Interaction” the Collaboration between University of Latvia and Freiburg University financed via Baltic-German University Liaison Office . U.Berzinsh, J.Klavins, J.Alnis, M.Eklund, and H.Helm. 72-nd Annual scientific conference of the University of Latvia, 07.02.2014, Riga, Latvia, Book of abstracts p.28 Skin fluorescence diagnostics with a femtosecond optical frequency comb I.Brice, I.Ferulova, J.Spigulis, J.Alnis. 2-nd Annual scientific conference of the University of Latvia, 07.02.2014, Riga, Latvia, Book of abstracts p.30 Bridging optical and microwave frequency standards with femtosecond frequency comb and precision timing distribution via optical links J. Alnis, I. Fescenko, I. Brice, A. Apsitis, J. Rutkis. Poster at International Conference on Collaboration in Space Technologies Riga, 5-6 June 2014 Optical diagnostic method for benzene detection in air. J. Alnis talk in conference Advanced Optical Materials and Devices, Riga 25-27.08.2014 Benzene Detection in Air with Zeeman Atomic Absorption Technique A. Vrublevskis, G. Revalde, J. Alnis, A. Skudra, Z. Gavare. Poster iAY62 13th conference on global research and education interAria 2014, Riga 10-12.09.2014 Reaching new limits of accuracy for distance measurements in satellite ranging by using technology of femtosecond frequency combs J. Alnis talk at 1st International conference nocturnal atmosphere and laser ranging: NOCTURNAL - Riga 16-17.10.2014. Blue diode lasers and Nobel prize 2014. J. Alnis talk during Photonics Day celebration at LU ASI 21.10.2014. Overview of impact of the FOTONIKA-LV project on the Laboratory of Quantum Optics, Institute of Atomic Physics and Spectroscopy Janis Alnis . Talk at 73-nd Annual scientific conference of the University of Latvia, 06.02.2015, Riga, Latvia, Book of abstracts p. 38 Rubidium optical transitions measuring with a femtosecond frequency comb. J. Alnis, I. Brice, J. Rutkis, I. Fescenko, C. Andreeva, talk at 73-nd |
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| | <p>Annual scientific conference of the University of Latvia, 06.02.2015, Riga, Latvia, Book of abstracts p.28.</p> <p>15. GNSS more than a tool for navigation. I. Brice, J. Alnis Poster at 73-nd Annual scientific conference of the University of Latvia, 06.02.2015, Riga, Latvia, Book of abstracts p. 51</p> <p>16. Dust particle counting in ambient laboratory air. J. Rutkis, J. Alnis Poster at 73-nd Annual scientific conference of the University of Latvia, 06.02.2015, Riga, Latvia, Book of abstracts p.55</p> <p>17. Summary of work at LU ASI Quantum Optics Laboratory for year 2014 J. Alnis talk at ASI weekly seminar 26.02.2015.</p> <p>18. Nobel prize in Physics 2014 . J. Alnis talk at LU ASI weekly seminar 12.03.2015.</p> <p>19. Optical air quality sensors: benzene, dust, CO₂. J. Alnis, I. Fescenko, Gavare, G. Revalde, A. Vrublevskis. Poster at 3rd International Eunetair Act Workshop, Riga, 26-27.03.2015</p> <p>20. Janis Alnis, Ilja Fescenko. Quantum optics laboratory <i>The FOTONIKA-LV conference: "Achievements and Future prospects" Riga, 23-24 April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV.</i></p> <p>21. <u>Janis Alnis</u>, Arnolds Ubelis, Ilja Fescenko, Janis Blahins, Aigars Apsitis, Viesturs Silamīkēlis. Advances in quantum sciences – source for the initiatives in sophisticated applications <i>The FOTONIKA-LV conference: "Achievements and Future prospects" Riga, 23-24 April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV.</i></p> <p>22. Development of a laser-based airborne dust counter. J. Alnis, J. Rutkis, I. Fescenko, G. Revalde EuroNanoForum 2015, Riga, 10-12 June 2015</p> <p>1) Contributions in Colloquiums of FOTONIKA-LV ➤ FOTONIKA-LV XXVIII colloquium, 12.04.2013. . Dr. Jānis Alnis. <i>Short survey of scientific activities of Max-Planck-Institut of Quantum Optics in Munich; Plans for the first step of research activities after repatriation; Basics of optical frequency combs</i> ➤ FOTONIKA-LV XXXVIII kolokvījs, 06.09.2013. <i>15 min introduction before talk of Jérôme Rousval. Optical frequency combs from Menlo Systems</i></p> |
| National and International projects | <p>1. The project proposal to Latvian Research Council call was submitted: Dr. Jānis Alnis & Dr. Māris Ābele. Advances in Satellite Ranging Science and Technologies, Earth Geodynamics and Breakthrough in Active Remote Sensing of Nocturnal Atmosphere. Getting marks 80 from 90 possible.</p> <p>2. In line with pending repatriation FP7 project proposal was submitted on November 2012. Dr. Janis Alnis. Coordinator. Reaching new limits of accuracy for distance measurements in satellite ranging by using technology of femtosecond frequency combs. FEMTO-SAT, 313027, SPA.2012.2.2-01. In consortium LV, DE, CZ, South Korea</p> <p>Dr. Alnis was listed among principal investigators in two following FP7 project proposals in 2013:</p> <p>1. Dr.Māris Ābele. Coordinator. Earth Based Sensors for Man-made Objects Navigation Solutions and Security of Space Assets. SAT-SENS, 313027, SPA.2013.3.1-01</p> <p>2. Dr.Māris Ābele. Coordinator. Towards New Performance of Distance Measurements in Satellite Laser Ranging – Advancement of Technologies Contributing to the Earth Sciences, GEODYNAMICS, FP7-PEOPLES-IRSES-2013,Nr 612609</p> <p>Participation in Bilateral project University of Latvia and Freiburg University : “Experimental research dedicated to interactions of negative ions</p> |

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| | <p>with femtosecond laser light beams”.</p> <p>Dr. Alnis was listed among principal investigators in the following HORIZON 2020 project proposals:</p> <ol style="list-style-type: none"> 1. PHOTONICS BALTICUM: Photonics and Quantum Sciences from Nano-World to Space Technologies. H2020-WIDESPREAD-2014-1-FPA Total score 9, threshold 10. Joint proposal of five universities in Baltic region. 2. Photonics, quantum sciences and quantum technologies European Researchers' Night. H2020-MSCA-NIGHT-2014 Score 6, threshold 10. Research and education organizations in Latvia 3. Slow light applications and materials. H2020-FETOPEN-2014-2015-RIA. Score 4.3, threshold 5. Coordinated by Lund University, Sweden. 4. PHOTONICS BALTICUM: H2020-TWINN-2015. Proposalnumber: 692275 <p>Novel application of frequency comb for high precision free-space time transfer and distance measurements. ERAF, Latvia 380 kEUR. Not financed.</p> |
| Education. | <ol style="list-style-type: none"> 1. Dr. Alnis gave a tutorial about stable lasers and precision measurements in a research training course linked with conference Photonics Technologies, 23-28 Aug. 2012, Riga, Latvia. "Precision measurements with optical frequency combs" 2. In August 2013 started to supervise two PhD students Inga Brice. 3. In 2014-2015 is supervised bachelor Jazeps Rutkis. 4. In Dec. 2015 Supervised bachelor programme laboratory exercises on diode laser spectroscopy of Rb atoms. The picture was taken in the ASI hall on the ground floor in December 2014.  <ol style="list-style-type: none"> 1. In 2014-2015 is supervising science projects of three high-school students (Air quality monitoring in school, precision timekeeping using GPS). Picture below illustrates the constructed sensor modules and typical signal over one week. |



3.4. PhD cand. Janis Blahins



„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.08.2013. - 31.04.2015. |
| Recruiting period | 01.02.2012.-31.04.2015. |
| Scientist (name, surname, laboratory) | Janis Blahins, Laboratory of Atomic Physics, Atmosphere Physics and Photochemistry The Institute of Atomic Physics and Spectroscopy Association FOTONIKA-LV, University of Latvia |
| Science | <p>Responsibilities covered wide spectra of problems.</p> <ol style="list-style-type: none"> Vacuum coating laboratory development Cleanroom development Altered RF ICP power supplies development Crystal growing oven development Subsequent procurement managing Göteborg GRIBA development Ion implantation apparatus development Other ion technologies development Optics and mechanics workshop development Take a part to new project proposal writing <p><i>Vacuum coating laboratory development</i></p> <p>The coating tasks was divided between three machines, the 150cm diameter vacuum chamber machine - largest one for astronomic mirrors metallization must stay behind the mirror encaving/polishing machines, therefore it was located at Baldone facilities, custom made at China, and all subsequent power supplies made by us customizing second hand laser power supplies. Vacuum ensuring system system is laboratory build - composed from forvacuum and high vacuum pumps already available in installations not in use now.</p> <p>The top level 70cm diameter vacuum chamber machine is redesigned for precision multilayered optically transparent coatings. Pending collaboration with Lithuanian laser optics companies having interest to commercialisate our capabilities. Besides there are visions to satisfy another specifical needs of research labs and research driven SMEs in Latvia and worldwide. Advanced energoeffective vacuun pumping system is installed to ensure cost effective frequent use of sputtering device. Advanced ultrafine coating thickness monitoring system is installed..</p> <p>The smallest 30cm vacuum chamber is ready for use for risky projects, or for students hands-on teaching.</p> <p><i>Cleanroom development</i></p> <p>Cleanroom mounting processes was organized and supervised, and a lot of everyday problems were solved. This task demanded enormous human resources and voluntary efforts. Ventilation system is ready to for first switchup. Still there are number of smaller works to be done.</p> <p><i>Altered RF ICP power supplies development</i></p> |

Efforts were made to design electronics for inductively coupled RF as well microwave plasma devices, including the 3kW CC SMPS, 3kV CV SMPS, 3kW PFC and other similar devices. As a result new opportunities opened for the development of electrodeless inductively coupled spectra sources for research on spectroscopic properties of atoms in Ue research on fundamental problems of atomic physics for the atoms having resonance spectra in far UV and in VUV region.

Crystal growing oven constructing

Experimental crystal grows set-up was developed in response to the needs of SMEs. .

Subsequent procurement managing

The University public procurement system is not flexible enough to satisfy demand for fast supply of necessary materials and instrumentation needed for intensive in experiments based research. That resulted frequently in supply delays as well as in not optimal solutions and cost effective purchases. In connection with over loaded bureaucracy that resulted in waste of time and as a result in less productivity of research efforts and finally less optimal use of resources. Only extraordinary efforts allowed the team to solve all purchase problems and to use available money to purchase needed equipment and materials.

GRIBA(Gothenburg Riga Ion Beam Apparatus mobile)development



GRIBA was build during the project basing on the secondments visits financing in the project allowing to join human resources in from Riga and Gothenburg. As a result GRIBA is unique contribution to EU research infrastructure – the first mobile negative ion beam source providing opportunity to bring ion beam to powerfull radiation sources in EU for cross beam experiments having interst from astrophysics and astrobiology to plasma technologies. GRIBA was build in Gothenburg and moved to Riga having no any harm to it's functionality after 1000 km travel. The roadmap for GRIBA is discussed and main target objects are clusters related to atmosphere sustainability issues and research for izocyanates with interest from Astrophysics.

Ion implantation apparatus development

Experience in GRIBA design was usefull to make first steps towards applied research related to the next generation ion implantation devices needed for research and industry purposes in response to the demand of progress of technologies of weak short wave radiation sensors and spectrometers.

Other ion technologies development

Initial works on in-solution ion techniques was made, what is new direction for institute. The good contacts with innovator and many patent author in this field Dr. H.Maurops was made on the way to design is milk fat tester, exploiting the photonics laws.

Optics and mechanics workshop development

In collaboration between LU-ASI and LU-AI institutes mechanical workshop was restored and upgraded in Baldone for for metal processing, for optics and glass processing and for crystall grow.


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| International and national cooperation | <p>During one month-long visit in Crimea Astrophysical Observatory Optics Workshop, their crushed multilayer vacuum sputtering machine was successfully revived and experienced shared how to organize the optics grinding and polishing and geometry testing machinery, and let get us hands-on experience how to make good astronomical mirror metalisation and preserving layer coatings.</p> <p>During visit in Minsk Mass and Heat transfer Institute we learned how to manipulate plasmas with various temperatures, especially the microwave plasmas, and how to realise their reflected wave neutralisation and impedance matching. This know-how may lead us to breakthrough into hard melting nanoparticle printer development.</p> <p>I assisted to Ukrainian (Odessa) researchers to realize their research plans here, helped LU Astronomy institute to save the small telescope movable roof, and helped to reorganize heavy optics stand geometry about welding jobs at Botanic Garden dislocated National SLR station to be altered etc.</p> |
| Papers and conferences | <ol style="list-style-type: none"> 1. Arnolds Ubelis, Janis Blahins, Aigars Apsitis, Uldis Gross. Plenary lecture: Applications of iodine and bromine atomic resonance spectra sources for atmosphere research. "6th International Symposium on Non-equilibrium Processes, Plasma, Combustion and Atmospheric Phenomena", Sochi, October 6-10, 2014; 2. <u>J.Blahins, A.Apsitis</u>, A mobile Instrument GRIBA for negative Ion studies, <i>MEASU SCIENCE REVIEW</i>, 2014, in press 3. Uldis Berzinsh, Janis Blahins, Aigars Apsitis, Dag Hanstorp. Ion beam instrument GRIBA success story of the Project <i>The FOTONIKA-LV conference: "Achievements and Future prospects"</i> Riga, 23-24 April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV. 4. Janis Blahins, Aigars Apsitis, Viesturs Silamikelis, Arnolds Ubelis. Contribution of the project in the development of assets for applied research to ensure collaboration with research driven SMEs in photonics domain. <i>The FOTONIKA-LV conference: "Achievements and Future prospects"</i> Riga, 23-24 April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV. 5. Janis Alnis, Arnolds Ubelis, Ilja Feschenko, Janis Blahins, Aigars Apsitis, Viesturs Silamikelis. Advances in quantum sciences – source for the initiatives in sophisticated applications <i>The FOTONIKA-LV conference: "Achievements and Future prospects"</i> Riga, 23-24 April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV. |
| International projects | <p>Contribution in writing of proposals:</p> <ol style="list-style-type: none"> 1. FP7 project proposal was submitted on March 2013 Dr.h.Uldis Berziņš. Coordinator Spectroscopy of Ions Using Lasers and Synchrotron Radiation – a Global Scale Community. IONS SPECTRA, FP7-PEOPLES-IRSES-2013, Nr 612582. In consortia research teams from Gothenburg, Stockholm, Bekerley, Mexico, St.Peterburg and Minsk.; 2. Call: MSCA-RISE-2015, Proposal Number: 691063, Proposal Acronym: ION SPECTRA; 3. Call. : H2020-TWINN-2015, Type of action: CSA, Proposal number: 692275. Proposal acronym: PHOTONICS BALTICUM |
| Reporting date | May, 2015. |

3.5. Dr.Phys. Roman Viter

„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.02.2012.-30.04.2015. |
| Recruiting period | 01.02.2012.-30.04.2015 |
| Scientist (name, surname, laboratory) | Roman Viter, Visiting researcher, Institute of Atomic Physics and Spectroscopy, Association FOTONIKA-LV, University of Latvia . Viter_r@mail.ru |
| Science | New photonic materials, based on 1-D ZnO and ZnO/Al ₂ O ₃ nanostructures have been developed. Structural properties of the nanostructures have been investigated with TEM, XPS, SEM, FTIR and Raman spectroscopy. Phase identification and grain size estimation were performed. Optical properties of the nanostructures have been studied by reflectance and photoluminescence. Application to optical gas sensors and biosensors has been developed. |
| International and national cooperation | <p>1D ZnO and ZnO/Al₂O₃ samples were deposited and structural characterization was performed together with colleagues from University of Montpellier 2.</p> <p>Photoluminescence properties of ZnO and ZnO/Al₂O₃ at room temperatures have been studied. Sensitivity of ZnO biosensors to leucosis and salmonella was tested. Detection of ethanol vapours with 1D ZnO optical sensors was developed.</p> <p>Mechanisms of immobilization of biological samples on ZnO surfaces were studied by means of confocal microscopy (Montpellier). Interaction of antigens and antibodies on ZnO surface has been demonstrated.</p> <p>Optical transmittance and photoluminescence measurements of ZnO and ZnO/Al₂O₃ nanostructures have been performed together with Odessa National University (Ukraine). The main optical parameters, such as band gap, absorption peaks and emission peaks have been obtained.</p> <p>New collaboration with Vilnius university, Poznan Nanobiotechnology center in the field of 1D nanostructures have been established.</p> |
| Papers and conferences | <p>Papers:</p> <ol style="list-style-type: none"> Dmitry Sodel, Volodymyr Khranovskyy, Roman Viter, Arnolds Ubelis, Lyudmila Dubovskaya, Per-Olof Holtz, Marer, Valerio Beni, Sebastien Balme, smyntyna@onu.edu.ua , mikhael bechelany Ref.: Ms. No. MIAC-D-15-00013R1. Continuous sensing of hydrogen peroxide and glucose via quenching of the UV and visible luminescence of ZnO nanoparticles Microchimica Acta. Accepted for publication M. Jędrzejewska-Szczerska, P. Wierzba, A. Abou Chaaya, M. |

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| | <p>Bechelany, P. Miele, R. Viter, A. Mazikowski, K. Karpienko, M. Wróbel, ALD thin ZnO layer as an active medium in a fiber-optic Fabry-Perot interferometer, <i>Sensors and Actuators A: Physical</i> (2015), 221 (2015) 88-94</p> <ol style="list-style-type: none"> 3. Maryline Nasr, Adib Abou Chaaya, Nadine Abboud, Mikhael Bechelany, Roman Viter, Cynthia Eid, Antonio Khoury, Philippe Miele, Photoluminescence: A very sensitive tool to detect the presence of anatase in rutile phase electrospun TiO₂ nanofibers, <i>Superlattices and Microstructures</i>, 77 (2015) 18–24 4. Roman Viter, Adib Abou Chaaya, Igor Iatsunskyi, Grzegorz Nowaczyk, Kristaps Kovalevskis, Donats Erts, Philippe Miele, Valentyn Smyntyna and Mikhael Bechelany, Tuning of ZnO 1D nanostructures by atomic layer deposition and electrospinning for optical gas sensor applications, <i>Nanotechnology</i> 26 (2015) 105501 (6pp)12. 5. Igor Iatsunskyi, Mykola Pavlenko, Roman Viter, Mariusz Jancelewicz, Grzegorz Nowaczyk, Ieva Baleviciute, Karol Załęski, Stefan Jurga, Arunas Ramanavicius and Valentyn Smyntyna, Tailoring the Structural, Optical, and Photoluminescence Properties of Porous Silicon/TiO₂ Nanostructures, <i>J. Phys. Chem. C</i> (2015) DOI: 10.1021/acs.jpcc.5b01670 6. Roman Viter, Volodymyr Khranovskyy, Nikolay Starodub, Yulia Ogorodniichuk, Sergey Geveluk, Zanda Gertnere, Nicolay Poletaev, Rositza Yakimova, Donats Erts, Valentyn Smyntyna and Arnolds Ubelis, Application of Room Temperature Photoluminescence From ZnO Nano-rods for Salmonella Detection, <i>IEEE Sensors Journal</i>, 14(6) (2014) 2028-2034 7. Roman Viter, Akash Katoch, Sang Sub Kim, Grain size dependent bandgap shift of SnO₂ nanofibers, <i>Metals and Materials International</i>, Volume 20, Issue 1 (2014) pp 163-167 8. Adib Abou Chaaya, Roman Viter, Ieva Baleviciute, Mikhael Bechelany, Arunas Ramanavicius, Donats Erts, Valentyn Smyntyna and Philippe Miele, Optical and structural properties of Al₂O₃/ZnO nanolaminates deposited by ALD method, <i>physica status solidi (c)</i>, (2014) DOI: 10.1002/pssc.201300607 9. Adib Abou Chaaya, Roman Viter, Ieva Baleviciute, Mikhael Bechelany, Arunas Ramanavicius, Zanda Gertnere, Donats Erts, Valentyn Smyntyna and Philippe Miele, Tuning Optical Properties of Al₂O₃/ZnO Nanolaminates Synthesized by Atomic Layer Deposition, <i>J. Phys. Chem. C</i>, 118 (7) (2014) 3811–3819 10. Chaaya AA, Viter R, Bechelany M, Alute Z, Erts D, Zaleskaya A, Zales Kovalevskis K, Rouessac V, Smyntyna V, Miele P. Evolution of micro and related optical properties of ZnO grown by atomic layer deposition. <i>Journal of Nanotechnology</i>. 2013;4(1):690-8 11. Viter R, Smyntyna V, Starodub N, Doycho I, Geveluk S, Ogorodniichuk ZnO nanorods room temperature photoluminescence biosensors for sa detection. <i>Frontiers in optics</i>, FIO 2012; ; 2012 12. Roman Viter, Sergey Geveluk, Valentyn Smyntyna, Igor Doych Rysiakiewicz-Pasek and Krisztian Kordas, Investigation of optical prop nanoporous glass filled with TiO₂ and TiO₂/porphyrine nanostructures <i>Applicata</i>, 42, N2 (2012) 307-313 <p>Conferences.</p> <ol style="list-style-type: none"> 1. Roman Viter, Arnolds Ubelis. Development and application of photonic materials for optical sensors/biosensors <i>The FOTONIKA-LV conference: “Achievements and Future prospects” Riga</i>, 23-24 |
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| | <p><i>April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV.</i></p> <ol style="list-style-type: none"> J. Orban, M. Griffith, , A.P.F. Turner, R. Viter, M. Bechelany, W.C. Mak, Surface nanoengineered contact lens as a wearable point-of-care diagnostics platform, poster, Biosensors 2014, 24th Anniversary World Congress on Biosensors, 27-30 May 2014, Melbourne, Australia. V. Khranovskyy, D. Sodzel, V. Beni, M. Eriksson, P-O. Holtz, L. Dubovskaya, R. Viter, V. Smyntyna, A. Ubelis, R. Yakimova, Glucose biosensor based on photoluminescence quenching of ZnO nanoparticles, poster, Biosensors 2014, 24th Anniversary World Congress on Biosensors, 27-30 May 2014, Melbourne, Australia. R. Viter, Optical and structural properties of metal oxide nanostructures, deposited by Atomic Layer Deposition, oral presentation, Workshop "NEW TRENDS IN NANOTECHNOLOGY OF COMPLEX OXIDES AND DIRAC MATERIALS", 16-19 May 2014, Jurmala, Latvia Kristaps Kovalevskis, Anastasiia Zalesskaya, Roman Viter, Mikhael Bechelany, Adib Abou-Chaaya, Viktoriia Vataman, Donats Erts Valentyn Smyntyna and Philippe Miele, Novel 1-D photonic materials, formed by atomic layer deposition, 10th International Young Scientist conference Developments in Optics and Communications 2014 & Laserlab III Training School for Potential Users Laser Applications in Spectroscopy, Industry and Medicine, poster, Riga, Latvia, April 9-12, 2014 Adib Abou Chaaya, Roman Viter, Ieva Baleviciute, Mikhael Bechelany, Arunas Ramanavicius, Donats Erts, Valentyn Smyntyna and Philipe Miele, Optical and structural properties of Al₂O₃/ZnO nanolaminates deposited by ALD method, EMRS, 2013, Warsaw, Poland |
| International projects | <p>Proposal for , NATO Science grant ‘Nanostructured biosensors for food pathogens detection’, NATO Science grant</p> <p>FP7 project proposals:</p> <ol style="list-style-type: none"> Nanostructured metal oxide optical biosensors for agriculture applications FP7,PEOPLES-IAAP 2013 reg. Nr. 612325, METOXNANOBIO FP7,PEOPLES-CIG 2013 reg. Nr. 333942 (2013 – 2016). Metal oxide nano heterostructures for optical biosensors; PI in PEOPLES-IRSES <i>BIOSENSORS-AGRICULT. Nr.316177 - DEVELOPMENT OF NANOTECHNOLOGY BASED BIOSENSORS FOR AGRICULTURE</i>”, ERA-NET project: Nano-sensor for rapid detection of CO toxicity in blood of poisoned peopleTOXICO-OP, RUSPLUS_S&T-246; <p>HORIZON 2020 proposals;</p> <ol style="list-style-type: none"> ‘Photonic biosensors for point-of-care diagnosis of kidney disease patients’, H2020-ICT-2014-one-stage, SEP-210157636 ‘Development of metal oxide nanomaterials for sensor applications’, H2020-MSCA-ITN-2014, ID-642336; H2020-MSCA-ITN-2014, Nr. 607534-METONANOSENS. Development of metal oxide nanomaterials for sensor applications; 4. ‘Development of novel 3D metal oxide nanostructures for biophotonic devices’, H2020-MSCA-RISE-2014, ID- 645692 |
| Reporting date | May2015. |

3.6. Dr.Phys. Nikolai Bezuglov

**„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective
Integration in the European Research area”**

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.02.2012.-31.03.2015. |
| Recruiting period | 01.02.2012-31.08.2012; 01.01.2013-31.08.2013; 01.01.2014-31.08.2014; 01.01.2015-30.03.2015. |
| Scientist (name, surname, laboratory) | Nikolai Bezuglov, DOB : 10.02.1950, e-mail : bezuglov50@mail.ru Institute of Atomic Physics and Spectroscopy and Molecular Beam Laboratory of the Laser Centre. |
| Science | Dr. Bezuglov studied a number of topics: <ul style="list-style-type: none"> • Forster resonances in the excitation of atomic Rydberg states; • Laser-dressing of atomic and molecular quantum states, developing an original theoretical model based on the split propagation and Floque techniques; • Ionization of Rydberg atoms due to stochastic migration of Rydberg electron in the energy spectrum and long-range interactions in a cold matter. The results of those studies are reported in detail in the below listed publications. |
| International and national cooperation | Professor of physical faculty of St.Petersburg State University, Russia. Cooperation with Vilnius University, Lithuania. Cooperation with Dipartimento di Fisica "E. Fermi", Università di Pisa, Italy. Cooperation with Institute of Semiconductor Physics, SB RAS, Novosibirsk, Russia. Cooperation with University of Kaiserslautern, Germany. Cooperation with Stony Brook University, USA. |
| Papers | <ol style="list-style-type: none"> 1. D. B. Tretyakova, I. I. Beterova, V. M. Entina, E. A. Yakshina, I. I. Ryabtseva,*, S. F. Dyubkob, E. A. Alekseev, N. L. Pogrebnyak, N. N. Bezuglov, and E. Arimondo. <i>Effect of Photoions on the Line Shape of the Forster Resonance Lines and Microwave Transitions in Cold Rubidium Rydberg Atoms. Journal of Experimental and Theoretical Physics</i>, 2012, Vol. 114, No. 1, pp. 14–24. 2. M. Bruvelis, J. Ulmanis, N. N. Bezuglov, K. Miculis, C. Andreeva, B. Mahrov, D. Tretyakov, and A. Ekers. <i>Analytical model of transit time broadening for two-photon excitation in a three-level ladder and its experimental validation</i>. Phys.Rev.A, v. 86, 012501 (2012). 3. N. N. Bezuglov, G. V. Golubkov, A. N. Klyucharev. <i>Ionization of Excited Atoms in Thermal Collisions (Chapter 1)</i> // The Atmosphere and Ionosphere: Elementary Processes, Discharges and Plasmoids / Bychkov, Vladimir; Golubkov, Gennady; Nikitin, Anatoly (Eds.). (Physics of Earth and Space Environments). — New York, London: Springer-Verlag, 2013., pp. 1-60. 4. A. N. Klyucharev, N. N. Bezuglov. <i>Elementary processes and ionization phenomena in gas environments</i>. (Monograph, ed. University of St. Petersburg, 2013, 212 p.). 5. D. K. Efimov, N. N. Bezuglov, A. N. Klyucharev, Yu. N. Gnedin, K. Miculis, and |

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| | <p>A. Ekers. “<i>Analysis of Light Induced Diffusion Ionization of a Three Dimensional Hydrogen Atom Based on the Floquet Technique and Split Operator Method</i>” Optics and Spectroscopy, 2014, Vol. 117, No. 6, pp. 10–19.</p> <p>6. D. K. Efimov, N. N. Bezuglov, A. N. Klyucharev, and K. Miculis. <i>On the Applicability of the One Dimensional Mode of Diffusion Ionization to the Three Dimensional Rydberg Hydrogen Atom in a Microwave Field. Optics and Spectroscopy</i>, 2014, Vol. 117, No. 12, pp. 861–868.</p> <p>7. N. N. Bezuglov, G. V. Golubkov, and A. N. Klyucharev. “<i>Dynamic Resonances in the Autoionization Rydberg States of Atomic Systems</i>” Russian Journal of Physical Chemistry A, 2014, v. 88, No. 11, pp. 1889–1903.</p> <p>8. V. Kudriašov, J. Ruseckas, A. Mekys, A. Ekers, N. Bezuglov, and G. Juzeliūnas. <i>Superluminal two-color light in a multiple Raman gain medium</i>. Phys. Rev. A, v. 90, 033827 (2014)</p> <p>9. N.N. Bezuglov, A.N. Klyucharev, A.A. Mihajlov, V.A. Sreckovic. “<i>Anomalies in radiation-collisional kinetics of Rydberg atoms induced by the effects of dynamical chaos and the double Stark resonance</i>”. Advances in Space Research. 2014, v. 54, pp. 1159–1163. N.N.</p> <p>10. Bezuglov, M.S. Dimitrijevic, A.N. Klyucharev, A.A. Mihajlov. <i>Dynamic Characteristics of Excited Atomic Systems</i>. Journal of Physics: Conference Series, Vol. 565, p. 012021 (2014).</p> <p>11. M. Bruvelis, D.K. Efimov, N.N. Bezuglov, A.N. Klyucharev, Yu.N. Gnedin, K. Miculis, and A. Ekers. “<i>Analysis of Light Induced Diffusion Ionization of a Three Dimensional Hydrogen Atom Based on the Floquet Technique and Split Operator Method</i>” Optics and Spectroscopy, submitted.</p> <p>12. M. Bruvelis, A. Cinins, A. Leitis, D. K. Efimov, N. N. Bezuglov, A. S. Chirtsov, F. Fuso, A. Ekers. <i>Specificity of the optical pumping upon excitation of cyclic transitions of Na and Cs in ultra-slow cold beam</i>. Optics and Spectroscopy, submitted.</p> <p>13. N. Porfido, S. Birindelli, F. Tantussi, F. Fuso, M. Bruvilis, N. N. Bezuglov, A. Ekers. <i>Nonlinear effects combinations in optical pumping of a cold and slow atom beam</i>. Prepared for publication in Phys. Rev. A.</p> <p>14. T. Kirova, A. Cinins, M. Bruvelis, D.K. Efimov, K. Miculis, N.N. Bezuglov, A. Ekers, M. Auzinsh and I.I. Ryabtsev. <i>Consequences of Multiple Dressed States formation in atomic nondegenerate Hyperfine Levels I: the Death of Dark and Bright Components in Autler-Townes Spectra</i>. Prepared for publication in Phys. Rev. A.</p> <p>15. D K Efimov, N N Bezuglov, K Miculis and A. Ekers. <i>Penning ionization of a non-symmetrical atomic pair in a cold Rydberg gas: the Tom and Jerry effect</i>. Prepared for publication in Phys. Rev. Lett.</p> |
| Conferences | <p>1. “<i>Dark State Formation in Three-Level Ladder System in Na Supersonic Atomic Beam</i>”, D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, T. Kirova, C. Andreeva, and A. Ekers, 17th International School on Quantum Electronics: Laser Physics and Applications”, 24-28 September 2012, Nessebar, Bulgaria.</p> <p>2. “<i>Manifestation of Dark State Formation in Na Hyperfine Level System</i>”, D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, T. Kirova, and A. Ekers, “Quantum Africa 2”, p.54, 3-7 September 2012, Drakensberg, South Africa.</p> <p>3. “<i>Effects of Dark State Formation in the Hyperfine Excitation Spectra of Na atoms</i>”, D. Efimov, M. Bruvelis, J. Ulmanis, K. Miculis, N. N. Bezuglov, T. Kirova, and A. Ekers, poster presentation, The 23rd International Conference on Atomic Physics ICAP 2012, p. 268, 23-27 July 2012, Paris, France.</p> <p>4. “<i>Two Component Superluminal Light</i>”, N. N. Bezuglov, A. Ekers, J. Ruseckas,</p> |

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| Conferences | <p>V. Kudriasov, and G. Juzeliunas, poster presentation, The 23rd International Conference on Atomic Physics ICAP 2012, p. 347, 23-27 July 2012, Paris, France.</p> <p>5. <i>"Manifestation of Dark State Formation in Na Hyperfine Level System"</i>, D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, T. Kirova, and A. Ekers, poster presentation, 44th meeting of EGAS, Volume number 36C, p.205, 9-13 July 2012, Gotheborg, Sweden.</p> <p>6. <i>"Applications of Laser Manipulation of Adiabatic States"</i>, A. Ekers, N. N. Bezuglov, K. Miculis, T. Kirova, M. Bruvelis, D. Efimov, C. Andreeva, A. Cinins, L. Kalvans, M. Auzinsh, 1st TLL/COLIMA Joint Workshop on manipulation of light by matter and matter by light, p. 7, 18-19 July, 2012, University of Latvia, Riga, Latvia.</p> <p>7. <i>"Analytical Model of Transit Time Broadening and Numerical Model of Residual Doppler Broadening for Two-Photon Excitation in a Three-Level Ladder and its Experimental Validation"</i>, M. Bruvelis, J. Ulmanis, A. Cinins, N. N. Bezuglov, K. Miculis, C. Andreeva, B. Mahrov, D. Tretyakov, A. Ekers, 1st TLL/COLIMA Joint Workshop on manipulation of light by matter and matter by light, p.10, 18-19 July, 2012, University of Latvia, Riga, Latvia.</p> <p>8. <i>"Assymetric Penning Ionization of Two Rydberg Atoms"</i>, D. Efimov, N. N. Bezuglov, K. Miculis, A. Ekers, I. Beterov, 1st TLL/COLIMA Joint Workshop on manipulation of light by matter and matter by light, p.11, 18-19 July, 2012, University of Latvia, Riga, Latvia.</p> <p>9. <i>"Formation of multiple dressed states in hyperfine level systems of Na"</i> A. Cinins, T. Kirova, N. Bezuglov, M. Bruvelis, K. Miculis, A. Ekers, L. Kalvans, M. Auzinsh, D. K. Efimov and I. I. Ryabtsev, poster presentation, ECAMP11, University of Aarhus, Denmark, June 2013.</p> <p>10. <i>"Many-mode Floquet technique for two component superluminal light."</i> J. Ruseckas, V. Kudriašov, G. Juzeliūnas, A. Cinins, M. Bruvelis, N. Bezuglov and A. Ekers, poster presentation, ECAMP11, University of Aarhus, Denmark, June 2013.</p> <p>11. <i>"Nonlinear optical pumping of a slow and cold Cs beam"</i> N. Porfido, S. Birindelli, F. Tantussi, F. Fuso, A. Ekers, N. N. Bezuglov, T. Kirova, oral presentation at CAMEL_2013, Bulgaria, June 2013.</p> <p>12. <i>"Peculiarities of Bright and Dark States Formation in Three-level Ladders of Na Hyperfine Levels"</i>, T. Kirova, N. N. Bezuglov, D. K. Efimov, K. Miculis, M. Bruvelis, A. Cinins, E. Stegenburgs, A. Ekers, M. Auzinsh, and I. I. Ryabtsev, 3rd TLL/COLIMA Workshop on manipulation of light by matter and matter by light, 18-19 October 2014, Hsinchu, Taiwan.</p> <p>13. <i>"Nonlinear Effects in Optical Pumping upon Resonant Excitation of Ultra-Slow Beam of Cold Cs Atoms"</i>, N. Porfido, S. Birindelli, F. Tantussi, F. Fuso, N. N. Bezuglov, M. Bruvelis, and A. Ekers, D. Efimov, N. Bezuglov, K. Miculis, and A. Ekers, 3rd TLL/COLIMA Workshop on manipulation of light by matter and matter by light, 18-19 October 2014, Hsinchu, Taiwan.</p> <p>14. <i>"Manipulation of Hyperfine State Populations via the Autler-Townes Effect"</i>, A. Ekers, N. Bezuglov, K. Miculis, T. Kirova, M. Bruvelis, D. Efimov, A. Cinins, C. Andreeva, M. Auzinsh, 2nd International Symposium on Optics and its Applications, 1-5 September 2014, Yerevan, Armenia.</p> <p>15. <i>"Quiet STIRAP: High-Efficiency Method of Selective HF Rydberg Sublevels Excitation"</i>, D. K. Efimov, N. N. Bezuglov, A. Ekers, International Conference on Problems of Strongly Correlated and Interacting Systems, 28-13 May, 2014 - Saint-Petersburg, Russia, book of abstracts, p.58.</p> <p>16. <i>"Nonlinear effects of optical pumping in spectroscopy of a cold Cs beam"</i>, A. Leitis, A. Cinins, M. Bruvelis, N. Bezuglov, D. Efimov, N. Porfido, F. Fuso, poster presentation, 10th International Young Scientist Conference "Developments in Optics and Communications", 9-12 April 2014, University of</p> |
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| | <p>Latvia, Riga, Latvia, book of abstracts, p.76.</p> <p>17. "Experimental Observation of the Formation of Multiple Dressed States in Sodium Hyperfine Level Systems", E. Stegenburgs, A. Leitis, A. Cinins, M. Bruvelis, D. K. Efimov, N. N. Bezuglov, A. Ekers, T. Kirova, poster presentation, 72-nd Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 7 February 2014, Riga Photonics Centre, Institute of Atomic Spectroscopy, Riga, Latvia, book of abstracts, p. 33.</p> <p>18. "Study of STIRAP efficiency of helium Rydberg atoms in supersonic beams", N. Bezuglov, K. Michulis, M. Bruvelis, A. Ekers, H. Metcalf, poster presentation, 72-nd Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 7 February 2014, Riga Photonics Centre, Institute of Atomic Spectroscopy, Riga, Latvia, book of abstracts, p. 45.</p> <p>19. N. N. Bezuglov, T. Kirova, A. Ekers, N. Porfido, S. Birindelli, F. Tantussi, F. Fuso. "Nonlinear optical pumping of a slow and cold Cs beam". 73 rd Annual Scientific Conference of the University of Latvia, Riga, Latvia, 6 February 2015.</p> <p>20. D.K. Efimov, N.N. Bezuglov, K. Miculis, A. Ekers. "Penning Ionization of a Non-Symmetrical Atomic Pair in a Rydberg Gas". 73 rd Annual Scientific Conference of the University of Latvia, Riga, Latvia, 6 February 2015.</p> <p>21. A. Cinins, M. Bruvelis, T. Kirova, N.N. Bezuglov, A. Ekers. "Coherent population switching in cold sodium atoms". 73 rd Annual Scientific Conference of the University of Latvia, Riga, Latvia, 6 February 2015.</p> |
| International projects | FP7-PEOPLE-2009-IRSES" Project N° 247475 COLIMA "Coherent manipulation of light and matter via interferences of laser-dressed states" |
| Additional Information | <p>It is important to stress my strong interaction with the experimental efforts in the laser center of the University of Latvia. A close collaboration with the Riga colleagues, experimentalists involved into investigations of physical processes under the scope of the FOTONICA project provided me with a unique possibility to efficiently tune-up current theoretical models and to extend, thus, the area of their applicability. In addition, I had important benefits from fruitful communications with the host's international visitors (Prof. Dr. Klaas Bergmann, Prof. Harold Metcalf and Prof. Ite A. Yu) who are known specialists in the field of atomic and molecular physics. Other important contacts had occurred during my secondments supported by FOTONICA funds with scientists from Pisa University (prof. E. Arimondo team), from Vilnius University (Dr. Gediminas Juzeliūnas team) from University of Strasburg (Prof. Guido Pupillo team) whose activities also closely interference with my interests.</p> |

3.7. Dr.Phys. Teodora Velcheva

**„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective
Integration in the European Research area”**

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.02.2012.-31.01.2015. |
| Recruiting period | 09.04.2012-30.04.2015 |
| Scientist | Teodora Velcheva, Kirova Institute of Atomic Physics and Spectroscopy, University of Latvia |
| Science | <p>In the duration of the project the scientist performed extensive theoretical simulations of the Autler-Townes spectra upon interaction of strong laser fields with multilevel atomic systems. In particular, she developed theoretical models and the corresponding computer codes, which allowed to investigate numerically the peculiarities of the occurrence of “bright” and “dark” states in strongly coupled hyperfine level systems of Na atoms. The theory was developed for a variety of three-level ladder excitation schemes, involving different combinations of intermediate and high excited states in Na, with the corresponding hyperfine, as well as Zeeman structure sublevels. The researcher performed a wide range of simulations under different conditions relevant to the experimental realization of the studied effects, e.g. laser detuning, intensities and spot size arrangements. These theoretical studies provided the base for further improvements in the running of the experiments, which aim at experimental resolution of the laser-dressed states, resulting from interaction of the strong laser field with the initially unresolved hyperfine levels of Na. Analysis of the numerical simulations performed by the scientist, lead to a deeper understanding of the role of the atomic hyperfine structure in the laser-matter interactions. On the other hand, it opened new perspectives for applications in quantum optics, for example generation of bichromatic polaritons, as well as quantum control, where it is possible to achieve control of two-photon selection rules and, in particular, selectively excite unresolved hyperfine sublevels of atomic Rydberg states.</p> <p>The work resulted in a number of conference abstracts and invited talks, as well as two manuscript which are being finalized for publication and one manuscript in preparation.</p> <p>During the project the researcher has worked extensively with graduate and undergraduate students, majoring in the fields of both experimental and theoretical quantum optics. She became the co-advisor for a BS student's work, whose thesis was graded 9 (out of 10) upon the committee evaluation and who is now pursuing his graduate studies abroad.</p> <p>In the last year of the project the scientist was appointed as a leading researcher at the Institute of Atomic Physics and Spectroscopy, University of Latvia and is currently involved in fundraising activities, which will facilitate the establishment of her own research group in the future.</p> |
| International and national | In the periods 22 April -22 May 2013, 18 April-18 May 2014 and 20 December 2014- 9 January 2015 the researcher visited the group of Nikolay N. Bezuglov at the |

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| cooperation | Department of Physics, St. Petersburg State University, Russia as a seconded scientist within the FP6 Project COLIMA. |
| Papers and conferences | <p>Papers</p> <ol style="list-style-type: none"> 1. "Consequences of Multiple Dressed States Formation in Atomic Nondegenerate Hyperfine Levels I: the Death of Dark and Bright Components in Autler-Townes Spectra", <u>T. Kirova</u>, A. Cinins, M. Bruvelis, D. K. Efimov, K. Miculis, N. N. Bezuglov, A. Ekers, M. Auzins, and I. I. Ryabtsev, to be submitted to Phys. Rev. A 2. "Consequences of Multiple Dressed States Formation in Atomic Nondegenerate Hyperfine Levels II: Control of Two-Photon Selection Rules", N. N. Bezuglov, D. K. Efimov, A. Ekers, <u>T. Kirova</u>, M. Bruvelis, A. Cinins, K. Miculis, to be submitted to Phys. Rev. A 3. "Visualization of Dark states in Hyperfine Levels of Na via Dynamic Excitation of a Three-level Ladder", A. Cinins, M. Bruvelis, <u>T. Kirova</u>, K. Miculis, D. K. Efimov, N. N. Bezuglov, and A. Ekers, in preparation 4. Electromagnetically Induced Transparency in Open Molecular Systems", J. Magnes, E. Ahmed, <u>T. Kirova</u>, A. Lazoudis, A. M. Lyyra, A. Hansson, F. C. Spano, and L. M. Narducci, submitted to Optics Communications, being revised 5. Formation of Multiple Bright and Dark States in Hyperfine Levels of Na via Autler-Townes Effect", <u>T. Kirova</u>, M. Bruvelis, A. Cinins, K. Miculis, A. Ekers, D. Efimov, N. N. Bezuglov, I. I. Ryabtsev, and M. Auzins, to be submitted to European Journal Physics D <p>Invited Talks</p> <ol style="list-style-type: none"> 1. "Peculiarities of Bright and Dark States Formation in Three-level Ladders of Na Hyperfine Levels", 3rd TLL/COLIMA Workshop on manipulation of light by matter and matter by light, 18-19 October 2014, Hsinchu, Taiwan 2. "Laser Manipulation of Electromagnetically Induced Transparency in Rydberg Atoms in the Dipole Blockade/Antiblockade Regimes", 3rd TLL/COLIMA Workshop on manipulation of light by matter and matter by light, 18-19 October 2014, Hsinchu, Taiwan 3. "Coherent Effects in Atomic and Molecular Systems", March, 2014, Institute of Atomic Physics and Spectroscopy, University of Latvia, Riga, Latvia, interview talk 4. "Formation of Dark States in Hyperfine Levels of Na via Autler-Townes Effect", September 2012, NITheP Seminars, NITheP, Stellenbosch Institute for Advanced Study, Stellenbosch, South Africa <p>Conference Abstracts</p> <ol style="list-style-type: none"> 1. <u>Teodora KIROVA</u>, Arturs CININS, Martins BRUVELIS, D. K. EFIMOV, Kaspars MICULIS, Nikolay BEZUGLOV, Aigars EKERS, Marcis AUZINS AND I. I. RYABTSEV. Consequences of Multiple Dressed States Formation in Atomic Nondegenerate Hyperfine Levels. <i>The FOTONIKA-LV conference: "Achievements and Future prospects" Riga, 23-24 April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV</i> 2. "Manifestation of Multiple Dressed States in Hyperfine Levels of Na: the Death of Dark and some Bright Components in Autler-Townes Spectra", <u>T. Kirova</u>, D. K. Efimov, K. Miculis, E. Stegenburgs, M. Bruvelis, A. Cinins, N. N. Bezuglov, I. I. Ryabtsev, A. Ekers, 73 Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 6 February 2015, Riga Photonics Centre, Latvia 3. "Nonlinear optical pumping of a slow and cold Cs beam", N. N. Bezuglov, <u>T. Kirova</u>, A. Ekers, N. Porfido, S. Birindelli, F. Tantussi, F. Fuso, poster |

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| | <p>presentation, 73rd Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 6 February 2015, Riga Photonics Centre, Institute of Atomic Spectroscopy, Riga, Latvia</p> <ol style="list-style-type: none"> 4. "Coherent population switching in cold sodium atoms", A. Cinins, M. Bruvelis, <u>T. Kirova</u>, N. N. Bezuglov, A. Ekers, 73 Annual Scientific Conference of the University of Latvia, Natural Sciences, Asrtospectroscopy, atomic, molecular and optical physics section, 5 February 2015, Faculty of Physics and Mathematics, Riga, Latvia 5. "Peculiarities of Bright and Dark States Formation in Three-level Ladders of Na Hyperfine Levels", T. Kirova, E. Stegenburgs, M. Bruvelis, A. Cinins, K. Miculis, A. Ekers, M. Auzinsh, D. K. Efimov, N. N. Bezuglov, and I. I. Ryabtsev, 10 International Workshop "Control of Quantum Dynamics of Atoms, Molecules and Ensembles by Light" (CAMEL 10), 23-27 June 2014, Nessebar, Bulgaria 6. "Formation of Multiple Dressed States in Hyperfine Level Systems of Na", <u>T. Kirova</u>, M. Bruvelis, A. Cinins, K. Miculis, A. Ekers, L. Kalvans, M. Auzinsh, D. K. Efimov, N. N. Bezuglov, and I. I. Ryabtsev, Petergof Workshop on Laser Physics (PWLP 2014), 21-25 April 2014, St. Petersburg State University, Department of Physics, St. Petersburg, Russia 7. "Quantum State Manipulation using Strong Light-Matter Interaction", M. Bruvelis, <u>T. Kirova</u>, A. Cinins, K. Michulis, D. K. Efimov, M. Auzinsh, N. N. Bezuglov, A. Ekers, Petergof Workshop on Laser Physics (PWLP 2014), 21-25 April 2014, St. Petersburg State University, Department of Physics, St. Petersburg, Russia 8. "Peculiarities of the Formation of Bright and Dark States at Hyperfine 3D3/2 and 3D5/2 Levels of Sodium", <u>T. Kirova</u>, N. N. Bezuglov, M. Bruvelis, A. Cinins, D. Efimov, A. Ekers, 72 Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 7 February 2014, Riga Photonics Centre, Institute of Atomic Spectroscopy, Riga, Latvia 9. "Laser Manipulation of Quantum States", A. Ekers, N. Bezuglov, K. Miculis, <u>T. Kirova</u>, M. Bruvelis, D. Efimov, C. Andreeva, M. Auzinsh, 72 Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 7 February 2014, Riga Photonics Centre, Institute of Atomic Spectroscopy, Riga, Latvia 10. "Experimental Observation of the Formation of Multiple Dressed States in Hyperfine Level Systems of Sodium", E. Stegenburgs, A. Leitis, A. Cinins, M. Bruvelis, D. K. Efimov, N. N. Bezuglov, A. Ekers, <u>T. Kirova</u>, poster presentation, 72 Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 7 February 2014, Riga Photonics Centre, Institute of Atomic Spectroscopy, Riga, Latvia 11. "Formation of Multiple Dressed States in Hyperfine Level Systems of Na", <u>T. Kirova</u>, N. Bezuglov, K. Miculis, D. K. Efimov, M. Bruvelis, A. Cinins, A. Ekers, L. Kalvans, M. Auzinsh, and I. I. Ryabtsev, poster presentation, International Workshop on Atomic Physics, focus days on "Quantum Dynamics in Tailored Intense Fields", November 25-29, 2013, Dresden, Germany 12. "Formation of Multiple Dressed States in Hyperfine Level Systems of Na", M. Bruvelis, T. Kirova, N. Bezuglov, A. Cinins, K. Miculis, A. Ekers, L. Kalvans, M. Auzinsh, D. K. Efimov, I. I. Ryabtsev, TLL/COLIMA 2 Workshop on manipulation of light by matter and matter by light, 1-5 September, 2013, Vilnius, Lithuania 13. "Formation of Multiple Dressed States in Hyperfine Level Systems of Na", A. Cinins, T. Kirova, N. Bezuglov, M. Bruvelis, K. Miculis, A. Ekers, L. Kalvans, M. Auzins, D. K. Efimov, I. I. Ryabtsev, poster presentation, 11th meeting of ECAMP, 24-28 June 2013, Aarhus, Denmark 14. "Nonlinear optical pumping of a slow and cold Cs beam", <u>T. Kirova</u>, 9 International Workshop "Control of Quantum Dynamics of Atoms, Molecules and |
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| | <p>Ensembles by Light" (CAMEL 9), 16-21 June 2013, Nessebar, Bulgaria</p> <p>15. "Dynamics of Ultracold Polar Molecules in a Circularly Polarized Microwave Field", <u>T. Kirova</u> and A.V. Avdeenkov, International meeting: "The role and applications of collision processes in different kinds of plasmas and laser beams" 22-24 April 2013, St. Petersburg State University, Department of Physics, St.Petersburg, Russia</p> <p>16. "Manifestation of Dark State Formation in Na Hyperfine Level System", D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, <u>T. Kirova</u>, and A. Ekers, poster presentation, 71 Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 14 February 2013, Riga Photonics Centre, Institute of Atomic Spectroscopy, Riga, Latvia</p> <p>17. "Dynamics of Ultracold Polar Molecules in a Circularly Polarized Microwave Field", <u>T. Kirova</u> and A.V. Avdeenkov, 71 Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 1 February 2013, Riga Photonics Centre, Institute of Atomic Spectroscopy, Riga, Latvia</p> <p>18. "Laser Manipulation of Adiabatic States and its Application towards Resolution of Hyper-fine Structure and Population Switching" M. Bruvelis, N. Bezuglov, K. Miculis, <u>T. Kirova</u>, D.Efimov, C. Andreeva, A. Cinins, and A. Ekers, 18-23 November 2012, Cold and Ultracold Molecules (ESF Conference in Partnership with LFUI), Universitätszentrum Obergurgl, Austria</p> <p>19. "Dark State Formation in Three-Level Ladder System in Na Supersonic Atomic Beam", D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, <u>T. Kirova</u>, C. Andreeva, and A. Ekers, poster presentation, 17 International School on Quantum Electronics: Laser Physics and Applications", 24-28 September 2012, Nessebar, Bulgaria</p> <p>20. "Manifestation of Dark State Formation in Na Hyperfine Level System", D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, <u>T. Kirova</u>, and A. Ekers, "Quantum Africa 2", 3-7 September 2012, Drakensberg, South Africa</p> <p>21. "Effects of Dark State Formation in the Hyperfine Excitation Spectra of Na atoms", D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, <u>T. Kirova</u>, and A. Ekers, poster presentation, 23 meeting of ICAP, 23-27 July 2012, Paris, France</p> <p>22. "Dynamics of Ultracold Polar Molecules in a Circularly Polarized Microwave Field", <u>T. Kirova</u> and A.V. Avdeenkov, TLL/COLIMA 1st Workshop on manipulation of light by matter and matter by light, 18-19 July, 2012, University of Latvia, Riga, Latvia</p> <p>23. "Applications of Laser Manipulation of Adiabatic States", A. Ekers, N. N. Bezuglov, K. Miculis, <u>T. Kirova</u>, M. Bruvelis, D. Efimov, C. Andreeva, A. Cinins, L. Kalvans, M. Auzinsh, 1st TLL/COLIMA Joint Workshop on manipulation of light by matter and matter by light, p. 7, 18-19 July, 2012, University of Latvia, Riga, Latvia</p> <p>24. "Manifestation of Dark State Formation in Na Hyperfine Level System", D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, <u>T. Kirova</u>, and A. Ekers, poster presentation, 44 meeting of EGAS, 9-13 July 2012, Gotheborg, Sweden</p> |
| Proposals | <p>During the period of the project, the scientist submitted:</p> <p>23. FP7 Reintegration Grant proposal (FP7-PEOPLE-2013-CIG LaMEITRA) rated above threshold (76.6 points);</p> <p>24. FP7 proposal (FP7-PEOPLE-2013-IOF RYDEIT) rated above threshold (81.6 points). Both proposals were not retained for funding.</p> <p>Currently the researcher is writing two proposals for international collaboration between EU and Third Countries research institutions, i.e. a Research and Innovation Staff Exchange proposal (H2020-MSCA-RISE-2015), as well as a Taiwan-Latvia-Lithuania trilateral proposal.</p> |

3.8.Dr. Christina Andreeva Markovska

„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.06.2012.-30.04.2015. |
| Recruiting period | 01.06.2012-31.07.2012, 01.09.2012-31.03.2013, 01.09.2013-31.03.2014, 01.09.2014-31.03.2015 |
| Scientist (name, surname, laboratory) | Christina Andreeva Markovska, Institute of Atomic Physics and Spectroscopy, University of Latvia |
| Science | Experiments on coherent effects in Na in supersonic atomic beam. Integrating new devices and apparatus into the existing laboratory equipment, participation in the building of the Quantum optics laboratory at ASI, preparing an experimental setup for Rb spectroscopy, measurement of Rb transitions by means of optical frequency comb. |
| International and national cooperation | Four one-month stays at the Institute of Semiconductor Physics, Russian Academy of Sciences, laboratory “Nonlinear resonance processes and laser diagnostics”, in the group of Prof. Igor Ryabtsev. Characterization and optimization of DFB laser system, and measurement of the lifetimes of highly excited Rb Rydberg atoms, realization of novel scheme for registration of Forster resonances (including forbidden Forster resonances) in Rb Rydberg atoms. |
| Papers and conferences | <p>Papers</p> <ol style="list-style-type: none"> 1. M.Bruvelis, J.Ulmanis, N.N. Bezuglov, K. Miculis, C. Andreeva, B. Mahrov, D. Tretyakov, and A. Ekers. <i>Analytical model of transit time broadening for two-photon excitation in a three-level ladder and its experimental validation</i>. Phys. Rev. A 86, 012501 (2012). 2. D. B. Tretyakov, V. M. Entin, E. A. Yakshina, I. I. Beterov, C. Andreeva, and I. I. Ryabtsev, <i>Controlling the interactions of a few cold Rb Rydberg atoms by radio-frequency-assisted Förster resonances</i>, Phys. Rev. A 90, 041403(R) (2014). <p>Conferences</p> <ol style="list-style-type: none"> 1. ”Dark State Formation in Three-Level Ladder System in Na Supersonic Atomic Beam”, D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, T. Kirova, C. Andreeva, and A. Ekers, poster presentation, 17th International School on Quantum Electronics: Laser Physics and Applications”, 24-28 September 2012, Nessebar, Bulgaria 2. ”Applications of Laser Manipulation of Adiabatic States”, A. Ekers, N. N. Bezuglov, K. Miculis, T. Kirova, M. Bruvelis, D. Efimov, C. Andreeva, A. Cinins, L. Kalvans, M. Auzinsh, 1st TLL/COLIMA Joint Workshop on manipulation of light by matter and matter by light, p. 7,18-19 July, 2012, |

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| | <p>University of Latvia, Riga, Latvia</p> <ol style="list-style-type: none"> 3. "Analytical Model of Transit Time Broadening and Numerical Model of Residual Doppler Broadening for Two-Photon Excitation in a Three-Level Ladder and its Experimental Validation", M. Bruvelis, J. Ulmanis, A. Cininsh, N. N. Bezuglov, K. Miculis, C. Andreeva, B. Mahrov, D. Tretyakov, A. Ekers, 1st TLL/COLIMA Joint Workshop on manipulation of light by matter and matter by light, p.10, 18-19 July, 2012, University of Latvia, Riga, Latvia 4. "Laser manipulation of adiabatic states and its application towards resolution of hyper-fine structure and population switching" M. Bruvelis, N. Bezuglov, K. Miculis, <u>T. Kirova</u>, D.Efimov, C. Andreeva, A. Cinins, and A.Ekers, 18-23 November 2012, Cold and Ultracold Molecules (ESF Conference in Partnership with LFUI), Universitätszentrum Obergurgl, Austria 5. I.I.Ryabtsev, D.B.Tretyakov, V.M.Entin, E.A.Yakshina, I.I.Beterov, A.A.Chernenko, Ch.Andreeva, A.Cinins, Z.Iftikhar, M.Saffman, "Laser spectroscopy of mesoscopic cold Rb Rydberg ensembles in a MOT and of nonlinear resonances in a Rb vapor cell", Abstracts of the 2nd TLL-COLIMA-FOTONIKA Joint Workshop, 1-5 September 2013, Vilnius, Lithuania, p.6-7 (invited talk) 6. I.I.Ryabtsev, D.B.Tretyakov, V.M.Entin, E.A.Yakshina, I.I.Beterov, Ch.Andreeva, A.Cinins, Z.Iftikhar, M.Saffman, "Three-photon spectroscopy and excitation statistics at long-range interactions between cold Rydberg atoms", Abstracts of the Workshop on Long-Range Interactions in the Ultra-Cold, 3-5 September 2013, Stuttgart, Germany, p.10 (invited talk). 7. I.I.Ryabtsev, D.B.Tretyakov, V.M.Entin, E.A.Yakshina, I.I.Beterov, Ch.Andreeva, A.Cinins, Z.Iftikhar, "Laser and microwave spectroscopy of cold Rydberg atoms", Abstracts of the Chinese-Russian Workshop on Laser Physics, Fundamental and Applied Photonics 2014, 29 April - 4 May 2014, Tianjin, China, p.14-15 (invited talk). 8. D.B.Tretyakov, V.M.Entin, E.A.Yakshina, I.I.Beterov, Ch.Andreeva, I.I.Ryabtsev, "Controlling the interactions of a few cold Rb Rydberg atoms by radiofrequency-assisted Förster resonances", Abstracts of the Second International Workshop on Ultracold Rydberg Physics, Recife, Brasil, 5-8 October 2014, p.66. 9. D.B.Tretyakov, V.M.Entin, E.A.Yakshina, I.I.Beterov, C.Andreeva, and I.I.Ryabtsev, "Using radio-frequency electric field to enhance Rydberg atom interaction", Abstracts of the International Conference "Micro- and Nanoelectronics – 2014" (Extended session "Quantum Informatics - 2014"), 6-10 October 2014, Moscow-Zvenigorod, Russia, p.q1-03 (oral presentation). 10. D.B.Tretyakov, V.M.Entin, E.A.Yakshina, I.I.Beterov, Ch.Andreeva, and I.I.Ryabtsev, "Controlling the interactions of a few cold Rb Rydberg atoms by radio-frequency-assisted Förster resonances", Abstracts of the 3rd TLL/COLIMA joint workshop on manipulation of light by matter and matter by light, 18-19 October 2014, Hsinchu, Taiwan, p.23-24 (invited talk). 11. C. Andreeva, Cinins A., Ekers A., Tretyakov D., Entin V., Yakshina E., Beterov I., Markovski A., Ryabtsev I., <i>Radio-frequency-induced Förster resonances in a few cold Rb Rydberg atoms</i>, 8 International conference "Basic Problems of Optics" BPO'2014, Saint Petersburg 20-24. 10. 2014 12. Radiofrequency-Induced Förster Resonances in Cold Rb Rydberg Atoms, C.Andreeva, A.Cinins, A.Ekers, D.B.Tretyakov, V.M.Entin, E.A.Yakshina, I.I.Beterov, I.I.Ryabtsev, 72-nd Annual scientific conference of the University of Latvia, 07.02.2014, Riga, Latvia, Book of abstracts p.15. 13. Laser manipulation of quantum states, A. Ekers, N. Bezuglov, K. Miculis, T. Kirova, M. Bruvelis, D. Efimov, C. Andreeva, A. Cinins, M. Auzinsh, 72-nd Annual scientific conference of the University of Latvia, 07.02.2014, Riga, |
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| | <p>Latvia, Book of abstracts p.23.</p> <p>14. J. Alnis, I. Brice, J. Rutkis, I. Fescenko, C. Andreeva, Measuring Rubidium Optical Transitions with a Femtosecond Frequency Comb, 73-nd Annual scientific conference of the University of Latvia, 06.02.2015, Riga, Latvia, Book of abstracts p.28.</p> <p>15. C. Andreeva, A. Cinins, A. Ekers, D. Tretyakov, V. Entin, E. Yakshina, I. Beterov, A. Markovski, I. Ryabtsev, Controlling the Interaction of a Few Cold Rb Rydberg Atoms by Radio-Frequency Assisted Förster Resonances, 73-nd Annual scientific conference of the University of Latvia, 06.02.2015, Riga, Latvia, Book of abstracts p.41.</p> |
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3.9. Dr.Phys. Asparuh Georgiev Markovski

„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.02.2012.-30.04.2015. |
| Recruiting period | 01.09.2012-31.01.2015 |
| Scientist (name, surname, laboratory) | Asparuh Georgiev Markovski, Institute of Atomic Physics and Spectroscopy, University of Latvia |
| Science | A computer-based system for automatic control of simultaneous operation of two laser systems is under development. The system will have GUI and data acquisition and processing block. Development of a web-site of the Laser Center of the Latvian University, representing the structure and latest achievements of the workgroups |
| International and national cooperation | Two one-month stays at the Institute of Semiconductor Physics, Russian Academy of Sciences, laboratory “Nonlinear resonance processes and laser diagnostics”, in the group of Prof. Igor Ryabtsev. Digital system for tuning and long-term frequency stabilisation of multi-laser systems. |
| Papers and conferences | <p>Papers</p> <p>I. Beterov, A. Markovski, S. Kobtsev, E. Yakshina, V. Entin, D. Tretyakov, V. Baraulya, I. Ryabtsev, Simple digital system for tuning and long-term frequency stabilization of a CW Ti:Sapphire laser, <i>Opt. Eng.</i> 54(3), 034111 (2015).</p> <p>Conferences</p> <ol style="list-style-type: none"> 1. C. Andreeva, A. Cinins, A. Ekers, D. Tretyakov, V. Entin, E. Yakshina, I. Beterov, A. Markovski, I. Ryabtsev, Controlling the Interaction of a Few Cold Rb Rydberg Atoms by Radio-Frequency Assisted Förster Resonances, 73-nd Annual scientific conference of the University of Latvia, 06.02.2015, Riga, Latvia, Book of abstracts p.41. 2. Beterov, A. Markovski, S. M. Kobtsev, E. A. Yakshina, V. M. Entin, D. B. Tretyakov, V. I. Baraulya, I. I. Ryabtsev, A Simple Cost-effective Digital System for Tuning and Long-Term Frequency Stabilisation of a CW Ti:Sapphire Laser, 73-nd Annual scientific conference of the University of Latvia, 06.02.2015, Riga, Latvia, Book of abstracts p.48. 3. C. Andreeva, Cinins A., Ekers A., Tretyakov D., Entin V., Yakshina E., Beterov I., Markovski A., Ryabtsev I., <i>Radio-frequency-induced Förster resonances in a few cold Rb Rydberg atoms</i>, 8 International conference "Basic Problems of Optics" BPO'2014, Saint Petersburg 20-24. 10. 2014 |

3.10. Dr. Uldis Gross

„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.10.2014.-30.11.2014. |
| Scientist (name, surname, laboratory) | Dr.Phys Uldis Gross, p.k. 151158-10026 Laboratory of Atomic Physics, Atmosphere Physics and Photochemistry The Institute of Atomic Physics and Spectroscopy Association FOTONIKA-LV, University of Latvia |
| Science | 1) Assistance to local Organizing committee in the organization of: The 1 st International Conference Nocturnal Atmosphere, Remote Sensing and Laser Ranging: NOCTURNAL - Riga 2014; October 16-18 Training course for Young Researchers Adventure of Nocturnal Atmosphere: From Earth to Night Sky - Riga 2014, October 20-22 (<i>Advances in Remote Sensing, Satellite Laser Ranging and Geodynamics</i>) October 20-22 2) Experimental research towards optimization of operational properties and spectral parameters of atomic Iodine resonance spectra sources and the development of Bromine resonance spectra sources |
| International and national cooperation | Cooperation with Dr. Alfonso Saiz-Lopez ² Atmospheric Chemistry and Climate Group, Institute of Physical Chemistry Rocasolano, CSIC, Spain on the upgrade of ROFLEX instrument with resonance spectra sources of atomic Bromine |
| Papers and conferences | Participation and plenary lecture in the Conference: ➤ Arnolds Ubelis, Alfonso Saiz-Lopez, Janis Blahins, Aigars Apsitis, Uldis Gross. Applications of iodine and bromine atomic resonance spectra sources for atmosphere research. Plenary lecture in the "6 th International Symposium on Non-equilibrium Processes, Plasma, Combustion and Atmospheric Phenomena" . Sochi, Russia, October 6-10, 2014. ➤ Drafted Article for submission in Physica Scripta |
| Reporting date | December 2014 |

3.11. Dr. Arvind Kumar Saxena

„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 04.08.2014.-31.01.2015. |
| Recruiting period | 04.08.2014.-30.04.2015. |
| Scientist (name, surname, laboratory) | Arvind Kumar, Saxena, Research Fellow, Laboratory of Atomic Physics, Atmosphere Physics and Photochemistry The Institute of Atomic Physics and Spectroscopy Association FOTONIKA-LV, University of Latvia |
| Science | <p>Responsibilities covered the Ion beam trajectory modelling, To extract the Ion beam under the influence of a combinations of electric as well as magnetic field, Making Gothenburg-Riga-Ion Beam Apparatus (GRIBA), To design experiments based on Molecule/clusters-Ion collisions, Working with Nd:YAG laser, To design experiments based on laser beam ionization.</p> <p>The initial Ion beam trajectory modelling is performed successfully using a SIOMION 8.0 simulation package. The 3D-modelling of the ion trajectory simulation is also performed. A new ion beam trajectory simulation package called LISA is also under trial for the charged particle trajectory simulations. The alignment of the different component of GRIBA is carried out, and the vacuum connections of the equipment is also checked and verified. The initial ion beam testing is expected soon. As soon as the ion beam is tested, It will be explored for the Ion-Molecule/cluster collisions using a single field Time-Of-Flight (TOF) mass spectrometer. The Ion beam simulation of TOF is carried out using SIMION model. TOF will be employed to detect ions comprising from the reactions between Ion-Molecule/cluster collisions. TOF is equipped with a Microchannel Plate detector. The ultimate pressure achieved in TOF is of the order of 10⁻⁷ mbar.</p> <p>An Nd:YAG laser is mounted and tested, all the optical component of laser is aligned. The laser beam is extracted and is found to be capable of ablating metal targets. This laser beam is expected to employ with the existing TOF facility for the Photoionization study of atoms, molecules and clusters. The initial testing may be carried out with a simple effusive molecular beam ionized by laser beam followed by the ion detection by TOF.</p> |
| International and national cooperation | <ol style="list-style-type: none"> 1. Visited Oulu university Physics department, Electron spectroscopy group during 4-12 September 2014 for scientific collaborations, presenting scientific work, and writing MARIE SKŁODOWSKA-CURIE ACTIONS Individual Fellowships (IF) Call: H2020-MSCA-IF-2014 project 2. Visited universities in India during 8-18 November 2014, like, Indian Institute of Teacher Education, Indian center of climate and societal impacts research, and Institute for Plasma Research to seek for future collaborations, delivered scientific colloquium/seminars, had fruitful scientific discussions with professors and |

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| | scientists on the scientific projects/collaborations. |
| Papers and conferences | <p>Papers</p> <ol style="list-style-type: none"> 1. Arvind Saxena, Prashant Kumar, S B Banerjee, K P Subramanian, B Bapat, R K Singh and Ajai Kumar, “Dependence of ion kinetic energy and charge on cluster size in multi-photon ionization of xenon clusters” <i>International journal of mass spectrometry</i> 357, 58-62 (2014); 2. Arvind Saxena, Prashant Kumar, Swaroop Banerjee, K. P. Subramanian and Bhas Bapat, “Optical Emission Spectroscopy of Carbon Clusters Produced in a Hollow Cathode Sputter Source” <i>Spectroscopy Letters</i> 47, 114-118 (2014) 3. “Mass Spectrometry of Atomic and Molecular Clusters”, Arvind Saxena, International Journal of Emerging Technologies and Application in Engineering, Technology and Sciences (IJ-ETAETS) , special issue, 91-99 (2014). <p>Conferences</p> <ol style="list-style-type: none"> 1. Attended 73rd Annual Scientific Conference of the University of Latvia held on 6th February 2015 in Riga Photonics center, Riga. Presented a poster entitled “Study on collisions of atomic clusters with charged particles”. 2. Attended a training school entitled “Adventure of Nocturnal Atmosphere: From Earth to Night Sky Riga 2014 (Advances in remote sensing, satellite laser ranging and geodynamics) 20-22 October 2014, University of Latvia, Latvia”. 3. Attended 1st International Conference on Nocturnal Atmosphere and Laser Ranging: NOCTURNAL - Riga 2014, University of Latvia, 16-18 October 2014 in Riga and presented a poster entitled Atmospheric Photochemistry of Carbon Clusters. |
| International projects | <p>Contribution in writing of proposals for HORIZON 2020 calls with Oulu University Finland, and FOTONIKA centre, Latvia:</p> <ul style="list-style-type: none"> ➤ <i>Individual Fellowships Call: H2020-MSCA-IF-2014: “AMOClusOulu” - “Molecular level physics on ionospheric nanoparticles”,</i> ➤ <i>Call: MSCA-RISE-2015, Proposal Number: 691063, Proposal Acronym: ION SPECTRA; .</i> |
| Reporting date | 30 April 2015 |

3.12. Dr. Justas Zdavicius

**„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective
Integration in the European Research area”**

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 20.06.2012.-20.06.2013. |
| Scientist (name, surname, laboratory) | Dr. Justas Zdanavičius, DOB: 04.05.1971, e-mail: Justas.Zdanavicius@tfai.vu.lt University of Latvia, Institute Astronomy. |
| Science | <p>For more than 34 years (1967-2001) 22000 direct and 3000 objective prism spectral photographic negatives, were obtained with the Baldone Schmidt telescope and collected at the Astrophysical Observatory of the Institute of Astronomy, University of Latvia. Each photo of the Baldone Schmidt telescope has been taken in order to study a definite cosmic objects or groups of their, therefore only for these objects either brightness or coordinates on the photos have been measured. Usually about 95% to 99% of the information fixed on the emulsion of photo is reminded unused. I. Therefore, these photos were stored and will be digitized and converted in astronomical fits format. The result of digitalization of photos will be a large astronomical database for different astronomical studies (bright variability, proper motion of stars, searching of nova, asteroids, comets ...). Digitalization of all photos of astronomical archive will end in five next years, therefore the methodology of reduction of digitalized data became very actual. Reduction process contains some very difficult problems. For example: the large size file of one digitalized photo (about 900MB); because the Schmidt system telescopes have a curved focus plane the photos were curved during exposure therefore the focus on photos sometime change from the middle to the edge; many small defects there are on photos; different exposures requires different digitalization aperture size; background density varies in different places on the photos and so on. Therefore reduction process of large number of photos requires a high degree of automation and time.</p> <p>For the data processing the standard IRAF (Image Reduction and Analysis Facility) program package was used. The best way to transform scanned transmission T to the intensity was obtained $I \sim 1/T$. The coordinates of stars, were determined using catalog UCAC4 as a standard of coordinates and magnitudes.</p> <p>Due to different (not uniform) photo plane curvature in the field corners sometime occur distortions. This distortion varies from corner to corner, and from photo to photo. To solve this problem, a computer code was written, which determine the celestial coordinates of stars. Fitted IRAF (Image Reduction and Analysis Facility) program calculates the plane solutions by iterations, started from the center and go on increasing radius, until it reaches the edge of field. The mean accuracy (standard deviation) of the coordinate determinations in the entire field is 0.5 pix. One scanned pixel corresponds to 0.91 arcsec in the sky.</p> <p>The magnitudes of stars were obtained using multi aperture photometry.</p> |

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| | <p>Instrumental catalog is adjusted on the zero point, calculated corrections of the coordinates and stellar magnitudes. To succeed in accuracy, the field is divided into five slightly overlapping parts. In order to improve the photometric accuracy each part has been split into two parts by measured errors of stars in instrumental catalog.</p> <p>Adjustment to a standard catalog was performed using IRAF gaussfit task (this task solves least square and nonlinear problems).</p> <p>As a result we obtain two catalogs: One with corrected color equation (includes calculated dependence from B-V). But in this case it can be done only for the stars with a known index B-V. Another catalog contains all detected objects but doesn't have color index correction. As in the most cases, variable stars do not have known index B-V, they can only be found in this catalog. The coordinates accuracy is ~0.5 arcsec and photometric accuracy is 0.5 mag.</p> |
| International and national cooperation | <p>Dr. Zdanavičius has engaged in international collaboration with a number of scientists from different countries. This includes collaboration with Dr. Ireneusz Włodarczyk from the Chorzow Astronomical Observatory, Poland, Dr. Richard Boyle from Steward observatory, Arizona, USA, Dr. Frederick Vrba from U.S. Naval Observatory Flagstaff Station.</p> |
| 1. Papers and conferences | <p>Papers in journals</p> <ol style="list-style-type: none"> 1. Čepas V., Zdanavičius J., Zdanavičius K., Straižys V., Laugalys V. 2013. Seven-color Photometry and Classification of Stars in the Vicinity of the Emission Nebula Sh2-205, <i>Baltic Astronomy</i>, 22, 243-258. 2. Milašius, K., Boyle R. P., Vrba F. J., Janusz R., Straižys V., Černis K., Laugalys V., Zdanavičius K., Zdanavičius J., Kazlauskas A., Smilgys R. 2013. Seven-color Photometry and Classification of Stars in the Direction of Open Cluster M 29 (NGC 6913) in Cygnus, <i>Baltic Astronomy</i>, 22, 181-221. <p>Conference contributions</p> <ol style="list-style-type: none"> 3. J.Zdanavicius, I.Eglitis, V.Lapoška, V.Eglīte.; Problems and results of reduction of digitalized photographic images of Baldone Schmidt telescope. 71.koference of University of Latvia 13.-14.02.2013 |
| Additional information | <p>This has been a successful recruitment. His evaluated IRAF gaussianfits program give possibilities to reduce the data of digitized astroplate in real time interval with good accuracy, especially in photometry. Further development of software for data processing in Institute of Astronomy of UL reveal cooperation with astronomer Vitaly Andruk from Main Astronomical observatory of National Academy of Sciences of Ukraine and Dr.Yuri Protsyuk from Research Institute of Nikolaev Astronomical Observatory of Ukraine.</p> |

3.13. Dr. Vygandas Laugalys

„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.07.2013.-30.06.2014. |
| Scientist (name, surname, laboratory) | Dr. Vygandas Laugalys, DOB: 17.01.1972, ID: 170172-18008, e-mail: vygandas.laugalys@gmail.com University of Latvia, Institute Astronomy. |
| Science | <p>Photographic observations using the Schmidt telescope were carried out from January 1967 till December 2005, more than 20 thousand photographic plates have been obtained and collected in archive at the Astrophysical Observatory of the Institute of Astronomy, University of Latvia. The plates, each covering a field with the 4.8 x 4.8 deg, contain a huge amount of scientific information. The extraction of this information requires a fast and automatic reliable method for processing the plate archive with a good accuracy. The images were scanned by Epson Expression10000XL and Expression11000XL scanners with 2400 dpi and the scans were saved in the TIFF format. Then the images were converted to the Fits format. Reduction process contains some very difficult problems: the large size of file of one digitalized photo (about 1GB); the Schmidt system telescopes have a curved focus plane the photos therefore the focus on photos sometime change from the middle to the edge; many small defects there are on photos; different exposures requires different digitization aperture size; background density varies in different places on the photos and so on.</p> <p>For the data processing the standard IRAF (Image Reduction and Analysis Facility) program package was fitted to gaussian task. The physical size of the image were reduced by binning this image 2x2. The coordinates of stars, were determined using catalogues Tycho2 or UCAC4 as a standard of coordinates and magnitudes respectively.</p> <p>Due to the curvature of focal plane in the field corners of plates sometime occur distortions. This distortion varies from corner to corner, and from photo to photo. To solve this problem, a computer code was written, which determine the celestial coordinates of stars by nonlinear equations by least square method using developed code:</p> $V = a + c1*(B-V) + d1*M + d2*M^2 + e1*PSF + a10*X + a20*X^2 + a30*X^3 + a40*X^4 + b10*Y + b20*Y^2 + b30*Y^3 + b40*Y^4 + M^1*(a11*X + a21*X^2 + b11*Y + b21*Y^2 + a31*X*Y).$ <p>Fitted IRAF program calculates the plane solutions by iterations, started from the manually identified standard star in the center of photo. The mean accuracy (standard deviation) of the coordinate determinations in the entire field is 0.5 arcsec.</p> |

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| | The mean accuracy in photometry is $SD=\pm 0.045$ mag. |
| International and national cooperation | Laugalys has engaged in international collaboration with a number of scientists from different countries in digitized data processing field with Dr. Ulisse Munari from UINAF Astronomical Observatory of Padova, Italia, Dr. Richard Boyle from Steward observatory, Arizona, USA, Dr. Frederick Vrba from U.S. Naval Observatory Flagstaff Station, Dr. Nolan Walborn from Space Telescope Science Institute, USA, E. Tognelli from U.S. Naval Observatory Flagstaff Station, USA. |
| Papers and conferences | <p>Papers in journals</p> <ol style="list-style-type: none"> 1. Straizys, V.; Milasius, K.; Boyle, R. P.; Vrba, F. J.; Munari, U.; Walborn, N. R.; Černis, K.; Kazlauskas, A.; Zdanavičius, K.; Janusz, R.; Zdanavičius, J.; Laugalys, V., The Enigma of the Open Cluster M29 (NGC 6913) Solved, The Astronomical Journal, Volume 148, Issue 5, article id. 89, pp. (2014). 2. Straizys, V.; Maskoliūnas, M.; Boyle, R. P.; Prada Moroni, P. G.; Tognelli, E.; Zdanavičius, K.; Zdanavičius, J.; Laugalys, V.; Kazlauskas, A., The distance to the young cluster NGC 7129 and its age, Monthly Notices of the Royal Astronomical Society, Volume 438, Issue 2, p.1848-1855. 3. Straizys, V.; Maskoliūnas, M.; Boyle, R. P.; Zdanavičius, K.; Zdanavičius, J.; Laugalys, V.; Kazlauskas, A., The open cluster NGC 7142: interstellar extinction, distance and age, Monthly Notices of the Royal Astronomical Society, Volume 437, Issue 2, p.1628-1635. 4. Straizys, V.; Boyle, R. P.; Janusz, R.; Laugalys, V.; Kazlauskas, A., The open cluster IC 1805 and its vicinity: investigation of stars in the Vilnius, IPHAS, 2MASS, and WISE systems, Astronomy & Astrophysics, Volume 554, id.A3, pp. 5. Čepas V., Zdanavičius J., Zdanavičius K., Straizys V., Laugalys V. 2013. Seven-color Photometry and Classification of Stars in the Vicinity of the Emission Nebula Sh2-205, Baltic Astronomy, 22, 243-258. 6. Milasius, K., Boyle R. P., Vrba F. J., Janusz R., Straizys V., Černis K., Laugalys V., Zdanavičius K., Zdanavičius J., Kazlauskas A., Smilgys R. 2013. Seven-color Photometry and Classification of Stars in the Direction of Open Cluster M 29 (NGC 6913) in Cygnus, Baltic Astronomy, 22, 181-221. 7. Straizys V., Boyle R. P., Janusz R., Laugalys V., Kazlauskas A. 2013. The open cluster IC 1805 and its vicinity: investigation of stars in the Vilnius, IPHAS, 2MASS, and WISE systems, Astronomy & Astrophysics, Volume 554, id.A3, 9 pp. <p>Conference contributions</p> <ol style="list-style-type: none"> 1. V.Laugalys, Progressi in the processing of scans of Schmidt telescope astronomical plates, 72 annual scientific conference of University of Latvia, February 1 2013. |
| Additional information | This has been a successful recruitment. His evaluated IRAF gaussian fits program work automatically to reduce the manual work of astronomer and operational time. |

3.14. Dr. Jorge del Pino

„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 22.04.2013.-31.04.2015. |
| Recruiting period | 22.04.2013.-30.04.2015. |
| Scientist (name, surname, laboratory) | <p><i>Jorge del Pino, Geodynamical station Riga, Institute of Astronomy University of Latvia</i></p> <p>Jorge.delpino@lu.lv</p> <p>Cuban Passport : B790611</p> <p>Latvia Temporal residence code: 070549-18004</p> |
| Science | <p>Created and Installed a new Automatic SLR Calibration Batch filtering program, All the SLR target calibrations for 2010-2013 has been reanalyzed with 4 different sigma criteria. An internal report is being prepared.</p> <p>The same program is being used for monitoring and optimizing the operation of the new SLR target single-mode optical fiber installed end of July 2013. The new calibrations are analyzed weekly.</p> <p>All the materials for the creation of a new SLR operation manual are being recopied. The writing of this manual has started.</p> <p>Preliminary work for an ESA proposal concerting Space Debris SLR Tracking in cooperative mode was started. it is expected than the application will be done for the next PECS call after evaluating the station performance after first upgrade stage.</p> <p>During the second half of 2013, the methodology for the optical alignment of the SLR system was reversed engineered and recovered. As a result SLR observations of the LAGEOS 1&2 satellites were possible again and restarted since October 2013.</p> <p>A new SLR alienation manual has been written (In English), this manual is currently is on the 3rd iteration, reflecting the improvements on the procedures.</p> <p>The optical realignment of the SLR system is now carried out routinely and in a minimum time.</p> <p>A small illustrated manual for the replacement of the laser cooling water was prepared.</p> <p>A new calibration filtering program, and XML format generator for the observational data (DOS version) has been written and tested to support the introduction of a new filtering program.</p> <p>The housekeeping SLR Excel suite originally developed for the SLR station Potsdam, has been introduced for the Riga SLR station. The tracking data for 2014 was processed. The current version is using the Eurolas report format information only and is ready to use also the information from the new filtering program.</p> <p>During summer 2014 a experimental redetermination of the Telescope mount</p> |

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| | <p>deformation model was carried out. A fully new mount model is dependent on the entry in operation of Az/El encoders</p> <p>The statistical analysis of the in-depth characterization of the PMT photodetectors carried out by the visiting team from the SLR station Alchevsk, Ukraine.</p> <p>Preliminary work for a application(s) proposal concerning Space Debris SLR Tracking in cooperative and independent modes continues.</p> |
| International and national cooperation | <p>The initial contacts, has been established with the SLR team at GFZ-Potsdam in Germany in order to:</p> <p>Analyze jointly at GFZ-Potsdam new sets of star position measurements from the Riga SLR telescope, in order to find the optimal Riga telescope mount mechanical deformation model. This will improve the SLR Telescope pointing precision, increasing the amount of SLR data.</p> <p>Measure the transmission parameters of the Riga SLR interference filter, and to transfer the filter measurement know-how to Riga.</p> <p>This working visit to GFZ-Potsdam will be done during the autumn 2013, date still to be determined.</p> <p>The new Riga SLR Timing System Symmetricom clocks were taken, to and from Potsdam, Germany for a full characterization against the GFZ-Potsdam CS clock. Several optical and mechanical parts has been loaned from GFZ-Potsdam to be used on calibration and upgrades at Riga</p> <p>In July 2014 a small working session with Drs L. Grunwaldt (Potsdam, Germany) and G. Kirchner (Graz, Austria) was carried out in Riga to define the development paths in the frame of the next generation of problems, in particular concerning space debris.</p> |
| Papers and conferences | <p>Papers:</p> <ol style="list-style-type: none"> 1. J. del Pino, "Hazards and Risks @ SLR Network, Updates and New Challenges", Proceedings of the 18th International Workshop on Laser Ranging, Fujiyoshida, Japan, 2013. 2. Kalvis Salminsh, Jorge R. del Pino: "Preserving history and technical 'know-how' - experience at SLR station Riga"; Proceedings of the 18th International Workshop on Laser Ranging, Fujiyoshida, Japan, 2013 3. J. del Pino, K. Salmins, A. Meijers, "Upgrading the Calibration Chain at Riga SLR Station", 1st International Conference Nocturnal Atmosphere and Laser Ranging: NOCTURNAL - Riga 2014. 4. E. Hoffman, K., J. R. del Pino, A. Meijers, "Modernization and Characterization of the Riga SLR Timing System", 19th International Workshop on Laser Ranging, Annapolis, USA, 2014 5. Kalvis Salmins, Jorge del Pino, Fundamental Geodynamic Observatory – Active Member of International Satellite Laser Ranging Service and International GPS service (IGS). The capacity of upgraded SLR LS-105 System Station (ILRS code name 1884 Riga) – Results of observation and research. <i>The FOTONIKA-LV conference: "Achievements and Future prospects" Riga, 23-24 April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV</i> <p>Posters:</p> <ol style="list-style-type: none"> 1. K. Salminsh, M. Abele, J. del Pino, "Riga SLR station upgrade and status report", Proceedings of the 18th International Workshop on Laser Ranging, Fujiyoshida, Japan, 2013. 2. J. del Pino, "A format proposal for reporting SLR-Airspace interaction Events", 19th International Workshop on Laser Ranging, Annapolis, USA, 2014. 3. J. del Pino, "A Spreadsheet tool for the visualization of long term calibration series parameters", 19th International Workshop on Laser Ranging, Annapolis, USA, 2014 |
| International projects | <p>Contribution in writing of proposals for HORIZON 2020:</p> <p>➤ Call ID: H2020-MSCA-RISE-2015, "NEXTSLR" Towards next generation of SLR instrumentation and advances in Geodynamics</p> |
| Date | May 2015 |

3.15. Dr.Phys. Ilja Fescenko

**„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective
Integration in the European Research area”**

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 20.02.2014.-20.03.2014., 16.06.2014.-30.04.2015. |
| Repatriation period | 20.02.2014.-20.03.2014., 16.06.2014.-30.04.2015. |
| Scientist (name, surname, laboratory) | Ilja Fescenko, Repatriated researcher, Laboratory of Atomic Physics, Atmosphere Physics and Photochemistry Institute of Atomic Physics and Spectroscopy, Association FOTONIKA-LV University of Latvia iliafes@gmail.com |
| Science WP2, Task 2.11. | <p>The objective of this task is to repatriate Ilja Fescenko, a research associate and Sciex program fellow in the group of Prof. Antoine Weis at Fribourg University, previously also worked in the group of Nobel prize winner Prof. Theodor Hänsch at Max Planck Institute of Quantum Optics.</p> <p><u>Scientific topic:</u> Experimental atomic and molecular spectroscopy: coherent processes in atoms and molecules; magnetic field visualization; whispering gallery mode optical resonators; ultrastable laser systems, frequency comb for laser locking and spectrometry.</p> <p><u>Description of work:</u> Ilja Fescenko works in group of quantum optics lead by Janis Alnis. Main tasks are the following:</p> <ol style="list-style-type: none"> 1) Laser spectroscopy of Rubidium using the frequency comb. 2) Development of a new method of longterm frequency stabilization of laser locked to a Fabry-Pérot resonator by using inhomogeneous mode structure. 3) Developments of methods of laboratory air quality control. 4) Defence of doctoral thesis in the University of Latvia. |
| Outcomes of implementation of above mentioned scientific tasks | <ol style="list-style-type: none"> 1) The setup for rubidium saturation spectroscopy was prepared and measurements of frequency of Rb D2 transitions with frequency comb were carried out. The results are going to consist the main part of student Jazeps Rutkis bachelor thesis, and are also in preparation for publication in a SCOPUS journal. 2) A Fabry-Pérot resonator setup for dual-mode temperature stabilization was prepared and tested. A principal possibility of using different modes in the zerodur resonator for intrinsic temperature measurements was demonstrated. The final part of experiment where temperature of the resonator is locked is under development. 3) Low-cost and sensitive dust sensors, as well as carbon dioxide sensors were constructed and build and calibrated for use in clean laboratory environments. 4) Dr. Ilja Fescenko has defended his PhD thesis on laser spectroscopy studies of the coherent processes in alkali atoms and molecules in 2014 December 10. |

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| International and national cooperation | Ilja Fescenko continued collaboration with Prof. Antoine Weis in Switzerland, which resulted in a new publication. |
| Colloquiums, conferences and publications | <p>Colloquiums:</p> <ul style="list-style-type: none"> ➤ „Laser spectroscopy studies of the coherent processes in alkali atoms and molecules”, LU ASI Colloquium, 2014 November 27. ➤ “Magnētiskā lauka vizualizācija, izmantojot ar lāzeru inducēto fluorescenci no tumšiem un gaišiem atomiem”, LU ASI Colloquium, 2013 November 28 <p>Conferencies:</p> <ol style="list-style-type: none"> 1. “Visualizing magneto-optical effects by bright and dark atoms” I. Fescenko, A. Weis. Talk at 73rd Annual Scientific Conference of the University of Latvia. 2. “Bridging optical and microwave frequency standards with femtosecond frequency comb and precision timing distribution via optical links”, J. Alnis, I. Fescenko, I. Brice, A. Apsitis, J. Rutkis. Poster at International Conference on Collaboration in Space Technologies Riga, 5-6 June 2014 3. “Rubidium optical transitions measuring with a femtosecond frequency comb”, J. Alnis, I. Brice, J. Rutkis, I. Fescenko, C. Andreeva, talk at 73rd Annual scientific conference of the University of Latvia, 06.02.2015, Riga, Latvia, Book of abstracts p.28. 4. “Optical air quality sensors: benzene, dust, CO₂”, J. Alnis, I. Fescenko, Z. Gavare, G. Revalde, A. Vrublevskis, Poster at 3rd International Eunetair Action Workshop, Riga, 26-27.03.2015 5. “Development of a laser-based airborne dust counter”, J. Alnis, J. Rutkis, I. Fescenko, G. Revalde, EuroNanoForum 2015, Riga, 10-12 June 2015 6. Janis Alnis, Ilja Fescenko. Quantum optics laboratory. The FOTONIKA-LV conference: “Achievements and Future prospects” Riga, 23-24 April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV. 7. <u>Janis Alnis</u>, Arnolds Ubelis, Ilja Fescenko, Janis Blahins, Aigars Apsītis, Viesturs Silamiķelis. Advances in quantum sciences – source for the initiatives in sophisticated applications. <i>The FOTONIKA-LV conference: “Achievements and Future prospects” Riga, 23-24 April, 2015. Dedicated to the 5th Anniversary of Association FOTONIKA-LV.</i> <p>Papers:</p> <ol style="list-style-type: none"> 1. Fescenko and A. Weis, “Imaging magnetic scalar potentials by laser-induced fluorescence from bright and dark atoms,” Journal of Physics D, 47, 235001, (2014). 2. <u>Fescenko</u>, P. Knowles, A. Weis, and E. Breschi, “A bell-bloom experiment with polarization-modulated light of arbitrary duty cycle,” Optics Express, 21, 15130, (2013). 3. <u>Fescenko</u>, J. Alnis, A. Schliesser, C. Y. Wang, T. J. Kippenberg, and T. W. Hänsch, “Dual-mode temperature compensation technique for laser stabilization of a crystalline whispering gallery mode resonator,” Optics Express, 20(17), 19193, (2012). <p>Three publications in progress</p> |
| National and International projects | <ul style="list-style-type: none"> ➤ Ilja Fescenko had applied for Marie-Curie individual global fellowship during the call of year 2014. The proposal was evaluated by 80.6 scores, which is quite close to founding threshold of 92.6 scores. The resubmission of the proposal is under preparation. ➤ The SNF proposal for a secondment visit to Prof. Antoine Weis in |

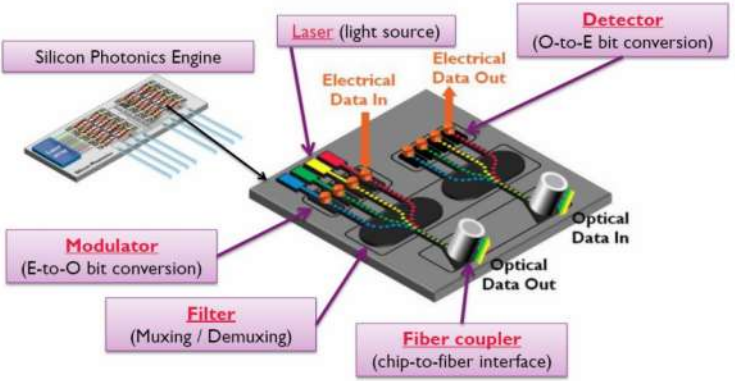
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| | Fribourg is under preparation. |
| Education | Ilja Fescenko together with Janis Alnis are supervising student Jazeps Rutkis bachelor thesis. |
| Reporting date | May 2015 |

3.16. Dr.Phys. Mikelis Svilans

„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Repatriation and recruitment period | <i>Repatriated from Canada in 2014.</i> <i>01.04.2014.-31.05.2014</i> <i>01.08.2014-5.10.2014.</i> <i>Unfortunately Mikelis Svilans dyed in October 2014</i> |
| Scientist (name, surname, laboratory) | <i>Dr.Phys. Miķelis SVILANS ,</i> Laboratory of Atomic Physics, Atmosphere Physics and Photochemistry The Institute of Atomic Physics and Spectroscopy Association FOTONIKA-LV, University of Latvia |
| Science | 1) Development of Silicon Microphotonics technologies for the industry developments in Latvia and in the EU Silicon photonics is a key enabling technology expected to revolutionise optical communications by paving the way for the creation of highly integrated, low power optical transceivers used for data transmission and telecommunications. 2) the longterm goal were industry linked applied research and training of skills for the industry demanded professionals |
| International and national cooperation | Cooperation with: ➤ Huawei Technologies, Photonics Research Group, Ottawa, Canada; ➤ Interuniversity Mmicroelectronics Cetrum IMEC, Leuven , Belgium License agreement was concluded with IMEC License agreement was concluded between FOTONIKA-LV, IMEC and EUROPRACTICE IC services on the granted service from EUROPRACTICE of use of Silicon Photonics technologies developed by them in the following processing:  |

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| Publications | <ol style="list-style-type: none">1. Nitiss E, Rutkis M, <u>Svilans M</u>. Effects of the multiple internal reflection and sample thickness changes on determination of electro-optic coefficient values of a polymer film. Lithuanian Journal of Physics. 2012;52(1):30-82. Nitiss E, Rutkis M, <u>Svilans M</u>. Electrooptic coefficient measurements by mach zehnder interferometric method: Application of abelès matrix formalism for thin film polymeric sample description. Opt Commun. 2013;286(1):357-62 |
| Reporting date | December 2014 (Coordinator Dr.Phys.A.Ubelis) |

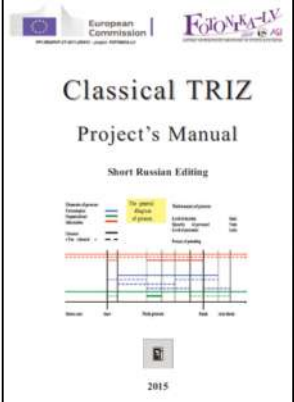
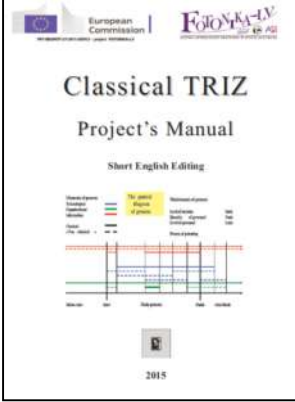
3.17. Dr.Alexander Narbut



„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”

Recruitment report

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|---------------------------------------|---|
| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.02.2015.-30.04.2015. |
| Recruitment period | 01.02.2015.-30.04.2015. |
| Scientist (name, surname, laboratory) | <i>Alexander Narbut, 1935962793, Recruited researcher from Ukraine, (scientific director of COMCON*TRIZ & FRT Corporation, Ukraine) Laboratory of Atomic Physics, Atmosphere Physics and Photochemistry Institute of Atomic Physics and Spectroscopy Association FOTONIKA-LV University of Latvia Alexander.Narbut@gmail.com</i> |
| Science WP2, | <p>Dr. A.Narbut was recruited as an experienced innovation specialist (Master of TRIZ with experience in new product development for Samsung corporation and other; holds about 35 patents) to foster the development of innovations in laboratories of association FOTONIKA-LV.</p> <p>TRIZ is a methodology of innovative problem solving created in 1950ties-1980ties in Soviet union and later used in industrial companies all around the world. TRIZ can be used to solve technical problems, scientific problems, social problems and to obtain results that are patentable.</p> <p>During the recruitment period A.Narbut visited research laboratories of FOTONIKA-LV and heard about their research and scientific problems, attended FOTONIKA-LV conference on 6th February 2015 (73rd Annual Scientific Conference of the University of Latvia, Section: The project “FOTONIKA-LV – FP7-REGPOT-CT-2011-285912”) and FOTONIKA-LV final conference on 23-24th April 2015 (Conference “Achievements and Future prospects”, Dedicated to 5th Anniversary of Association FOTONIKA-LV), gave a colloquium on TRIZ methodology, about 16 lectures on TRIZ (with attendance of about 6-15 people), participated in foresight sessions of FOTONIKA-LV and presenting foresight methodology that is used in TRIZ to predict the development of systems. Advices were given to laboratory leaders to solve some of their specific problems and a lot of teaching was done to teach innovation methodology to FOTONIKA-LV personnel.</p> <p>As the summary of the work, A.Narbut published 2 books (RUS and ENG edition, each about 150 pages) on TRIZ methodology for scientists in FOTONIKA-LV and other.</p> |

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| | <div style="display: flex; justify-content: space-around;">   </div> <p>A.Narbut was accompanied by A.Atvars, the leading researcher of Institute of Atomic Physics and Spectroscopy, who have already obtained knowledge of TRIZ since 2007 and who is familiar with scientific work in laboratories. A.Atvars is planned to be a contact person for collaboration of A.Narbut and FOTONIKA-LV in the future too.</p> <p>Benefiting labs and departments of FOTONIKA-LV:</p> <ul style="list-style-type: none"> A) Laboratory of Atomic Physics, Atmospheric Physics and Photochemistry at LU ASI; B) Laboratory of Quantum Optics at LU ASI C) Laboratory of Bio-optics and Fiber-optics at LU ASI; D) High-resolution Spectroscopy and Light Source Technology at LU ASI; E) Fundamental Geodynamical observatory at LU AI. |
| Outcomes of implementation of above mentioned scientific tasks | <p>Outcomes are:</p> <ul style="list-style-type: none"> ➤ better knowledge of innovation methodology TRIZ of FOTONIKA-LV personnel. It is planned that this methodology will help to obtain new innovations in the near future; ➤ contribution to foresight of Association FOTONIKA-LV with the help of foresight techniques that are in TRIZ; ➤ establishment of contacts with A.Narbut and his team that will be useful in the future for new project applications where partners from Ukraine are needed, and for new industrial projects. |
| International and national cooperation | <p>Dr. A.Narbut is the scientific director & President of the COMCON*TRIZ & FRT corporation, Ukraine - the company that produce various innovations. He is also the general director of the National Strategic Intelligence (Ukraine), Head of projects in the National Institute of Strategic Study (Department of Homeland Security and Defense of Ukraine), has large experience in practical system projects in the aerospace and nuclear power industry, is a researcher and lecturer in Kiev Polytechnic Institute, Ukraine. He has scientific contacts also with South Korea. During his recruitment in Latvia, A.Narbut get to know laboratories of FOTONIKA-LV. He is working on establishing contacts with scientific community of Ukraine to help to raise new European projects by FOTONIKA-LV. More close cooperation with A.Narbut and his company and scientific community of Ukraine is still in the development and is planned to be active in near future.</p> |
| Colloquiums, conferences and publications | <p>Lectures: During 01.02.2015.-30.04.2015 about 16 lectures was given by A.Narbut (16 x 5 hours = 80 hours) on TRIZ methodology including foresight methodology that is used in TRIZ.</p> <p>Report in the abstract book. A.Atvars, A.Narbut, TRIZ knowledge for FOTONIKA-LV, The FOTONIKA-LV conference “Achievements and Future prospects”, 23-24th April 2015, Book of</p> |

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| | <p>Abstracts, University of Latvia, Latvia.</p> <p>Two books by A.Narbut published:</p> <ul style="list-style-type: none"> - A.Narbut ed. Classical TRIZ. Project's manual. Short Russian Editing, University of Latvia, 2015, 162 p. - A.Narbut ed. Classical TRIZ. Project's manual. Short English Editing, University of Latvia, 2015, 144 p. |
| National and International projects | No additional projects have been raised during the visit of A.Narbut. But perspectives for new scientific and industry projects are present. A.Narbut is planned to be involved in the future to make more close collaboration between FOTONIKA-LV and industry. |
| Education | <p>During recruitment in Riga, A.Narbut gave about 16 lectures (each lecture typically the whole day long - about 2+1+2= 5 hours) on TRIZ (with the attendance of 5-15 people). Lectures were organized twice in a week in February 2015 and once in a week in March and April 2015. There he introduced researchers of FOTONIKA-LV to the methodology of TRIZ. Lectures were video-recorded and are available for future learning (lectures were in Russian).</p>  <p>Fig.1. A. Narbut giving lecture in Association FOTONIKA-LV in April 2015.</p> <p>After the lecture session participants could get certificates on TRIZ methodology issued by COMCON*TRIZ & FRT Corporation in a leadership of A.Narbut.</p>  <p>Fig.2. Certificate example issued to attendees of TRIZ seminar of FOTONIKA-LV.</p> <p>It is planned that after the recruitment period of A.Narbut seminars on TRIZ methodology will be continued in FOTONIKA-LV with the leadership of A.Atvars and distant supervision of A.Narbut.</p> |
| Reporting date | May 2015 |

3.18. Dr. Amara Linna Grapa

„Unlocking and Boosting Research Potential for Photonics in Latvia – Towards Effective Integration in the European Research area”

“Atbalsts fotonikas jomai Latvijā virzībā uz efektīvu integrāciju Eiropas Pētniecības telpā”


Recruitment report

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|---------------------------------------|---|
| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 01.09.2014.-30.04.2015. |
| Recruitment period | 01.09.2014.-30.04.2015. |
| Scientist (name, surname, laboratory) | Dr. Amara Linda Grapa, Repatriated researcher from USA, Astrophysical Observatory Institute of Astronomy Association FOTONIKA-LV University of Latvia amara@konteur.com |
| Science WP2, | <p>Amara Graps, 47, is an astronomer interested in studies of circum/interplanetary dust charging and dynamics and the origin of water on the terrestrial planets. Her work experience, primarily in astronomy, astrophysics, and planetary science research, was gained from work at SwRI, IFSI, MPI-K, NASA-Ames, Stanford University, the University of Colorado and the Jet Propulsion Laboratory. In addition, she consulted for engineering, computer, and medical companies in Heidelberg and the Silicon Valley working on numerical analysis, technical writing, and WWW site projects.</p> <p>In her ESA and NASA projects, she has analyzed data from the Ulysses spacecraft, GORID/Express spacecraft, Cassini spacecraft, Galileo spacecraft, SOHO spacecraft, NASA's Kuiper Airborne Observatory, NASA's ER-2 aircraft, the Voyager 2 spacecraft, the Pioneer Venus Orbiter spacecraft, the Infrared Astronomical Satellite (IRAS), the Space Shuttle's SpaceLab 2, and ground-based telescopes in Hawaii, California, and Arizona. The data includes dust from Jupiter's magnetosphere and Earth's geostationary orbit, the Sun, Comet Shoemaker-Levy 9, Comet Halley, Supernova 1987a, Venus, Mars, Io, Mercury, the Moon, Saturn's and Uranus' rings, asteroids, Earth's atmosphere, protostars, molecular clouds, galaxies, novas, main-sequence stars, and the exhaust-cloud around the Space Shuttle</p> <p><i>Benefiting labs and departments of FOTONIKA-LV:</i> C) Astrophysical Observatory in Baldone, LU AI,</p> |

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| | E) Fundamental Geodynamical observatory at LU AI. |
| Outcomes of implementation of above mentioned scientific tasks | Papers Conferences ➤ Amara Graps. Poster: "Development of an Asteroid Regolith Database" Asteroids, Comets, Meteors 2014, June 30 – July 04, 2014 |
| International and national cooperation | Various ESA and NASA space mission projects |
| Colloquiums, | Coloquiums: FOTONIKA-LV colloquium XLII. Laiks: 01.11.2013., plkst 10.00 – 11.30, Dr. Amara Graps <i>Planets, asteroids, cosmic dust and relevant research project experience.</i> |
| National and International projects | HORIZON 2020 proposals: <ul style="list-style-type: none"> • Horizon 2020, CallPROTEC2-14: RIA. SEP-210130656, Acronym: PROTEC2-14-Lowry. Title:TheEuropeanNEOScienceNetwork • Collaborator: for Horizon 2020 COMPET8 - Comet Data Reduction from the ESA Rosetta mission. (due October 2, 2014) • 2014 Co-I: Horizon 2020 INFRAIA-1-2014-2015 (Advanced Research Networks) EUROPLANET 2020 Research InfrastructureNr. 654208 (financed) |
| Education | Supervision of PhD thesis |
| Reporting date | April 2015 |

3.19. Vidvuds Beldavs

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| Project Number | REGPOT-CT-2011-285912-FOTONIKA |
| LU budget registration number | A6-2773-ZF-N-015 |
| Reporting period | 15.08.2013.-30.04.2015. |
| Repatriation period | 15.08.2013-30.04.2015 |
| Scientist (name, surname, laboratory) | <i>Vidvuds (Vid) Beldavs, 181242-13557 Repatriated expert, Laboratory of Atomic Physics, Atmosphere Physics and Photochemistry Institute of Atomic Physics and Spectroscopy Association FOTONIKA-LV University of Latvia Vid.beldavs@fotonika-lv.eu</i> |
| <p>Foresight, public outreach, science and innovation policy, space policy</p> <p>WP4, Task 4.1 Task 4.6 WP5, Task 5.3.</p> | <p>The Fotonika-LV project gave Vid Beldavs the opportunity to apply his expertise in strategic planning and foresight to the problems of science and innovation policy particularly as that applies to photonics Latvia and building collaboration between research and industry. Vid prepared presentations to numerous conferences and meetings with ministry officials, industry and members of Parliament about photonics, innovation policy and regional smart specialization strategy drawing on his background in strategic planning, economic development planning, technology commercialization, foresight and futures research. He also represented FOTONIKA-LV at the Industrial Technologies Conference in Athens, Greece that was acknowledged with a press release by the Latvian Ministry of Foreign Affairs.</p>  <p>The project also enabled Vid to play a leading role in the expansion of opportunities for Latvia in space sciences and space technologies. He was the inspiration for initiatives to seek collaboration with Africa in space applications with the Baltic and Central European region and chaired the 5-6 June 2014 International Conference on Collaboration in Space Technologies held in Riga also delivering the keynote address "The Role of Space Science and Technologies in National Economic Development." The conference was opened by former President of Latvia Dr. Vaira Vike-Freiberga followed by Dr. Ina Druvieta, Minister of Education and Science.</p> |

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| |  <p>Vid has been instrumental in the organization of the International Lunar Decade (ILD) a global initiative planned for launch in 2017, the 60th anniversary of the International Geophysical Year. ILD came into focus at the conference “The Next Giant Leap:Leveraging Lunar Assets for Sustainable Pathways to Space”, http://2014giantleap.aerospacehawaii.info/ 9-13.11.2015 in Hawaii for which FOTONIKA-LV was an organizing sponsor and where Vid with the support of Dr. Aigars Atvars, presented the International Lunar Decade Declaration, See - https://ildwg.wordpress.com/the-international-lunar-decade-declaration/ . The initiating organizations of the ILD are the the International Lunar Exploration Working Group (ILEWG), Executive Director Dr. Bernard Foing, see http://sci.esa.int/ilewg/, the National Space Society (principal ILD contact David Dunlop) see – www.nss.com, The Hawaii Office of Aerospace Development, Director Jim Crisafulli, and FOTONIKA-LV.</p> |
| International and national cooperation | <p>Collaboration launched with Africa as a result of the International Conference on Collaboration in Space Technologies – www.iccst.eu</p> <p>Invited to participate in the Pioneering Space Summit, Washington, DC, 19-20.02.2015 where space leaders including six astronauts, heads of several space businesses, heads of major space organizations, discussed future strategy for spaceflight – see . http://spacesummit.org/</p> <p>Collaboration with ILEWG, NSS, The Hawaii Office of Aerospace Development and other organizations to plan and organize the International Lunar Decade.</p> |
| Colloquiums, conferences and publications | <p>Articles</p> <ol style="list-style-type: none"> 1. Beldavs, V., Foing, Bernard 2015 “The International Lunar Decade: From Lunar Exploration to a Sustainable Lunar Market, (to be published in Space Policy – peer reviewed) 2. Beldavs, V., 2015 “The International Lunar Decade: Scenarios for long term collaboration in space development, The Space Review, http://www.thespacereview.com/article/2728/1 3. Beldavs, V, 2013 The asteroid mining bank, The Space Review, January 28, 2013, If asteroid mining does emerge as a viable industry, there will need to be mechanisms for recognizing claims and financing the extraction of resources. The article presents an idea how asteroid and other planetary resources can be banked to back a space currency to finance commercial development in space. 4. Beldavs, V, 2013 The Coming Era of Atomically Precise Manufacturing and its Implications for Space Development, The Space Review, October 12, 2013, This is an extended review of Eric Drexler's book Radical Abundance |

5. Beldavs, V., 2013 "The Obligation" and the vision of space settlement", *The Space Review*, November 25, 2013, This is a review of Steve Wolfe's novel "The Obligation" which presents the argument that space settlement is a basic drive of mankind that expresses itself in different ways in people that the author refers to as Endowments. The overarching view is that space settlement is an obligation of humankind to the planetary superorganism of which humanity is a part.
6. Beldavs, V., 2014 *The International Lunar Decade*, *The Space Review*, January 13, 2014 The Moon is the game-changer for mankind's expansion into the Solar System. What is proposed is an international decade to study the full potential of the Moon scientifically and commercially and through this process to develop an international regime for the further development of human presence on the Moon and the development of infrastructure in cislunar space to dramatically lower the cost of activities in space..
7. Beldavs, V., 2013 *How to form the Lunar Development Corporation to implement the Moon Treaty*, *The Space Review*, December 9, 2013, Presents a pathway to develop the Lunar Development Corporation to fulfill Article 11 of the Moon Treaty and develop the Moon.

Conferences:

1. Beldavs, V., Ubelis, A. 2013 Commercialization of Photonic Technologies in Latvia. 2013 Baltic Dynamics, Thursday, September 12, 2013, University - Industry cooperation, Session 6-6,
 2. Beldavs, V. "Photonics as a smart specialization for Latvia", Presentation, Baltic Photonics Cluster Symposium December 20, 2013,, Riga
 3. Beldavs, V. "Towards building an effective cluster linking photonics and quantum sciences technologies and production in Latvia on the basis of the FOTONIKA-LV Project" LU 72 FOTONIKA-LV Section, February, 2014,
 4. Beldavs, V., A. Ubelis, "Foresight activities at the FOTONIKA-LV and support from the project - "FP7-PEOPLE-IRSES-GA-2011-294959 - International Foresight Academy" (2012-2015)"Poster.
 5. Beldavs, V., Posters and booth presenting FOTONIKA-LV at the Industrial Technology Conference in Athens, 11-14.04.2014 presented photonics research, development and industries to an audience that included companies from Europe, Russia, Saudi Arabia, the US and other countries. The photonics booth featured three posters prepared by Beldavs that summarized R&D and production of photonics products in Latvia.
- Contributions in Colloquiums of FOTONIKA-LV
6. Beldavs, V., Chaired "International Conference on Collaboration in Space Technologies 5-6.06.2014. See – www.iccst.eu.
 7. Beldavs, V., Keynote address "The Role of Space Science and Technologies in National Development" at "International Conference on Collaboration in Space Technologies 5-6.06.2014. See – www.iccst.eu.
 8. Beldavs, V. "FOTONIKA-LV and the International Year of Light", LU73 Conference, FOTONIKA-LV section, 06.02.2015 (Poster)
 9. Beldavs, V. "Cooperation in Space Technologies with Africa", LU73 Conference, FOTONIKA-LV section, 06.02.2015 (Poster)
 10. Beldavs, V. "The International Lunar Decade: A Giant Leap Forward in Understanding the Moon and Opportunities for its Development", report on the Hawaii conference held November, 2014. (Poster)
 11. Beldavs, V. Invited participant as a leader in space to the Pioneering Space Summit, Washington, DC 19-20.02.2015
 12. Beldavs, V., Dunlop D., Atvars, A., Ubelis, A., Salmins, K., "The International

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| | <p>Lunar Decade: A Giant Leap Forward in Understanding the Moon and Opportunities for its Development”, European Geophysical Union Congress, 13.04.2015, Vienna</p> <p>13. Beldavs, V., Foing, B., The international lunar decade – 2017 – 2029: framework for concurrent development of enabling technologies, infrastructures, financings and policies for lunar development. European Lunar Summit, 13.05.2015, Ferascati, Italy. (Poster)</p> <p>14. Beldavs, V., “International Lunar Decade: From lunar exploration to a lunar economy”, International Space Development Conference, 22-24.05.2015, Toronto.</p> <p>15. Beldavs, V., Foing, B., Bland, D., Crisafulli, J., “The International Lunar Decade Declaration”, European Planetary Science Congress 2015 (27 September – 02 October 2015, La Cité des Congrès, Nantes, France http://epsc2015.eu)</p> <p>16. Beldavs, V., Foing, B., Dunlop, D., "Strategy for the International Lunar Decade", European Planetary Science Congress 2015 (27 September – 02 October 2015, La Cité des Congrès, Nantes, France http://epsc2015.eu)</p> <p>17. Beldavs, V. Foing, B. Dunlop, D. “Status of International Lunar Decade (ILD)”, 66th International Astronautical Congress to be held from 12-16 October 2015 in Jerusalem, Israel</p> |
| National and International projects | <p>Contribution in writing of proposals for HORIZON 2020 calls:</p> <ol style="list-style-type: none"> 1. Photonics and Quantum Sciences from Nano-World to Space Technologies - PHOTONICS-BALTICUM to the H2020 WIDESPREAD 2014-1 TEAMING call (deadline 17.09.2014, submission ID-SEP-210203803); 2. WIDESPREAD 2014-1 ERA-Chairs SPACE-LV; 3. Call: MSCA-RISE-2015, Proposal Number: 691063, Proposal Acronym: ION SPECTRA; 4. PHOTONICS BALTICUM : H2020-TWINN-2015. Proposalnumber: 692275 <p>Contribution to The International Lunar Decade initiative</p> <p>Contribution to The International Lunar Decade is an initiative of the International Lunar Exploration Working Group, the National Space Society, FOTONIKA-LV, and the State of Hawaii office of Aerospace Development. V. Beldavs is the contact person for FOTONIKA-LV on this initiative and the primary author of a significant share of articles, conference presentations and other materials relating to the ILD. In 2015 about ten conferences include panels, tracks, sessions, papers and presentations about ILD. The goal is to secure the endorsement of all major organizations involved with space science and space technology. This includes the UN Committee on the Peaceful Uses of Outer Space (COPUOS) whose approval is necessary for ILD to be presented to the UN General Assembly for its endorsement of ILD as a UN sponsored global event and decade long international collaboration to advance the concurrent exploration of the Moon with the development of policies, technologies and infrastructures required for industrial and commercial development of the Moon. The PHOTONICS BALTICUM proposal that was submitted to the Horizon 2020 Twinning call on May 7, 2015 includes Dr. Bernard Foing, Executive Director of ILEWG as a member of Scientific Steering Committee reflecting the intent that project consortium partners will be introduced to research and technology development opportunities relating to lunar and planetary science studies as well as to potential involvement in the development of related technologies required.</p> <p>Contribution to RIS 3 process.</p> <p>FOTONIKA-LV has been a strong advocate for greater collaboration in the Baltic region in photonics and disciplines framed by photonics including quantum</p> |

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| | <p>sciences, space sciences and related technologies. Vid Beldavs has been a significant contributor to this effort. Seminars have been organized in support of the idea of a pan-Baltic smart specialization in photonics and presentations have been made to members of the Saeima (parliament) as well as to the Prime Minister and her advisors. See - https://fotonikalv.files.wordpress.com/2014/12/ris3-latvia_14_10_2014.pdf and https://fotonikalv.files.wordpress.com/2014/12/research-and-innovation-a_pan-baltic-priority-2014-10-31.pdf This work will continue with further efforts targeting photonics related enterprises and research centers across Estonia, Latvia and Lithuania to promote greater regional collaboration in the domain of photonics.</p> |
| Reporting date | <i>May 15, 2013</i> |

Conclusions

The Project provided never been opportunity to the laboratories, departments and observatories in Institutes of Association FOTONIKA-LV to recruit excellent researchers and to repatriate our best colleagues and among them we succeeded to repatriate Dr.Janis Alnis who worked previously in the labs of Nobel Prize winner Teodor Hansch in the Institute of Quantum Optics in Munich. That changed substantially the intellectual environment and contributed remarkably in unlocking and boosting research potential of FOTONIKA-LV evidenced via reports listed above.

Now Association FOTONIKA-LV is a leader in Latvia in repatriation and recruitment having reached the percentage 10% of total staff. That is still below average number of 20% as usual praxis in EU leading institutes. Therefore this project and few other financed projects together with pending ones still foreseen and targets the development of human resources as long-term strategy. That will be also contribution to national targets as well because Latvia needs to increase number of researchers 3 times to reach average per capita level of EU.

The project Coordinator

Arnolds Ubelis

Annexes

Annex 1: CV Teodora Velcheva Kirova

CURRICULUM VITAE

Name: Teodora Velcheva Kirova

Date and place of birth: February 7th, 1974 in Yambol, BULGARIA

Permanent Address: c-x "M. Roudnik"
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Bourgas, 8011, BULGARIA
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Present Address: Laser Centre, Laser-Manipulation Laboratory
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e-mail: teo@lu.lv

Education

2000-2005 PhD in Physics, Department of Physics, Temple University,
Philadelphia, PA, USA
Dissertation topic: "State Selectivity and Eigenstate Control in Molecules using
Multiple CW Lasers"
Co-advisors: *A. Marjatta Lyyra* and *Frank C. Spano*

1998-2000 MA in Physics, Department of Physics, Temple University,
Philadelphia, PA, USA

1993-1998 MS in Physics, Specialization Solid State Physics, Department
of Physics, Sofia University, BULGARIA; with Teacher
Certification for High School Education

Experience

April 2012-present Seconded researcher, EU FP7 Center of Excellence
Project FOTONIKA-LV, Laser Centre, Laser-Manipulation
Laboratory, Faculty of Physics and Mathematics, University of
Latvia, Riga, LATVIA
Advisor: *Aigars Ekers*

January 2010 Postdoctoral Fellow, National Institute for Theoretical Physics,
Institute for Advanced Study, Stellenbosch,
SOUTH AFRICA
Advisor: *Alexander V. Avdeenkov*

November 2006- Researcher, Molecular Beam Laboratory of A. Ekers,
June 2009 Laser Centre, Faculty of Physics and Mathematics,
University of Latvia, Riga, LATVIA
Supported by Latvian Science Council

August 2005- Marie-Curie Fellow, EU FP6 Marie-Curie Transfer of
November 2006 Knowledge (ToK) Project LAMOL, Laser Centre, Molecular Beam Laboratory,
Faculty of Physics and Mathematics, University of Latvia, Riga, LATVIA
Advisor: *Aigars Ekers*

September 2000- Graduate Research Assistant, Molecular Quantum Optics
December 2004 group of A. Marjatta Lyyra, Department of Physics, Temple
University, Philadelphia, PA, USA
Supported by National Science Foundation

September 1998- Graduate Teaching Assistant, Department of Physics,
August 2000 Temple University, Philadelphia, PA, USA
January - Taught undergraduate physics laboratory sections,
May 2005 undergraduate physics recitations and tutoring

Visiting positions

22April-22May Seconded Scientist, FP6 Project COLIMA, St. Petersburg State
2013 University, Department of Physics, St. Petersburg, Russia
Advisor: *Nikolay, N. Bezuglov*

September - Adjunct Assistant Professor, Molecular Quantum Optics group
December 2009 of A.Marjatta Lyyra, Department of Physics, Temple University
April-June 2008 Philadelphia, PA, USA
Supported by Lagerqvist Research Fund of Temple University
and the National Science Foundation

Research Interests

- Theoretical treatment of quantum control of quantum state character in molecular systems using numerical and analytical approaches based on the density matrix equations of motion and dressed-state methods
- Simulations of experimental data on quantum control of quantum state character in molecular Lithium (Li_2)
- Development of theoretical models for Autler-Townes (AT) effect and Electromagnetically Induced Transparency (EIT) in open molecular systems
- Simulations of experimental data on AT effect and EIT in molecular Lithium (Li_2) and Sodium (Na_2) with spectroscopic applications for measuring transition dipole moment matrix elements and lifetimes of excited molecular states
- Development of theoretical models for AT effect in atomic and molecular systems with hyperfine structure
- Development of theoretical models for dynamics of ultracold polar molecules in microwave fields, blockade and anti-blockade in ultracold polar molecules

Publications

1. "Formation of Dark and Bright States in the Hyperfine Levels of Na via the Autler-Townes Effect", T. Kirova, M. Bruvelis, D. Efimov, K. Miculis, N. N. Bezuglov, A. Ekers, I. I. Ryabtsev, L. Kalvans, and M. Auzinsh, to be submitted to Phys. Rev. A
2. "Visualization of Dark states in Hyperfine Levels of Na via Dynamic Excitation of a Three-level Ladder", M. Bruvelis, T. Kirova, K. Miculis, D. Efimov, N. N. Bezuglov, and A. Ekers, to be submitted to Phys. Rev. A
3. "Dynamics of Ultracold Polar Molecules in a Microwave Field", T. Kirova and A.V. Avdeenkov, to be submitted to New J. Phys.

4. 4."Electromagnetically Induced Transparency in Open Molecular Systems", J. Magnes, E. Ahmed, T. Kirova, A. Lazoudis, A. M. Lyyra, A. Hansson, F. C. Spano, and L. M. Narducci, submitted to Optics Communications, being revised
5. 5."Quantum Control of the Spin-Orbit Coupling Interaction using the Autler-Townes Effect", E. H. Ahmed, S. Ingram, T. Kirova, O. Salihoglu, J. Huennekens, J. Qi, Y. Guan and A. M. Lyyra, Phys. Rev. Lett. 107, 163601 (2011)
6. 6."Electromagnetically Induced Transparency in an Open V-type Molecular System", A. Lazoudis, T. Kirova, E. H. Ahmed, P. Qi, J. Huennekens, and A. M. Lyyra, Phys. Rev. A 83, 063419 (2011)
7. 7."Electromagnetically Induced Transparency in an Open Λ -type Molecular System", A. Lazoudis, T. Kirova, E. H. Ahmed, J. Qi, L. Li, and A. M. Lyyra, Phys. Rev. A 82, 023812 (2010)
8. 8. "Conditions and Limitations for Resolution of Hyperfine Structure in the Autler-Townes Spectra" T. Kirova, A. Ekers, N. N. Bezuglov, I. I. Ryabtsev, M. Auzinsh, and K. Blushs, in: Proceedings of the MPLP Symposium (Novosibirsk, Russia, 2008), to appear in Laser Physics
9. 9. "Experimental Observation of the Dependence of Autler-Townes Splitting on the Probe and Coupling Laser Wavenumber Ratio in Doppler Broadened Open Molecular Cascade Systems", A. Lazoudis, E. Ahmed, L. Li, T. Kirova, P. Qi, A. Hansson, J. Magnes, and A. M. Lyyra, Phys. Rev. A **78** 043405 (2008)
10. 10. "Measurement of Absolute Transition Dipole Moment Functions of the $3^1\Pi_u \rightarrow 1(X)^1\Sigma^+$ and $3^1\Pi_u \rightarrow 2(A)^1\Sigma^+$ transitions in NaK using Autler-Townes Spectroscopy and Calibrated Fluorescence", S. J. Sweeney, E. H. Ahmed, P. Qi, T. Kirova, A.M. Lyyra, and J. Huennekens, J. Chem. Phys. 129 154303 (2008)
11. 11. "Measurement of the Electronic Transition Dipole Moment by Autler-Townes Splitting: Comparison of Three-and Four-Level Excitation Schemes for the $\text{Na}_2 \text{A}^1\Sigma_u^+ - \text{X}^1\Sigma_g^+$ System", E. Ahmed, A. Hansson, P. Qi, T. Kirova, A. Lazoudis, S. Kotochigova, A. M. Lyyra, L. Li, J. Qi, and S. Magnier, J. Chem. Phys. **124**, 084308 (2006)
12. 12. "Designing Molecular Eigenstates in a Four-level Λ System", T. Kirova and F. C. Spano, Phys. Rev. A. **71**, 063816 (2005)
13. 13. "Measurement of Transition Dipole Moments in Lithium Dimers Using Electromagnetically Induced Transparency", J. Qi, F. C. Spano, T. Kirova, A. Lazoudis, J. Magnes, L. Li, L. M. Narducci, R. W. Field, and A. M. Lyyra, Phys. Rev. Lett. **88**, 173003-1 (2002)

Book Chapters

1. "The Autler-Townes Effect in Molecules: Observations, Theory, and Applications", E. H. Ahmed, J. Huennekens, T. Kirova, J. Qi, and A. M. Lyyra, invited chapter, *Advances in Atomic, Molecular, and Optical Physics*, Volume **61**, Chapter 9, p.467, edited by P. Berman, E. Arimondo, and Ch. Lin (Elsevier, 2012)
2. "Prospects for All-Optical Alignment and Quantum State Control of Nonpolar Molecules", A. M. Lyyra, F. C. Spano, J. Qi, and T. Kirova, invited chapter, *ACS Symposium Series*, Volume **821** "Laser Control and Manipulation of Molecules", edited by A. D. Bandrauk, Y. Fujimura, and R. J. Gordon, pp. 304 – 319 (2002)

Manuscripts in Preparation

1. "Determination of Lifetimes of Excited Molecular States using the Autler-Townes Effect", R. Garcia-Fernandez, A. Ekers, K. Michulis, N. N. Bezuglov, T. Kirova, K. Blushs, M. Auzinsh, K. Bergmann, L. P. Yatsenko, O. Dulieu, M. Aymar, in preparation
2. "Determination of Branching Ratios of Excited Molecular States using the Autler-Townes Effect", R. Garcia-Fernandez, A. Ekers, K. Michulis, N. N. Bezuglov, T. Kirova, K. Blushs, M. Auzinsh, K. Bergmann, L. P. Yatsenko, O. Dulieu, M. Aymar, in preparation

Conference Proceedings

1. "Selection of Unresolved Hyperfine States in Atoms and Molecules via Autler Townes Effect", T. Kirova, A. Ekers, M. Auzinsh, N. N. Bezuglov, and K. Blushs, Proceedings of XIV National Conference "Laser Physics-2007", October 9-12, 2007, Ashtarak, Armenia (accepted)
2. "Conditions and Limitations for Resolution of Hyperfine Structure in the Autler Townes Spectra" T. Kirova, A. Ekers, N. N. Bezuglov, I. I. Ryabtsev, M. Auzinsh, and K. Blushs, Proceedings of V International Symposium "Modern Problems of Laser Physics" MPLP 2008, August 24-31, 2008, Novosibirsk, Russia (submitted)

Invited Talks

18. "Formation of Dark States in Hyperfine Levels of Na via Autler-Townes Effect", September 2012, NITheP Seminars, NITheP, Stellenbosch Institute for Advanced Study, Stellenbosch, South Africa

19. "Dynamics of Ultracold Polar Molecules in a Circularly Polarized Microwave Field", March 2012, NITheP Seminars, University of the Witwatersrand (WITS), Johannesburg, South Africa
20. "Dynamics of Ultracold Polar Molecules in Microwave Field", February 2012, NITheP Seminars, University of Kwazulu-Natal (UKZN), Durban, South Africa
21. "Dynamics of Ultracold Polar Molecules in a Microwave Field" September 2010, Laser Centre Seminar, Faculty of Physics and Mathematics, University of Latvia, Riga, Latvia
22. "Coherent Effects in Atomic and Molecular Systems", April 2010, Laser Physics Institute (LRI) Seminars, Department of Physics, Stellenbosch University, Stellenbosch, South Africa
23. "Coherent Effects in Atomic and Molecular Systems", February 2010, NITheP Seminars, NITheP, Stellenbosch Institute for Advanced Study, Stellenbosch, South Africa
24. "Effect of Hyperfine Structure on the Autler-Townes Splitting", September 2008, Laser Centre Seminar, Faculty of Physics and Mathematics, University of Latvia, Riga, Latvia
8. "Molecular Autler-Townes Effect and Spectroscopic Applications", January 2007, School of Chemistry, University of Birmingham, Birmingham, UK
25. "Autler-Townes Effect in Molecular Sodium: Spectroscopic Applications", October 2006, Cold Atoms Group, Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark
26. "Eigenstate Design in a Molecular Four-level Ladder Scheme", November 2005, Institute of Atomic Physics and Spectroscopy, University of Latvia, Riga, Latvia
27. "Molecular Eigenstate Design in a Four-level Cascade Scheme via Strong Optical Fields", November 2005, Molecular Physics Division, Department of Physics, Stockholm University, Stockholm, Sweden

Workshops Attended

1. TLL/COLIMA 1st Workshop on manipulation of light by matter and matter by light, 18-19 July, 2012, University of Latvia, Riga, Latvia
2. 2.23rd Chris Engelbrecht Summer School 2012, "Quantum Biology", 18-28 January 2011, Salt Rock Hotel, Salt Rock, South Africa
3. 3. International Workshop on Ultracold Molecules, 7-11 November 2011, Stellenbosch Institute for Advanced Studies (STIAS), Stellenbosch, South Africa
4. 7th International Workshop "Control of Quantum Dynamics of Atoms, Molecules and Ensembles by Light" (CAMEL 7), 3-9 July 2011, Nessebar, Bulgaria
5. "Equilibration and Equilibrium", 2nd Stellenbosch Workshop on Statistical Physics, 7-18 March 2011, Stellenbosch Institute for Advanced Studies (STIAS), Stellenbosch, South Africa
6. 22nd Chris Engelbrecht Summer School 2011, "The Standard Model of Particle Physics and Beyond", 19-30 January 2011, Stellenbosch Hotel, Stellenbosch, South Africa
7. International Workshop on Quantum Physics of Low-Dimensional Systems and Materials, 3-7 January 2011, Wallenberg Research Center, Stellenbosch, South Africa
8. Non-equilibrium Quantum Many-Particle Correlated Systems, 4-8 October 2010, Stellenbosch Institute for Advanced Studies (STIAS), Stellenbosch, South Africa
9. 16th International School on Quantum Electronics: Laser Physics and Applications, 20-24 September, Nessebar, Bulgaria
10. 21st Chris Engelbrecht Summer School on Quantum Optics, 18-27 January 2010, Stellenbosch Institute for Advanced Studies (STIAS), Stellenbosch, South Africa
11. 11.5th International Workshop "Control of Quantum Dynamics of Atoms, Molecules and Ensembles by Light", (CAMEL 5), 23-28 June 2009, Nessebar, Bulgaria
12. Second Workshop on High Dimensional Quantum Dynamics: Challenges and Opportunities, February 24-28, 2008, La Grande Motte (Montpellier), France
13. International Workshop on Atomic Physics, Focus Days on "Relativistic Laser-Matter Interaction", November 27-December 1, 2006, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany
13. CCP6 Workshop on Coherent Control of Molecules, July 3-5, 2006, University of Birmingham, Birmingham, UK
14. International Workshop on Atomic Physics, Focus Days on "Electronic Correlation in Atomic and Molecular Dynamics", November 27-December 2, 2005, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany

Conference Abstracts

1. 1."Formation of multiple dressed states in hyperfine level systems of Na", A. Cinins, T. Kirova, N. Bezuglov, M. Bruvelis, K. Miculis, A. Ekers, L. Kalvans, M. Auzinsh, D. K. Efimov, I. I. Ryabtsev, poster presentation, 11th meeting of ECAMP, 24-28 June 2013, Aarhus, Denmark
2. 2."Nonlinear optical pumping of a slow and cold Cs beam", T.Kirova, 9th International Workshop "Control of Quantum Dynamics of Atoms, Molecules and Ensembles by Light" (CAMEL 7), 16-21 June 2013, Nessebar, Bulgaria
3. "Dynamics of Ultracold Polar Molecules in a Circularly Polarized Microwave Field", T. Kirova and A.V. Avdeenkov, International meeting: "The role and applications of collision processes in different kinds of plasmas and laser beams" 22-24 April 2013, St. Petersburg State University, Department of Physics, St.Petersburg, Russia
4. "Manifestation of Dark State Formation in Na Hyperfine Level System", D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, T. Kirova, and A. Ekers, poster presentation, 71st Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 14 February 2013, Riga Photonics Centre, Institute of Atomic Spectroscopy, Riga, Latvia
5. "Dynamics of Ultracold Polar Molecules in a Circularly Polarized Microwave Field", T. Kirova and A.V. Avdeenkov, 71st Annual Scientific Conference of the University of Latvia, Natural Sciences, Photonics section, 1 February 2013, Riga Photonics Centre, Institute of Atomic Spectroscopy, Riga, Latvia
6. "Laser manipulation of adiabatic states and its application towards resolution of hyper-fine structure and population switching" M. Bruvelis, N. Bezuglov, K. Miculis, T. Kirova, D.Efimov, C. Andreeva, A. Cinins, and A.Ekers, 18-23 November 2012, Cold and Ultracold Molecules (ESF Conference in Partnership with LFUI), Universitätszentrum Obergurgl, Austria
7. 7."Dark State Formation in Three-Level Ladder System in Na Supersonic Atomic Beam", D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, T. Kirova, C. Andreeva, and A. Ekers, poster presentation, 17th International School on Quantum Electronics: Laser Physics and Applications", 24-28 September 2012, Nessebar, Bulgaria
8. 8."Manifestation of Dark State Formation in Na Hyperfine Level System", D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, T. Kirova, and A. Ekers, "Quantum Africa 2", 3-7 September 2012, Drakensberg, South Africa
9. 9."Effects of Dark State Formation in the Hyperfine Excitation Spectra of Na atoms", D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, T. Kirova, and A. Ekers, poster presentation, 23rd meeting of ICAP, 23-27 July 2012, Paris, France
10. 10 "Dynamics of Ultracold Polar Molecules in a Circularly Polarized Microwave Field", T. Kirova and A.V. Avdeenkov, TLL/COLIMA 1st Workshop on manipulation of light by matter and matter by light, 18-19 July, 2012, University of Latvia, Riga, Latvia
11. 11."Manifestation of Dark State Formation in Na Hyperfine Level System", D. Efimov, N. N. Bezuglov, J. Ulmanis, M. Bruvelis, K. Miculis, T. Kirova, and A. Ekers, poster presentation, 44th meeting of EGAS, 9-13 July 2012, Gotheborg, Sweden
12. 12."Temporal Evolution of Ultracold Polar Molecules in Circularly Polarized Microwave Field", T. Kirova and A.V. Avdeenkov, poster presentation, 7th International Workshop "Control of Quantum Dynamics of Atoms, Molecules and Ensembles by Light" (CAMEL 7), 3-9 July 2011, Nessebar, Bulgaria
13. 13."Temporal evolution of ultracold polar molecules in circularly polarized microwave field", A.V. Avdeenkov and T. Kirova, 43rd meeting of EGAS, 28 June-2 July, 2011, Fribourg, Switzerland
14. 14."Interference of Laser-Dressed States in the Autler-Townes Effect", J. Ulmanis, M. Bruvelis, N. N. Bezuglov, K. Miculis, C. Andreeva, T. Kirova, A. Ekers, I. I. Ryabtsev, poster presentation, 43rd meeting of EGAS, 28 June-2 July, 2011, Fribourg, Switzerland
15. 15."Creation of Dark States in the Autler-Townes Spectrum of Na Hyperfine Levels", T. Kirova, N. N. Bezuglov, A. Ekers, I. I. Ryabtsev, M. Auzinsh, and K. Blushs, poster presentation, 43rd meeting of EGAS, 28 June-2 July, 2011, Fribourg, Switzerland
16. 16 "Electromagnetically Induced Transparency in an Open V-type Molecular System", A. Lazoudis, T. Kirova, E. H. Ahmed, P. Qi, J. Huennekens, and A. M. Lyyra, poster presentation, 42nd Meeting of DAMOP, June 13-17, 2011, Atlanta, Georgia, USA
17. 17."Dynamics of Ultracold Polar Molecules in a Microwave Field", T. Kirova and A.V. Avdeenkov, poster presentation, 4th IUPAP International Conference on Women in Physics (ICWIP 2011), 5-8 April 2011, Stellenbosch, South Africa

18. 18. "Control of Molecular Singlet-Triplet State Character using the Autler-Townes Effect", E. H. Ahmed, S. Ingram, T. Kirova, O. Salihoglu, Y. Guan, J. Huennekens, and A. M. Lyyra, 55th Annual Conference of the South Africa Institute of Physics (SAIP), 26 September-1 October, 2010, Pretoria, South Africa
19. 19. "Control of Molecular Singlet-Triplet State Character using the Autler-Townes Effect", E. H. Ahmed, S. Ingram, T. Kirova, O. Salihoglu, Y. Guan, J. Huennekens, and A. M. Lyyra, poster presentation, 16th International School on Quantum Electronics: Laser Physics and Applications", 20-24 September 2010, Nessebar, Bulgaria
20. "Dynamics of Ultracold Polar Molecules in a Microwave Field", T. Kirova and A.V. Avdeenkov, poster presentation, 22nd Meeting of ICAP (International Conference on Atomic Physics), 25-30 July 2010, Cairns, Australia
21. 21. "Quantum control of the spin-orbit coupling interaction using the AC Stark effect", E. H. Ahmed, S. Ingram, T. Kirova, O. Salihoglu, Y. Guan, J. Huennekens, and A. M. Lyyra, poster presentation, 41st Meeting of DAMOP, May 25-29, 2010, Houston, Texas, USA
22. 22 "Electromagnetically Induced Transparency in a Λ type Molecular System", A. Lazoudis, L. Li, T. Kirova, J. Qi, E. H. Ahmed, and A. M. Lyyra, poster presentation, 41st Meeting of DAMOP, May 25-29, 2010, Houston, Texas, USA
23. "Formation of Dark States in Hyperfine Level Systems of Na via the Autler-Townes Effect", T. Kirova, N. N. Bezuglov, A. Ekers, I. I. Ryabtsev, M. Auzinsh, and K. Blushs, poster presentation, 41st meeting of EGAS, 8-11 July, 2009, Gdansk, Poland
24. "Autler-Townes effect: line-shape analysis and determination of excited state lifetimes", A. Ekers, N.N. Bezuglov, K. Miculis, T. Kirova, K. Blushs, M. Auzinsh, R. Garcia-Fernandez, O. Dulieu, M. Aymar, poster presentation, 41st meeting of EGAS, 8-11 July, 2009, Gdansk, Poland
25. "Effect of hyperfine structure on the Autler-Townes splitting" T. Kirova, A. Ekers, N. N. Bezuglov, I. I. Ryabtsev, M. Auzinsh and K. Blushs, poster presentation, Fifth International Symposium "Modern Problems of Laser Physics" 2008, 24-30 August 2008, Novosibirsk, Russia
26. 26. "Effects of Hyperfine Structure on the Autler-Townes", T. Kirova, A. Ekers, N. N. Bezuglov, I. I. Ryabtsev, K. Blushs, and M. Auzinsh, poster presentation, 40th Meeting of EGAS, 2-5 July, 2008, Graz, Austria
27. "Resolution of Hyperfine Structure in the Autler-Townes Effect", T. Kirova, A. Ekers, N. Bezuglov, I. Ryabtsev, M. Auzinsh, and K. Blushs, International conference "Advances in Atomic and Molecular Physics 2008", June 16-18, 2008, Ratnieki, Latvia
28. "All-Optical Control of Quantum State Singlet-Triplet Character by Autler-Townes Splitting", O. Salihoglu, P. Qi, S. Ingram, T. Kirova, E. Ahmed, F. Spano and M. Lyyra, poster presentation, 39th Meeting of DAMOP, May 27-31, 2008, State College, PA, USA
29. 29. "Effects of Hyperfine Structure on the Autler-Townes", T. Kirova, A. Ekers, N. N. Bezuglov, I. I. Ryabtsev, K. Blushs, and M. Auzinsh, poster presentation, Workshop on Rydberg Excited Atoms, May 14-16, 2008, Sandbjerg Estate, Denmark
30. 30 "Effect of Hyperfine Structure on the Autler-Townes Splitting in Atomic and Molecular Ladder Excitation Schemes", T. Kirova, A. Ekers, I. I. Ryabtsev, M. Auzinsh, and K. Blushs, poster presentation, 2nd Workshop on High Dimensional Quantum Dynamics: Challenges and Opportunities, February 24-28, 2008, La Grande Motte (Montpellier), France
31. 31. "Selection of Unresolved Hyperfine States in Atoms and Molecules via Autler-Townes Effect", T. Kirova, A. Ekers, M. Auzinsh, N. N. Bezuglov, and K. Blushs, XIV National Conference "Laser Physics-2007", October 9-12, 2007, Ashtarak, Armenia
32. "Selection of Unresolved Hyperfine States of Molecules using the Autler-Townes Effect", T. Kirova, A. Ekers, M. Auzinsh, N. N. Bezuglov, and K. Blushs, poster presentation, ICPEAC 25, July 25-31, 2007, Freiburg, Germany
33. 33. "Autler-Townes Effect in Atoms and Molecules with Hyperfine Structure", T. Kirova, A. Ekers, M. Auzinsh, N. N. Bezuglov, and K. Blushs, poster presentation, Femtochemistry and Femtobiology 8, July 22-27, 2007, Oxford, UK
34. "Selection of Unresolved Hyperfine States of Molecules using the Autler-Townes Effect", T. Kirova, A. Ekers, M. Auzinsh, N. N. Bezuglov, and K. Blushs, poster presentation, ECAMP 9, May 6 -11, 2007, Hersonissos, Greece
35. "Molecular Autler-Townes Effect and Spectroscopic Applications", T. Kirova, A. Ekers, R. Garcia-Fernandez, M. Auzinsh, K. Blush, N. N. Bezuglov, K. Miculis, L. P. Yatsenko, K. Bergmann, O. Dulieu,

- and M. Aymar, poster presentation, International Workshop on Atomic Physics, November 27-December 1, 2006, Dresden, Germany
36. "Autler-Townes Effect in Molecular Sodium: Spectroscopic Applications", T. Kirova, A. Ekers, R. Garcia-Fernandez, M. Auzinsh, K. Blush, N. N. Bezuglov, K. Michulis, L. P. Yatsenko, K. Bergmann, O. Dulieu, and M. Aymar, International Conference "Advances in Laser Spectroscopy: in Memory of Prof. Maris Jansons", September 28-29, 2006, Riga, Latvia
 37. "Determination of Lifetimes of Excited Molecular States using the Autler-Townes Effect", A. Ekers, T. Kirova, K. Miculis, K. Blushs, M. Auzinsh, N. N. Bezuglov, R. Garcia-Fernandez, K. Bergmann, L. P. Yatsenko, O. Dulieu, M. Aymar, poster presentation, 20th International Conference on Atomic Physics, July 16-21, 2006, Innsbruck, Austria
 38. "Determination of Branching Ratios of Excited Molecular States using the Autler-Townes Effect", K. Miculis, T. Kirova, A. Ekers, N. N. Bezuglov, R. Garcia-Fernandez, K. Bergmann, O. Dulieu, M. Aymar, poster presentation, 20th International Conference on Atomic Physics, July 16-21, 2006, Innsbruck, Austria
 39. "Measuring of Degenerate Molecular Levels Lifetimes using the Autler-Townes Effect", T. Kirova, A. Ekers, R. Garcia-Fernandez, M. Auzinsh, K. Blush, N. N. Bezuglov, L. P. Yatsenko, K. Bergmann, O. Dulieu, and M. Aymar, CCP6 Workshop on Coherent Control of Molecules, July 3-5, 2006, University of Birmingham, Birmingham, UK
 40. "Eigenstate Control in Molecules using Strong Optical Fields", T. Kirova, F. Spano, and A. M. Lyyra, poster presentation, 38th meeting of EGAS, June 7-10, 2006, Ischia (Naples), Italy
 41. "Lifetime Determination of Degenerate Molecular Levels in cw Regime using the Autler-Townes Effect", T. Kirova, A. Ekers, R. Garcia-Fernandez, M. Auzinsh, K. Blush, N. N. Bezuglov, L. P. Yatsenko, K. Bergmann, O. Dulieu, and M. Aymar, poster presentation, 38th meeting of EGAS, June 7-10, 2006, Ischia (Naples), Italy
 42. "Lifetime Determination of Degenerate Molecular Levels in cw Regime using the Autler-Townes Effect", T. Kirova, A. Ekers, R. Garcia-Fernandez, M. Auzinsh, K. Blush, N. N. Bezuglov, L. P. Yatsenko, K. Bergmann, O. Dulieu, and M. Aymar, International Student Conference on Developments in Optics and Communications, April 28-30, 2006, Riga, Latvia
 43. "Manipulation of Molecular Properties by Coherent Light Fields", T. Kirova, A. Ekers, R. Garcia-Fernandez, M. Auzinsh, K. Blush, N. Bezuglov, K. Michulis, and K. Bergmann, Marie Curie Conference (MC2): Putting the Knowledge Based Society into Practice, April 10-12, 2006, Manchester, UK
 44. "State Selectivity and Eigenstate Design in Molecules using Multiple cw Lasers", T. Kirova, F. C. Spano, and A. M. Lyyra, poster presentation, International Workshop on Atomic Physics, November 27-December 2, 2005, Dresden, Germany
 45. "Designing Molecular Eigenstates in a Four-level Lambda System", T. Kirova, F. C. Spano and A. M. Lyyra, 36th Meeting of DAMOP, May 17-21, 2005, Linkln, Nebraska, USA
 46. "Measurement of the $X^1\Sigma_g^+ \rightarrow A^1\Sigma_u^+$ of Na_2 Transition Dipole Moment by Autler Townes Splitting: Comparison of Three and Four Level Excitation Schemes", P. Qi, A. Hansson, T. Kirova, L. Li, A. Lazoudis, E. Ahmed, S. Magnier, A. M. Lyyra, J. Qi, poster presentation, 36th Meeting of DAMOP, May 17-21, 2005, Linkln, Nebraska, USA
 47. "Quantum State Control using Multiple cw Lasers", T. Kirova, F. C. Spano, and A. M. Lyyra, poster presentation, CLEO/ IQEC, May 16-21, 2004, San Francisco, California, USA
 48. "Diatomic Alkali as a Gateway to Molecular Quantum Optics", J. Magnes, E. Ahmed, A. Lazoudis, T. Kirova, L. Narducci, F. Spano, and M. Lyyra, poster presentation, 89th Symposium of the New York State Section of the American Physical Society, October 15 -16, 2004, Brooklyn, NY, USA
 49. "Electromagnetically Induced Transparency in Open Molecular Systems by Lambda, Vee and Cascade Excitation Schemes", A. Lazoudis, T. Kirova, P. Qi, E. Ahmed, J. Magnes, F. Spano, L. Narducci, L. Li, M. Lyyra, poster presentation, Gordon Research Conferences, August 3-8, 2003, Hollyoke, New Hampshire, USA
 50. "Enhancement of Excited Triplet State Populations Using Quantum State Control", T. Kirova, F. C. Spano, A. M. Lyyra, OSA Annual Meeting and Exhibit, September 29-October 3, 2002, Orlando, Florida, USA
 51. "Measurement of Transition Dipole Moments in Molecular Lithium Using Electromagnetically Induced Transparency", A. Lazoudis, J. Qi, F. C. Spano, T. Kirova, J. Magnes, L. Li, L. M. Narducci, R. W. Field and A. M. Lyyra, 33rd Meeting of DAMOP, May 28-June 1, 2002, Williamsburg, Virginia, USA

52. “Electromagnetically Induced Transparency in a Molecular System”, J. Magnes, A. Lazoudis, T. Kirova, M. Lyyra, F. Spano, OSA Annual Meeting and Exhibit, October 14-18, 2001, Long Beach, California, USA
53. “Coherent Effects in Molecular Systems”, J. Qi, F. C. Spano, T. Kirova, A. Lazoudis, J. Magnes, L. Bloy, P. Fox, L. Li, L. M. Narducci, A. M. Lyyra , poster presentation, Gordon Research Conferences, July 29- August 3, 2001, Hollyoke, New Hampshire, USA

Awards

1997 “German Foundation for Support of the Bulgarian Higher Education” Special Skills

Computer

Programming Languages: Mathematica, Fortran, C++

Operating Systems: UNIX, MS Windows, Linux

Languages

English-fluent, Bulgarian-native, Russian-intermediate, Latvian- beginners

Memberships

Optical Society of America (OSA)

References

A. Marjatta Lyyra: Department of Physics, Barton Hall, BA 123, Temple University, Philadelphia, PA 19122, USA, phone:(+1)215-204-3776, lyyra@temple.edu

Frederik Scholtz, director: National Institute for Theoretical Physics, Stellenbosch Institute for Advanced Study, 10 Marais Street, Stellenbosch 7600, SOUTH AFRICA, phone:(+27) (0)21-808-3871, fqs@sun.ac.za

Frank C. Spano: Department of Chemistry, Beury Hall, Temple University Philadelphia, PA 19122, USA phone:(+1)215-204-5302, spano@temple.edu

2. Annex CV Dr. Jorge Roberto Del pino Boytel**PERSONAL INFORMATION:**

Name(s): Jorge Roberto
Family Name(s): del Pino Boytel
Date of Birth: May 7, 1949
Place of Birth: La Habana, Republic of Cuba
Citizenship: Cuban
Cuban ID number: 49050707100
Family Status: Single, No children
Current Passport: Republic of Cuba
 Ordinary Passport
B790611
 Valid until March 2016



Current Address: Donato Mármol #472
 e/ Bayamo y Sanchez Hechavarria
 Santiago de Cuba 90100
 Cuba

Phone: 053 (22) 627841 (Home)

Current e-mails: pino@cenais.cu (Cuba)
ipino@medired.scu.sld.cu
pino@gfz-potsdam.de (Germany)

Degrees: B.S. in Physical Engineering
 Universidad de Oriente,
 Santiago de Cuba
 1970
 Ph.D. in Physical and Mathematical Sciences
 (In Czech: Kandidata Fyzikálny-Matematických Véd)
 Czech Technical University in Prague (ČVUT)
 Faculty of Nuclear Sciences and Physical Engineering (FJFI)
 1985 (Ph.D. number 14 729)
Last employer: Centro Nacional de Investigaciones Sismológicas (CENAIIS)
 Calle 17 # 64, Vista Alegre
 Santiago de Cuba 90400
 Cuba
 A pensioner from CENAIIS since February 26/2010.

Work Experience (Short Overview)

| Period | Activity | note |
|-------------|---|------|
| 2010 - 2011 | Upgrade and redesign of the Santiago de Cuba Sciences Museum "Tomás Romay" Astronomy Section (Including writing new Planetarium Conferences). | 1 |
| 1999 - 2010 | SLR real-time software development for the SLR Potsdam-3, GFZ-Potsdam, Germany | 2 |

| | | |
|--------------------|--|----|
| 2002 - 2004 | Installation and operation of a digital tidal meter and borehole water level monitoring near the “Observatorio Geodinámico” in Santiago de Cuba | 3 |
| 2001 – 2003 | Installation and operation of a GFZ-owned gravimetric station Lacoste – Romberg in Santiago de Cuba. | 4 |
| 2000 - 2010 | Installation and operation of the IGS GPS station “scub” at the “Observatorio Geodinámico”, CENAIIS in Santiago de Cuba | 5 |
| 1996 - 2000 | Long term GPS measurements at Santiago de Cuba. | 6 |
| 1993 - 1995 | Participation on the DARA project 50 ee 9219 "ERS-Lasertracking Santiago de Cuba" for upgrading the SLR station 1953 to a 10 Hz Nd/Yag laser system | 7 |
| 1981 - 2000 | Construction, installation, operation, maintenance and upgrading of the 2 nd Generation SLR system “SBG” in Santiago de Cuba | 8 |
| 1976 - 1985 | Installation, operation, maintenance and upgrading the 1 st Generation INTERKOSMOS SLR station “Krypton” in Santiago de Cuba | 9 |
| 1975 - 1991 | Observational work with the Satellite Photographic Camera AFU-75 | 10 |
| 1975 - 2010 | Working at the Satellite Tracking Station “Santiago de Cuba”. (Since 1999 “Observatorio Geodinámico”, CENAIIS) | 11 |
| 1970 - 1975 | Junior lecturer at the School of Physics, Science Faculty, “Universidad de Oriente”, Santiago de Cuba | 12 |
| 1970 | B.Sc. Physical Engineering, “Universidad de Oriente” Santiago de Cuba | 13 |

Notes:

1. The Santiago de Cuba Sciences Museum “Tomás Romay” Astronomy Section was inaugurated in 1966 and has not been upgraded since then.
I have been working as a voluntarily team leader which includes the section employees and a professional designer.
The new Posters set will reach more than 45 m², covering from the creation myths of many civilizations around the world and the origin of the Universe to the Solar System including extrasolar planets and the history of the Planetarium. A new set of prerecorded conferences for the old Zeiss Jena medium size planetarium are being developed.
2. I have worked in Germany (total 19.5 months since 1999) at the GFZ-Potsdam on the development of real-time control and associated software for the 10Hz Potsdam-3 SLR station (using PowerBasic 3.5®). This software includes advanced capabilities p.e.: Multisatellite Tracking with optimized fast switching, advanced avoidance of solar interference during daylight tracking and automatic management of high elevation/speed passes. I also wrote the Target Calibration program, the Star Calibration program for mount modeling, the long term meteorological data acquisition and monitoring program and the data collating program for the input to the data filtering/analysis program.
With the join operation of TerraSAR-X and TanDEM-X, the automatic fast switching between both satellites during a single pass was added, in this moment (winter 2012) only the SLR stations Potsdam and Herstmonceux are capable of doing so.
Part of the current code will be reused on the Potsdam-3 Khz Linuix based version starting operation in 2012.
Before that, I contributed with software for the Potsdam-2 station, in particular, the improved Star Calibration Software.

I have developed several MSExcel® Spreadsheets for the SLR data and target statistical analysis. I have worked on PC's using the LINUX OS.

3. As part of the long-term cooperation program with GFZ-Potsdam, I supervised the work of two technicians and carried out the troubleshooting and data pre-processing. I used the one year water table data set to prove the inverse partial correlation between the water level and the weekly GFZ height solution for the "scub" GPS station due to the local geological structure.
4. As a part of the long-term cooperation program with GFZ-Potsdam.
I upgraded the DOS based software for the data extraction from the Gravimeter control PC and wrote a new "quick-look" viewing/analysis software for the gravimeter sensor drift management.
A paper with the results was published at the Journal Of Geodynamics, Vol.40, No.1, 1, August 2005.
5. As part of the long-term cooperation program with GFZ-Potsdam.
Currently the station "scub" is a IGS **"reference frame station"**.
6. As part of the long-term cooperation program with GFZ-Potsdam.
7. The SLR "SBG" station was upgraded under the DARA project to a 10 Hz/Nd-YAG configuration. For this project I wrote new versions of the real-time control and analysis programs and a general upgrading of the SLR software packet and was co-leader of the upgrading team.
8. The SLR "SBG" station in Santiago de Cuba was started in 1981 as a joint GDR, Cuba and USSR (until 1991) project under the general leadership of Dr. R. Neubert (ZIPE/Potsdam). From 1985-1992 the SLR was operated with the partnership IGA/Cuba-ZIPE/GDR and from 1992-2000 with CENAIIS/Cuba-GFZ-Potsdam/BRD.

Among my responsibilities were the software development since 1983, the SLR installation logistics in Cuba in 1985, and the systems upgrades, maintenance and its regular operation. The software I wrote covered all of the steps of the realization of SLR observations: orbital data acquisition and preprocessing (from Telex tape and later using email), observation scheduling, realization of observations and calibrations, SLR data analysis, data transfer and the calibration and setting of the original Loran-C SLR time base. This software set was upgraded several times, starting with a programmable calculator EMG 666/B; the last version was for 10 Hz tracking using a 50 Mhz Pentium based PC's.

Several of the written programs were also used in the similar SBG SLR system in Potsdam and in the Potsdam-2 SLR, in particular the prediction/pass listing program which is still in use in the current Potsdam-3 SLR system at GFZ.

I was the Santiago team leader, having under my command a Cuban team of 4 observers, one electronic engineer and a general technical assistant; and for the period 1985-1990 I also had a visiting observer from the URSS for half a year every year until 1989.

9. I was trained in 1976 on the operation of the 1st generation INTERKOSMOS SLR "Krypton" at the Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University, Prague.
The SLR "Krypton" was installed in Santiago de Cuba on summer 1977 (Team Leader Dr. Karel Hamal, Czech Technical University) and operated until 1985.
10. Initially I carried out part of the observation schedule as observer, Since 1977, I managed the AFU-75 time service and its calibration.
During the late 80's until its closing in 1991, the AFU-75 observations were concentrated on geostationary satellite identification campaigns.
In this period my responsibility was, based on the general guidelines emitted by the Astronomical Service of the Soviet Union (Astrosviet), to organize the observational schedule, supervise the preprocessing and quality control and send the useful negatives to the Analysis Center in Moscow.
11. Originally was part of the Department of Astronomy, Institute of Geophysics and Astronomy (IGA) Cuban academy of Sciences.

In February 1992 the Seismological Department was split from IGA and was the foundational core of the National Center for Seismological Research (CENAIIS) based in Santiago de Cuba.

The Satellite Tracking Station operation was transferred from IGA to CENAIIS at the same time.

In 1999 the Satellite Tracking Station and the Central Station of the Cuban National Seismical Network were consolidated on the same place and was renamed as “Observatorio Geodinamico”

12. My teaching workload was on the fields of: optics and atomic physics including the upgrading of the optical and atomic physics labs. I also gave some courses of Calculus II. In parallel I worked on the installation and implementation of the Classical Raman spectral analysis method.
13. Before graduating at the “Universidad de Oriente” I worked as a teaching assistant during 1969 and 1970 on the general physics laboratory and Analytic Geometry courses.

Languages:

I am a Spanish native speaker and fluent in English, both written and spoken, English has been my working language for both my Ph.D. work in Prague and all the SLR related work carried out in Germany.

I have an English language proficiency certificate from the Czech Technical University.

During my work in the period 1970-1990, I developed basic conversational abilities both in Russian and Czech.

Scientific Work:

My Ph.D. dissertation on laser physics was done at the Czech Technical University in Prague (CVUT), in 1985 on "Second Harmonic Generation for Satellite Tracking". Dr. Karel Hamal was my supervisor.

Member of the International Astronomical Union, formally I am associated with the commission 19, Rotation of the Earth.

As the bulk of my work has been the supporting and carrying out observational programs I have only a few peer-reviewed publications, however I have been author or co-author of presentations in specialized publications of workshop proceedings.

Among them:

1. Grunwaldt, L., Fischer, H., Neubert, R., del Pino, J.: “The “SBG” Laser Ladar Stations Potsdam and Santiago de Cuba: Status and Performance Report”; Proc. 6th Intern. Workshop on Laser Ranging Instr., 93-96, Antibes 1986
2. Mashevich, A., Chepurinov, B., Fundora, M., del Pino, J., Kautzleben, H., Neubert, R., Grunwaldt, L., Fischer, H.: “The new 2nd Generation Laser Station at Santiago de Cuba”; Gerl. Beitr. Geophys. 96 (1987), 75-81
3. Montag, H., Grunwaldt, L., del Pino, J.: “Determination of Geocentric Coordinates of the Station Santiago de Cuba”; Nabl. Issk. Sputn. Zemli 25, Budapest 1987
4. Grunwaldt, L., Neubert, R., del Pino, J.: “Status and performance of the “SBG” laser radar stations Potsdam and Santiago de Cuba”; Proc. 7th Intern. Workshop on Laser Ranging Instr., 73-76, Matera 1989
5. Grunwaldt, L., Neubert, Fischer, H., Salminsh, K., del Pino, J.: “First Laser Ranging Results of the new Potsdam SLR System” 13th Intern. Workshop on Laser Ranging Instr. Washington, 2002.
6. Rosabal S., García J., Palau R., Collantes A, Vives J., Del Pino J.: “Estudio de los efectos de los movimientos tectónicos en la dinámica de la bahía de Santiago de Cuba a través de técnicas GPS”. MAPPING, monográfico del programa iberoamericano de ciencia y tecnología para el desarrollo (CYTED), ISSN 1.131-9.100, p. 66
7. J. Neumeyer, J. del Pino, O. Dierks, H.P. Sun, H. Pflug: ”Improvement Of Ocean Loading Correction On Gravity Data With Additional Tide Gauge Measurements”; Journal Of Geodynamics, Vol.40, No.1, pp. 104-111, August 2005.
8. del Pino J., “Hazards And Risks @ SLR Network”, 17th Intern. Workshop on Laser Ranging Instr. Bad Koetzting Germany, 2011.

Summary:

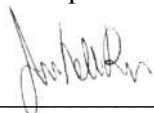
Over 35+ years of experiences on the field of SLR related work, both on the observational and on the development side of SLR systems, this experience included working as a Team Leader inside Cuba and as a development team member both in Potsdam and Prague.

I am used to work together with electronics specialists on the SLR electronics maintenance and repairs and on the Ruby and Nd/YAG lasers used on the different SLR configurations in Cuba.

Near 30 years experience on writing software for SLR system using PowerBasic® since 1990 covering all the steps of the SLR observational cycle.

15+ years in experience in the continuous operation of a GPS station.

Field Experience in the operation of Gravimeter, Tidal Meter and Water Table meter.



Dr. Jorge R. del Pino

Contacts for references:

Photographical and SLR tracking

Dr. Suriya K. Tatevian INASAN, Moscow statev@inasan.ru

PhD. Disertation, work on SLR „Krypton“

Prof. Dr. Karel Hamal Czech Technical University (deceased)
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Dr. Ivan Prochazka Czech Technical University prochazk@troja.fjfi.cvut.cz
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Prof. Dr. Helena Jelinková Czech Technical University hjelin@troja.fjfi.cvut.cz
Faculty Of Nuclear Sciences
and Physical Engineering

SBG SLR station 1953 (1981-2000)

Prof. Dr. Horst Montag Horst Montag montag@rftonline.net
Am Rosenhag 2 phone: 0049-3381-301027
D-14470 Brandenburg
(retired)

Dr. Reinhart Neubert GFZ-Potsdam reinhart.neubert@web.de
(retired)

Dr. Ludwig Grunwaldt GFZ-Potsdam grun@gfz-potsdam.de
Prof. Dr. Christoph Reigber GFZ-Potsdam christoph.reigber@spacetechn-i.com
(retired)

Gravimetric station, tidal meter, operation of the IGS GPS „scub“ station

Dr. Jürgen Neumeyer GFZ-Potsdam juergen_neumy@yahoo.de
(retired)

Dr. Markus Ramatschi GFZ-Potsdam maram@gfz-potsdam.de

Cuban work at IGA and CENAIIS

Dr. Alejandro Zapata CENAIIS zapata@cenais.cu
Dr. Bladimir Moreno CENAIIS bladimir@cenais.cu
Dr. Oscar Alvarez Sciences Department. oscar@citma.cu
Cuban Academy of Sciences
Havana, Cuba (former chief Astronomy department IGA)

3. Annex . CV Justas Zdanavičius

Curriculum vitae

Name: Justas Zdanavičius

Address: Ukmergės 214-3 Vilnius, Lithuania;
Justas.Zdanavicius@tfai.vu.lt

Education: Vilnius University, Faculty of Physics (1989-1994)

Dissertation: Doctoral dissertation 2006 “Interstellar extinction in the direction of the Camelopardalis Dark Clouds”. Physical science, physics, astronomy, space research, cosmic chemistry.

Teaching Experience: 2005 Vilnius pedagogical university course “CCD in astronomy”

Experience: Institute of Theoretical Physics and Astronomy Vilnius University

- 1994– 1995 – engineer
- 1995-1999 – PhD student
- 2000- 2007 – junior researcher
- 2007-2011 – researcher
- 2011.09 – senior researcher

Postdoctoral research :

2008.06 -2010.05 Postdoctoral Fellow. Multicolor CCD photometry of galactic open clusters. Department of Physics, The University of Vilnius.

Languages: Lithuanian – native, Russian – excellent, English – good.

List of Dr. Justas Zdanavičius scientific publications:

1. Zdanavičius K., Zdanavičius J., Kazlauskas A., 1996, Interstellar Extinction in the Camelopardalis Dark Clouds, *Baltic Astronomy* 5, 563-577.
2. Zdanavičius J., Černis K., Zdanavičius K., Straizys V., 2001, Photometric Classification of Stars and the Interstellar Extinction near the Camelopardalis and Perseus Border, *Baltic Astronomy* 10, 349-373.
3. Zdanavičius J., Zdanavičius K., 2002, Photometry and classification of stars along the Camelopardalis and Perseus border, *Baltic Astronomy* 11, 75-90.
4. Zdanavičius J., Straizys V., Corbally C., 2002, Interstellar extinction law near the Galactic equator along the Camelopardalis, Perseus and Cassiopeia border. *A&A* 392,295-300
5. Zdanavičius J., Zdanavičius K., 2002, Interstellar extinction along the Camelopardalis and Perseus border, *Baltic Astronomy* 11,441-463.
6. Zdanavičius J., Zdanavičius K., 2003, A New CCD Camera at the Moletai Observatory. *Baltic Astronomy*..12..642
7. Zdanavičius,J.; Zdanavičius,K.; Straizys,V.; Kazlauskas,A.; Černis,K.; Chen,C.W.; Chen,W.P.; Boyle,R.P.; Tautvaišienė,G., 2004, Seven-Color Photometry of the Open Cluster NGC 2395 Area. *Baltic Astronomy*..13..555
8. Straizys,V.; Zdanavičius,J.; Zdanavičius,K.; Laugalys,V.; Kazlauskas,A.; Černis,K.; Boyle,R.P.; Philip,A.G.D., 2004, Interstellar extinction in the MBM 12 molecular cloud area in Aries. *AAS*...205.5904
9. Zdanavičius J., Zdanavičius K., 2005, CCD photometry and classification of stars in the camelopardalis, *Baltic Astronomy* 14. 1.
10. Zdanavičius J., Zdanavičius K., Straizys V., 2005, Interstellar extinction in the direction of the association Cam OB3, *Baltic Astronomy* 14. 31.
11. Zdanavičius, J.; Straizys, V.; Chen, C. W.; Chen, W. P.; Zdanavičius, K.; Kazlauskas, A.; Černis, K.; Davis Philip, A. G.; Boyle, R. P.; Tautvaišienė, G., 2005, Seven-Color Photometry of the Open Cluster NGC 1647 Area, *Baltic Astronomy* 14. 179.
12. Zdanavičius J., Zdanavičius K., Straizys V., 2005, Space distribution of stars in the direction of the association Cam OB3, *Baltic Astronomy* 14. 313.
13. Straizys, V.; Zdanavičius, J.; Zdanavičius, K.; Kazlauskas, A.; Černis, K.; Laugalys, V.; Boyle, R. P.; Corbally, C. J.; Philip, A. G. D. 2005 Photometric Investigation of the MBM 12 Molecular Cloud Area in ARIES. III. CCD Photometry *Baltic Astronomy* 14. 555.

14. Černis, K.; Zdanavičius, J.; Zdanavičius, K.; Tautvaišienė, G. 2006 Astrometric Observations Of Asteroids And Comets At The Molėtai Astronomical Observatory IAUS 236E 101.
15. Černis, K.; Zdanavičius, J.; Zdanavičius, K.; Tautvaišienė, G. 2007 Astrometry of small Solar System bodies at the Moletai observatory IAUS.236..377 Proceedings of IAU Symposium 236.
16. Zdanavičius, K.; Zdanavičius, J.; Straižys, V.; Kotovas, A. 2008 Photometry and Classification of Stars around the Reflection Nebula NGC 7023 IN Cepheus. I. A Catalog of Magnitudes, Color Indices and Spectral Types of 1240 Stars Baltic Astronomy 17 161.
17. Černis, K.; Zdanavičius, J.; Zdanavičius, K.; Włodarczyk, I. 2008 Discovery, Observational Data and the Orbit of the Aten Group Asteroid 2006 SF77 Baltic Astronomy 17 235.
18. Zdanavičius, J.; Palevičius, A.; Tamulevičius, T.; Zdanavičius, K. 2008 On the Transmittance Nonuniformity of Large Interference Filters, Baltic Astronomy 17 415.
19. Zdanavičius, K.; Zdanavičius, J.; Straižys, V.; Maskoliūnas, M. 2009 Photometry and Classification of Stars around the Reflection Nebula NGC 7023 IN Cepheus. II. Interstellar Extinction and Cloud Distances Baltic Astronomy 18. 33.
20. Zdanavičius, K.; Zdanavičius, J.; Straižys, V.; Maskoliūnas, M. 2009 Photometry and Classification of Stars in the Direction of the Dark Cloud Tgu 619 IN Cepheus. I. a Catalog of Magnitudes, Color Indices and Spectral Types of 1304 Stars, Baltic Astronomy 18. 161.
21. Zdanavičius, J.; Bartašiūtė, S.; Zdanavičius, K. 2010 Wide Field CCD Photometry of the Open Cluster NGC 752 Baltic Astronomy 19. 35.
22. Zdanavičius, J.; Bartašiūtė, S.; Boyle, R. P.; Vrba, F. J.; Zdanavičius, K. 2010 Multicolor CCD Photometry of the Open Cluster IC 361 Baltic Astronomy 19. 63.
23. Zdanavičius, J.; Čepas, V.; Zdanavičius, K.; Straižys, V. 2010 Wide Field Multicolor CCD Photometry in the Vicinity of the Open Cluster King 7 Baltic Astronomy 19. 197.
24. Černis, K.; Eglitis, I.; Włodarczyk, I.; Zdanavičius, J.; Zdanavičius, K. 2010 The Apollo Group Asteroid 2008 OS9: Discovery, Orbit, Rotation and the Yarkovsky/YORP Effects 235.
25. Zdanavičius, Justas; Boyle, Richard P.; Vrba, Frederick J.; Zdanavičius, Kazimieras; Bartašiūtė, Stanislava 2010 IC 361, a distant intermediate-age cluster in Camelopardalis IAUS 266 557.
26. Pakštienė, E.; Solheim, J.-E.; Handler, G.; Reed, M.; Bognár, Zs.; Rodler, F.; Paparó, M.; Zdanavičius, J.; Steininger, B.; Wolf, G. 2011 "The cool ZZ Ceti star PG 2303+243: observations and analysis of variability in 2004", Monthly Notices of the Royal Astronomical Society, Volume 415, Issue 2, pp. 1322-1333.
27. Zdanavičius, K.; Maskoliūnas, M.; Zdanavičius, J.; Straižys, V.; Kazlauskas, A. 2011 Photometry and Classification of Stars in the Direction of the Dark Cloud Tgu 619 in Cepheus. II. Interstellar Extinction and Cloud Distance, Baltic Astronomy, Vol. 20, p. 317-337
28. Zdanavičius, J.; Vrba, F. J.; Zdanavičius, K.; Straižys, V.; Boyle, R. P. 2011 CCD Photometry of the Open Cluster Tombaugh 5 in the Vilnius System, Baltic Astronomy, Vol. 20, p. 1-25

4. Annex . CV Vygandas Laugalys**Vygandas Laugalys****e-mail:** laugalys@itpa.vu.lt**Permanent address:**

Vilnius, PO 12119

Lithuania

+370 (685) 19819

Recent publications: 2008-present

1. 2013 March, accepted to A&A Straizys, V.; Boyle, Richard P.; Janusz, R.; Laugalys, V.; Kazlauskas, A. The Open Cluster IC 1805 and its vicinity: investigation of stars in the Vilnius, IPHAS, 2MASS, and WISE systems
2. 2013AAS...22125604B; Boyle, Richard P.; Straizys, V.; Janusz, R.; Laugalys, V.; Kazlauskas, A. The Open Cluster IC 1805 in the Perseus Arm: Distance, Extinction and YSO
3. 2012AAS...21934912B; Boyle, Richard P.; Janusz, R.; Straizys, V.; Laugalys, V. The Emission Nebula Sh2-231 And Its Relation To The Dust Cloud TGU 1192 (LDN 1525)
4. 2011AAS...21734011B; Boyle, Richard P.; Janusz, R.; Vrba, F. J.; Straizys, V.; Laugalys, V.; Kazlauskas, A.; Stott, J.; Philip, A. G. D. The Pelican Nebula and its Vicinity: a New Look at Stellar Population in the Cloud and around It.
5. 2010BaltA..19..169S; Straizys, V.; Drew, J. E.; Laugalys, V. Extinctions and Distances to Dark Clouds from 2MASS, MegaCam and IPHAS Surveys: LDN 1525 in the Direction of the Aur OB1 Association
6. 2009BaltA..18..141S; Straizys, V.; Laugalys, V. Extinctions and Distances of Dark Clouds from ugrihjk Photometry of Red Clump Giants: the North America and Pelican Nebulae Complex
7. 2009BaltA..18..111C; Corbally, C. J.; Straizys, V.; Laugalys, V. Spectral Analysis of YSOs and Other Emission-Line Stars in the North America and Pelican Nebulae Region
8. 2008hsf1.book..294S; Straizys, V.; Laugalys, V. Young Stars and Clouds in Camelopardalis
9. 2008BaltA..17..253S; Straizys, V.; Laugalys, V. 2MASS Two-Color Interstellar Reddening Lines in the Inner Galaxy
10. 2008BaltA..17..143S; Straizys, V.; Laugalys, V. O-Like Stars in the Direction of the North America and Pelican Nebulae
11. 2008BaltA..17..125S; Straizys, V.; Corbally, C. J.; Laugalys, V. 2MASS Two-Color Interstellar Reddening Line in the Direction of the North America and Pelican Nebulae and the CYG OB2 Association
12. 2008BaltA..17....1S; Straizys, V.; Laugalys, V. Young Stars in the Camelopardalis Dust and Molecular Clouds. III. The GL 490 Region

5. Annex. Arvind Kumar Saxena**Curriculum vitae****Personal Profile:**

Name: Arvind Kumar Saxena
Date of birth: 20/04/1984
Nationality: Indian
Gender: Male
Marital status: Single
Languages known: English and Hindi (mother tongue)
Present position: Senior Researcher, University of Latvia, Latvia
Mailing address: Institute of Atomic Physics and Spectroscopy,
university of Latvia, 4 Skunu iela, Riga, LV-1050, Latvia
Contact number: +91-9974408411
Webpage: www.prl.res.in/~aksaxena
Email: arvindsaxenaa@gmail.com

Professional positions:

- **Senior Researcher** (from February 2015) in Institute of Atomic Physics and Spectroscopy, Latvia
- **Visiting Research fellow** (August 2014-January 2015) in Institute of Atomic Physics and Spectroscopy, Latvia
- **Postdoctoral fellow** (Oct 2013-July 2014) from Physical Research Laboratory, Ahmedabad, India

Academic Qualifications:

- **Ph.D. in Physics** from Physical Research Laboratory (PRL), Ahmedabad, and Mohan Lal Sukhadia University, Udaipur, India in December 2014.
- Master of Science (M.Sc.) in Physics from Lucknow university, Lucknow (India) with **1st division (61 %)** in 2006.
- Bachelor of Science (B.Sc.) in Physics, Chemistry and Mathematics from M.J.P. Rohilkhand university, Bareilly (India) with **1st division (75 %)** in 2004.

Working Experience:**Development/Instrumentation:**

- Design and construction of a double field time-of-flight mass spectrometer
- Experience in handling high Vacuum systems (order of 10^{-10} mbar)
- Designing and development of cluster sources based on Sputtering, laser ablation and Supersonic expansion technique for generating atomic, molecular and mixed clusters
- Experience of handling an experimental setup for low temperature (~ 85 K) Astrochemistry of molecules and clusters
- Development of a pulsed electron gun (maximum energy 2.0 keV)
- Experience of handling a microwave He-discharge driven UV source
- Experience of handling a quadrupole mass spectrometer

Scientific Investigations during thesis:

- Mass spectrometric study of atomic, molecular and mixed clusters
- Study of multiply charged atomic ion formation in MPI of xenon clusters
- Optical emission spectroscopic study of carbon clusters
- Optical emission spectroscopic study of glow discharge and laser ablated plasma plume in the presence of an ambient gas
- Electron impact ionization study of gas clusters and fullerene

Computer/Software skills:

- Working experience operating systems: Windows and Linux
- Working knowledge of Software's: AutoCad, ORIGIN, SRIM, TRIM, SIMION

Fellowships and Awards:

- Council of Scientific and Industrial Research (CSIR), National Eligibility Test (NET) – Junior Research Fellowship, June 2007
- Council of Scientific and Industrial Research (CSIR) National Eligibility Test (NET) – Junior Research Fellowship, December 2007
- Graduate Aptitude Test for Engineering (GATE)- 2007, GATE SCORE - 467, Percentile- 97.46, All India Rank- 133

- iv. Junior research fellowship (2007-2009) from Physical Research Laboratory, Ahmedabad
- v. First prize for presenting research work of Space and Atmospheric Science Division during annual competition held in PRL 2009
- vi. Senior research fellowship (2009-2012) from Physical Research Laboratory, Ahmedabad
- vii. Fellowship from Plasma Science Society of India (PSSI) in 2013
- viii. Post Doctoral Fellowship (Oct2013-Sep2014) from Physical Research Laboratory, Ahmedabad
- ix. Visiting fellow in Indian Institute for Teacher Education (IITE) for motivating and teaching graduate and postgraduate science students 2014
- x. Visiting fellowship for one month in Electron Spectroscopy group, university of Oulu, Finland in March 2014
- xi. Visiting fellowship from Institute of Atomic Physics and Spectroscopy (Riga), university of Latvia, Latvia in April 2014
- xii. Postdoctoral fellowship (Aug 2014-Jan 2015) from university of Latvia, Latvia
- xiii. Senior Researcher fellowship from February 2015 for six years

► **Publications in peer-reviewed journals:**

1. "Optical Emission Spectroscopy of Carbon Clusters Produced in a Hollow Cathode Sputter Source" **Arvind Saxena**, Prashant Kumar, Swaroop Banerjee, K. P. Subramanian and Bhas Bapat, *Spectroscopy Letters* **47**, 114-118 (2014).
2. "Dependence of ion kinetic energy and charge on cluster size in multi-photon ionization of xenon clusters" **Arvind Saxena**, Prashant Kumar, S B Banerjee, K P Subramanian, B Bapat, R K Singh and Ajai Kumar, *International journal of mass spectrometry* **357**, 58-62 (2014).
3. "Mass Spectrometry of Atomic and Molecular Clusters", **Arvind Saxena**, *International Journal of Emerging Technologies and Application in Engineering, Technology and Sciences (IJ-ETA-ETS)*, special issue, 91-99 (2014).

A brief outline of PhD Thesis:

Atomic and molecular clusters play an important role in many branches of science. The investigation of environmental clusters covers a broad spectrum of research areas and unites Atomic and molecular physics to Atmospheric science, Space science, Astrochemistry, Material science and Nanotechnology. Environmental clusters play a key role for the environmental chemistry occurring in the upper atmosphere. The investigation of such chemical reactions occurring between the atmospheric gas molecules adsorbed on the surface of a cluster would be a breakthrough scientific investigation for better understanding the influence of such complex reactions on earth atmosphere.

The title of thesis is "*Study of Cluster Ions by Mass Spectrometry and Optical Spectroscopy*". Thesis is based on the investigation of the interaction of clusters with the charged particles, photons and ambient gas species. For studying such interactions, the primary task becomes the development of a cluster source and a diagnostic tool. Three cluster sources based on different techniques, such as sputtering, laser ablation and supersonic expansion of gas are developed. In order to detect heavy cluster ions, a two field linear Time-of-flight mass spectrometer is developed in lab.

Different atomic and molecular clusters, such as carbon clusters, mixed clusters of carbon and Argon, Xenon clusters, Ethyl alcohol clusters, mixed clusters of Ethyl alcohol, Benzene and Water vapor have been studied. We have found that three body collision between the ejecta and Argon atoms is the dominant mode, than the ejection of clusters via sputtering, for cluster formation in a hollow cathode carbon cluster source. In an investigation of xenon clusters subjected to IR and UV irradiation, we have investigated the significance of laser wavelength, intensity and cluster size for the production of multiple charge atomic ions. We have found that mean kinetic energy and mean charge state of fragment ions increases with the mean cluster ion size, on the other hand mean cluster ion size increases with the stagnation pressure.

► **Research interests:**

- Photo-ionization and fragmentation study of atomic and molecular clusters using high intensity laser pulses and synchrotron beam
- Study on interaction of clusters with charged particles
- Catalytic behavior of environmental clusters
- Optical emission spectroscopy of the laser ablated plasma plume interacting with the ambient gas
- Infrared spectroscopy of astrochemical ice analogs
- Cooling and trapping of atoms and their investigations

Project work during Ph.D.:

I carried out a six month research project entitled “*Bose-Einstein condensate in an optical lattice*” under the supervision of Prof. Prasanta Panigrahi (PRL, India).

Life memberships:

- (1) Plasma Science Society of India (PSSI)
- (2) Indian Laser Association (ILA)
- (3) Indian Society of Atomic and Molecular Physics (ISAMP)

Research training school attended:

1. SERC School on “Laser Spectroscopy”, November 3-21 (2008), held in Bhaba Atomic Research Center (BARC) Mumbai (India).
2. SERC School on “Experimental Techniques In Atomic And Molecular Physics”, April (2009), held in Physical Research Laboratory (PRL), Ahmedabad (India).
3. Adventure of Nocturnal Atmosphere: From Earth to Night Sky Riga 2014 (*Advances in remote sensing, satellite laser ranging and geodynamics*) 20-22 October 2014, University of Latvia, Latvia.

Invited talk/lectures:


- Institute for plasma research (IPR), Gandhinagar, India 2013
- Physics department, ELSP group, Oulu university, Finland 2014
- Institute of Atomic Physics and Spectroscopy, Riga, Latvia 2014

Paper presented in conferences:

1. Arvind K Saxena, Swaroop Banerjee and Bhas Bapat, *Hollow cathode carbon cluster source (poster)*, DAE -BRNS Symposium on Atomic, Molecular and Optical Physics, Inter University Accelerator Centre, (February 10 -13, 2009).
2. Arvind K Saxena, I.A.Prajapati, Bhas Bapat, *Development of a cluster source by laser ablation (poster)*, Topical Conference on Atomic and Molecular Physics (TC-2010) at the Raja Ramanna Centre for Advanced Technology, Indore, (March 3-6, 2010).
3. Arvind K Saxena, Swaroop Banerjee, I.A.Prajapati, K.P.Subramanian and Bhas Bapat, *A modified ion sputtering source for carbon clusters (poster)*, DAE-BRNS Symposium on Atomic Molecular and Optical Physics, Karnatak University, Dharwad (India), (Feb 22-25, 2011).
4. Arvind K Saxena, Swaroop Banerjee, Prashnat Kumar, I.A.Prajapati, K.P.Subramanian and Bhas Bapat, *A laser ablation-supersonic expansion source for carbon clusters (poster)*, 3rd international conference in Atomic, Molecular, Optical and Nano Physics (CDAMOP) Delhi university-Delhi (India) (Dec 14-16, 2011).
5. Arvind K Saxena, S. B. Banerjee, Prashant Kumar, K. P. Subramanian, Bhas Bapat and Rajesh Singh, *A laser ablation-supersonic expansion cluster beam source (poster)*, DAE-BRNS Symposium on atomic, molecular and optical physics, Kolkata (Dec 19-22, 2012).
6. Prashant Kumar, Arvind K Saxena, S.B. Banerjee, K.P. Subramanian and Bhas Bapat, Optical emission spectroscopy of carbon plasma plume in pulsed gas (poster), ISAMP topical conference on Laser interactions with atoms, molecules and cluster (TC2012), Hyderabad Central University, Hyderabad, India (2012).
7. Arvind K Saxena, S. B. Banerjee, Prashant Kumar, K. P. Subramanian and Bhala Sivaraman, *On the formation of higher oxides of Nitrogen and Carbon on the surface of icy staeellites (poster)*, ISAMP-TC 2013 on Atomic Processes in Plasmas, IPR Gandhinagar, Nov 18-20 2013.
8. Arvind K Saxena et al., *Atmospheric Photochemistry of Carbon Clusters*, 1st International Conference on Nocturnal Atmosphere and Laser Ranging: NOCTURNAL - Riga 2014, University of Latvia, 16-18 October 2014.
9. Arvind K Saxena, *Mass Spectrometry of Atomic and Molecular Clusters*, International Conference on Information, Knowledge and Research in Engineering, Management and Sciences (IC-IKR-EMS 2014), Kalol Institute of Technology and Research Centre, Kalol, Gujarat, 07 December 2014.
10. Arvind K Saxena, J. Blahins and A. Apsitis, *Study on Collisions of Atomic Clusters with Charged Particles*, 73rd Annual Scientific Conference of University of Latvia, section: the project “FOTONIKA-LV-FP7-REGPOT-CT2011-285912, Institute of Atomic Physics and Spectroscopy, 6 February 2015.

6. Annex. Alexander Narbut

Curriculum Vitae

| Personal Information | |
|---|--|
|  | Name: Alexander (Theodor) |
| | Surname: Narbut |
| | Nationality: Ukraine |
| | Marital Status: married |
| | Children: 6 children |
| | Registered Home Address: 26 – 60, Ladozka Str., Zaporizhia, 69121, Ukraine |
| | What field you are trying to apply in Turkey: TRIZ for technology, TRIZ for education, TRIZ for management and social processes |

Keywords (please, choose one or two most adequate areas for your professional activities and type them here):

TRIZ

| Education History | | | | | |
|--|------------------------------|---|--|---|---|
| University / Department | Period MM.YYYY to MM.YYYY | Major * Key word, accurately | Degree | Graduation Year MM.YYYY | Thesis |
| Classical TRIZ*OTSM Laboratory (COMCON*TRIZ International, Korea University for Technology and Education) | 09.1998 till now | TRIZ, Mathematics. System Researches | Doctor of Science Professor | 09.2010 registered 01.2011 registered 08.2011 | Contemporary Classical TRIZ - Science About Evolution of Technical Systems |
| TRIZ Laboratory of G.S.Altshuller | 09.1975 to 09.1998 | TRIZ | TRIZ Master | registered 09.1998 | |
| | | | | | |
| National Technical University, Zaporizhia, Ukraine (USSR) | 08.1976 to 06.1986 | Radio-design | Magister | registered 06.1986 | |
| | | | Bachelor | | |
| State Engineers Academy, Zaporizhia, Ukraine (USSR) | 08.1969 to 04.1973 | Semiconductors | | | |

| Professional Experience (Job Career) | | | |
|--|------------------------------|--------------------------------------|--|
| Total years of experience | | | |
| Organization | Period MM.YYYY to MM.YYYY | Position | Describe your responsibilities including role in detail |
| FRT corporation (COMCON*TRIZ International, Narbut TRIZ School), Ukraine | 09.1975 till Now | President and scientific director | TRIZ for researchers, TRIZ for using, TRIZ for education |
| Science and Practical Center TRIZ of Academy of Science of Ukraine | 09.2011 till Now | CEO | TRIZ for researchers, TRIZ for using, TRIZ for education |
| National Technical University, Zaporizhia, Ukraine (USSR) | 04.1977 to 08.1986 | Engineer | The engineer of science-researcher department |
| Plan of Semiconductors, Zaporizhia, Ukraine (USSR) | 09.1975 to 04.1977 | serviceman | The serviceman for special technology equipment |
| State Engineers Academy, Zaporizhia, Ukraine (USSR) | 08.1969 to 04.1973 | student | The student of semiconductor's faculty |
| | | | |

| Research & Development Project (main) | | | |
|---|------------------------------|---|--|
| Organization (Univ. or Company) | Period MM.YYYY to MM.YYYY | Subject / Title | Describe your responsibilities including role in detail |
| Kiev Polytechnic Institute, Ukraine Classical TRIZ*OTSM Laboratory | 09.2010 till Now | Education, Consulting and Researcher of TRIZ | The Scientific Head |
| Korea University for Technology and Education | 05.2008 to 08.2011 | Education and Consulting TRIZ Project | The Head of Project |
| Milano Polytechnic University, Italy | 08.2009 to 04.2010 | Education and Consulting TRIZ Project | The Head of Project |
| Agency of Innovation, Latvia | 10.2007 to 06.2010 | Education and Consulting TRIZ Project | The Head of Project |
| Agency of Innovation, Changwon, Korea | 01.2005 to 08.2006 | Education and Consulting TRIZ Project | The Head of Project |
| Korea TRIZ Association | 04.2004 to 03.2005 | Education and Consulting TRIZ Project | The Head of Project |
| Samsung Electronics | 04.2002 to 04.2004 | TRIZ using, TRIZ education, TRIZ researchers | The Engineer-researcher |
| National Institute of Strategy Studies, Ukraine | 09.1994 to 10.2001 | Consulting Project | The Head of Project |

| Winning Awards / Grants / Prizes / Scholarships (main) | | |
|--|----------------|--|
| Month and Year of Winning | Place / Detail | Title |
| 02.1981 | Moscow, USSR | Prizes of Government Committee of Science and Technics of USSR |
| 05.1981 | Kyiv, Ukraine | Prizes of Union of Journalists of Ukraine |
| 06.1981 | Kyiv, Ukraine | Prizes of Ministry of Higher Education of Ukraine |
| | | FRT corporation (COMCON*TRIZ International) is founder of TRIZ Prize since 2003. |

| Publications (Most Relevant) | |
|--|---|
| Title | Journal / Proceedings |
| Classical TRIZ*OTSM. Practicum Patent's Examples | Handbook. Ukraine, 2012. |
| TRIZ. History of the Instruments | Handbook. Ukraine-Korea, 2006 (also 2008, 2010, 2011, 2012), Latvia, 2008, 2010). |
| Projections of Economy | Handbook of TRIZ information found. Ukraine-Korea, 2005. |
| TRIZ. From start to stars | Handbook of TRIZ tasks. Ukraine-Korea, 2004 (also 2008, 2010). |
| More 300 TRIZ publications total | From 1975 till Now |

| Patents | | |
|--|-------------------------------------|---------------------|
| Subject | Applied No./Date | Registered No./Date |
| A COMPOSITE COOKING APPARATUS | KR20050052082 (A) | 2005-06-02 |
| Also published as: | EP1536670 (A1) | |
| | US2005115959 (A1) US7026587 (B2) | |
| | JP2005166630 (A) | |
| | CN1622698 (A) CN100490592 (C) | |
| One example is show. | | |
| Total more 35 patent's unique published from Samsung Electronics only. | | |

Annex. 7 Abbreviations

| Abbreviation | |
|---------------------------------------|---|
| Association FOTONIKA-LV | Association of three University of Latvia research institutes: Institute of Atomic Physics and Spectroscopy, Institute of Astronomy and Institute of Geodesy and Geoinformation |
| Baltic Sea Region | 11 countries: Baltic countries (Estonia, Latvia and Lithuania), Nordic countries (Denmark, Finland, Iceland, Norway and Sweden), Germany (Northern), Poland (Northern), and Russia (North-western and Kaliningrad) |
| D | Deliverable |
| ERA | European Research Area |
| EU | European Union |
| EU Council | Council of the European Union - a part of the bicameral EU legislature, representing the executives of EU member states |
| EU Council in Gothenburg | 86 th European Council meeting in Gothenburg, 15–16 June 2001 |
| FP7 | Seventh Framework Programme of the European Community for research, technological development and demonstration activities |
| HORIZON 2020 | EU Framework Programme for Research and Innovation (2014- 2020) |
| ICT | Information and Communication Technologies |
| Lisbon Strategy | also known as the Lisbon Agenda or Lisbon Process - an action and development plan devised in 2000, for the economy of the European Union between 2000 and 2010 |
| Photonics21 | European Technology Platform for photonics |
| RTD | Research and technology development |
| SME | Small and medium enterprise |
| UN | United Nations |
| Vision of Innovation Union 2020 | EU's growth strategy on employment, innovation, education, social inclusion and climate/energy to be reached by 2020 |
| WP | Work package |