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BOOK OF ABSTRACTS

INTERNATIONAL YEAR OF LIGHT 2015

Results of WP 3 – Upgrading, Development or Acquisition of Research Equipment

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WP 3 in the Project FOTONIKA LV was designed to answer the needs for upgrade of the existing research infrastructure via replacement of outdated equipment, purchase of new components and modules, and developing new apparatus to replace the old equipment. Such upgraded infrastructure will ensure that the human potential gained via recruitment or repatriation of researchers has been placed in the *state-of- the-art* environment enabling them to efficiently perform research. Furthermore, condition of the infrastructure is also an important precondition for the achievement of full mutual benefit from cooperation with partnership organizations and secondments organized in WP 1.

The following tasks were accomplished during project implementation:

Task 3.1. Equipment to develop a lab made working model device for night-time cartography of atmosphere by exposing satellite instruments with a white light beam from the Earth's surface

Optical lens kit for Schmidt telescope optical channel was purchased. This improvement will allow of a small part of curved focal plane image carry out of tube where it will be perceived with the CCD. Two that channels increase the effectiveness of observations with telescope more than 30 times.

Task 3.2. Development of satellite laser ranging systems towards application of femtosecond lasers and frequency combs

Femtosecond laser system is used for optical frequency standards, remote sensing and laser ranging. It is emitting a rainbow of colors in the range 500...1000 nm. Frequency comb has applicability in bio-optics research, for example skin fluorescence after illumination with fs pulses, and could be used for cancer diagnostics.

Task 3.3 Upgrade of laser equipment of the molecular beam laboratory of the repatriated researcher Dr. A. Ekers

The key components of the purchased tunable single frequency laser system with frequency doubling were purchased. The laser system including optical components and fibre couplers have been installed in the laboratory, fundamental Ti:Sa laser radiation of up to 6W in single frequency and second harmonic radiation of op to 500mW are available for experiments. Laser system upgrade provides wider range of laser frequencies and higher laser output power. An essential improvement is that the new laser systems enable the achievement of higher Rabi frequencies in experiments, which in turn ensures the right experimental conditions for the achievement of well-resolved interference fringes.

Task 3.4. Upgrade of UV and vacuum UV, spectroscopy instrumentation, and linked quartz & glass blowing workshop and technology laboratory and development of far UV laser spectroscopy

There are purchased parts for a vacuum spectrometer Mc Person 234/302. Spectrometer can record spectra in the range from 37nm -151nm at the same time, which allows performing complex and effective research of UV sources and respective radio frequency excitement generators.

Task 3.5. Upgrade of biophotonics research facilities

Mixed signal oscillograph (MSO4054B) was purchased. It is used for autofluorescence lifetime measurements of skin. The lasers and lasers' controller comprise one system. With this equipment the three wavelengths we worked before, measured autofluorescence photo bleaching.

Photon counting detector, detector's controller, data processing system, SPC-150 is one system for photon counting and time-correlating; with the minimum requirements for lifetime imaging.

Task 3.6. Advanced upgrade of research equipment for Fundamental Geodynamical Observatory

Purchased equipment allowed restoring existing SLR system functionality and now it's possible to take steps to participate in upcoming projects such as space debris tracking.

The most important result is restoring SLR system functionality and several of its subsystems were improved. Redesigned SLR system calibration – calibration RMS now is about 7ps instead of 14ps, also it is now more stable. Fully upgraded time and frequency system now features GPS steered Rb oscillators and OXCO slave clocks connected with fiberoptic and coaxial cables. Timing system clocks were evaluated and compared with primary cesium time standards at GFZ Potsdam, Germany. Redesigned telescope alignment instrumentation is using stable 532nm laser diodes. Construction of new combined visual tracking/receiver channel unit is currently under way. New unit will allow to use additional detectors like SPAD will use CCD for tracking.

Task 3.7. Advanced upgrade of the largest wide field Schmidt telescope in the Baltic States

Flatbed scanner complex needed to digitalize the wide field Baldone Schmidt telescope astronomical plate archive from the 1966-2005 time period. The uniqueness of this archive is record of regular observations almost 40- year long period toward constellation of Swan and anticenter of Galaxy directions. Digitization will give a high volume database which will allow to explore the brightness variability of stars of different spectral types in long time span, to measure the intrinsic speed of stars, and to discover new asteroids and comets.

Task 3.8. Zenith Refractometer

The Zenith refractometer used in the Laboratory of the Institute of Geodesy and Geoinformatics was upgraded with:

1. Equipment for mobile computerized large volume data flow registration in field conditions is necessary. A laptop computer was purchased for this purpose that will also be used for mechanical component design and associated calculations using Solid Edge software package and for device control and data acquisition software compiling.
2. SBIG CCD matrix will be used for star field image acquisition, necessary to calculate accurate instrument orientation, relative to coordinate system, defined by reference stars.
3. Hemisphere GPS A325 will be used to determine an accurate instrument position in geocentric coordinate system and .time of star imaging events.

Tripod and a number of mechanical and electronic components will be used for instrument assembly, power supply, data flow support and control functions.

Task 3.10. Advanced upgrade of electron-beam and resistive evaporation of dielectric, semiconductor and metal multilayer achromatic optical coating installation – VU-2M for interference mirrors and filters etc. (250-1100 nm) with simultaneous photometric layer testin

For general air inlet to cleanroom where the sputtering laboratory will have processing machinery, calculated in accordance to standards for cleanrooms HVAC systems.

At this time we have a small test deposition apparatus whose construction was used as student graduation exercise. As soon as possible we plan to process several astronomical mirrors and many more in the future. We plan to be able to produce optical equipment in small series on demand. We plan to install the negative ion research apparatus GRIBAM in the hall next to the cleanroom with the crystal growing apparatus with zone refinement regime, and use the semi-clean zone for constructing and adjusting the ion implantation instrument while it remains in our facility. Subsequently the implanter location will be occupied by a special laser or precision frequency comb instrument. The cleanroom will be permanently occupied with three deposition devices and sample cleaning equipment.