

Dispersion engineering of whispering gallery mode resonators (WGMRs)

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NACIONĀLAIS
ATTĪSTĪBAS
PLĀNS 2020



EIROPAS SAVIENĪBA

Eiropas Reģionālās
attīstības fonds

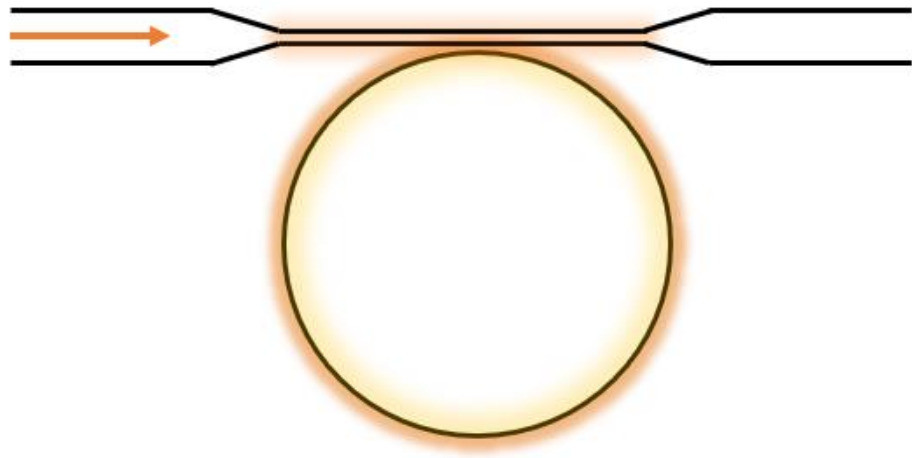
IEGULDĪJUMS TAVĀ NĀKOTNĒ



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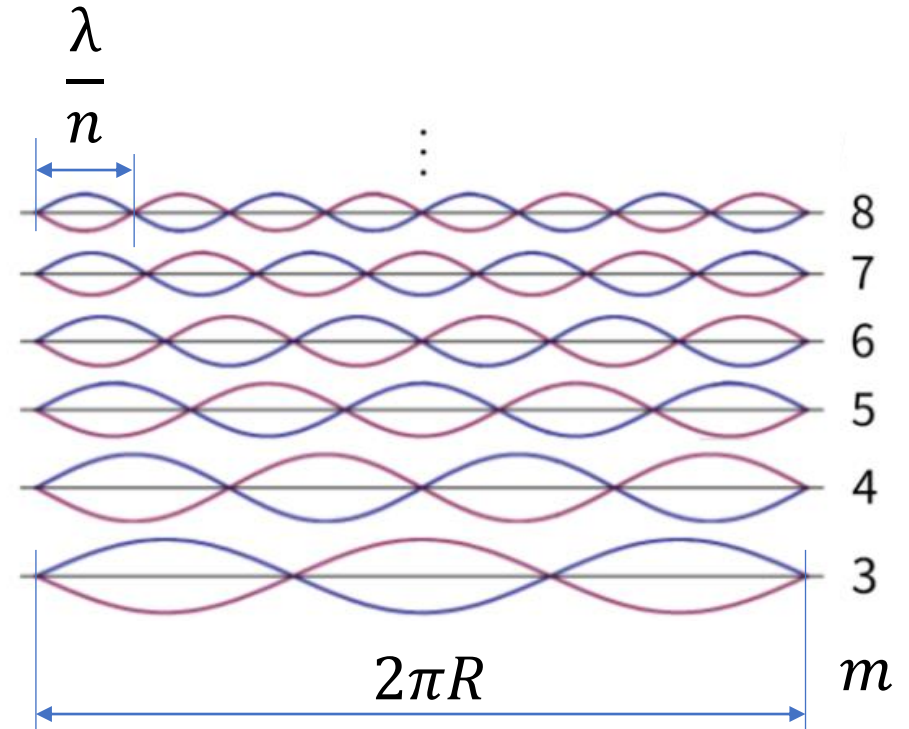


What are WGMRs?

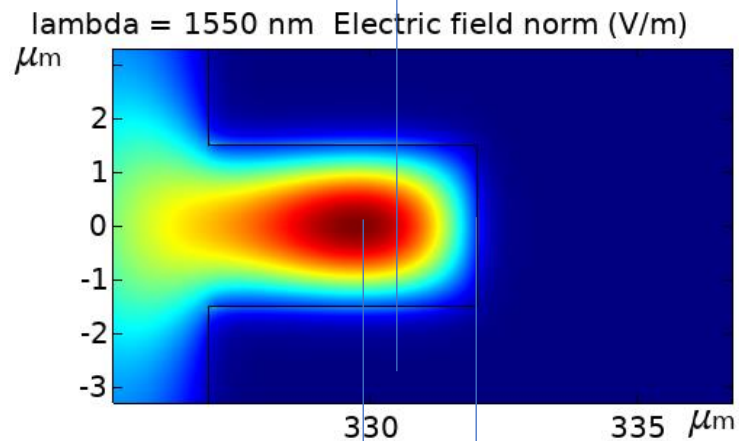
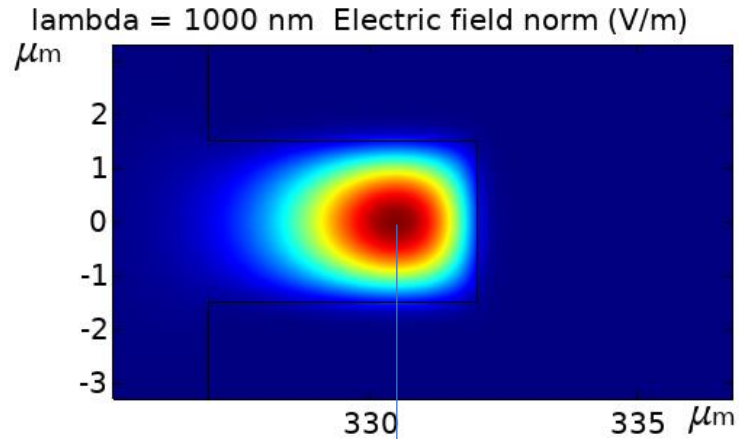


$$2\pi Rn = m\lambda$$

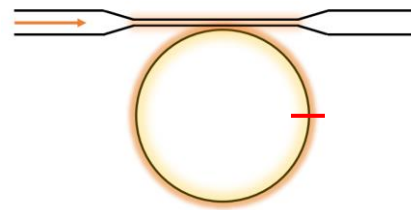
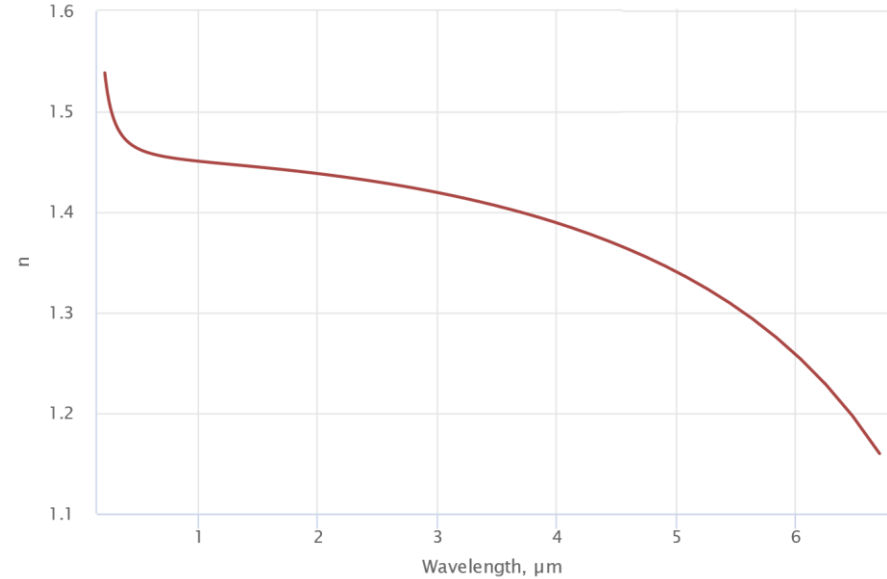
$$\lambda \ll R$$



COMSOL Multiphysics simulations



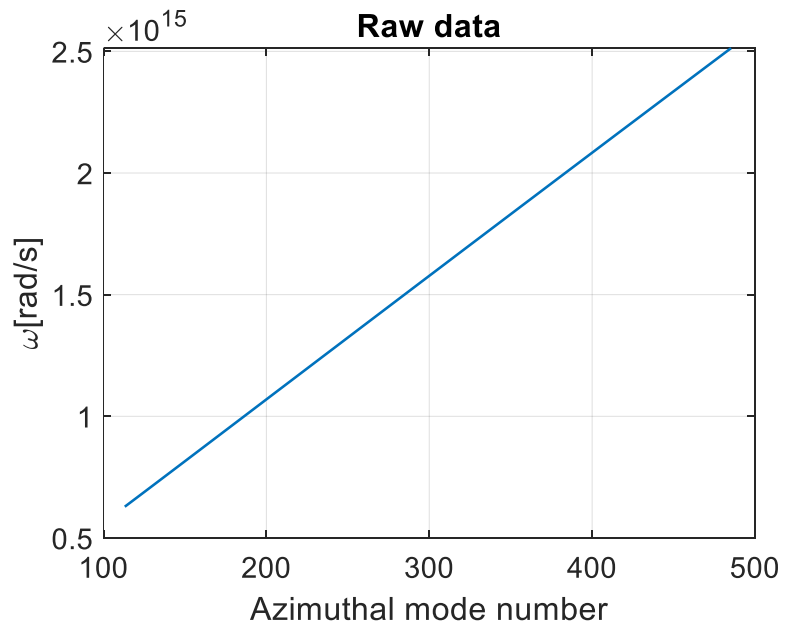
R_m R_r



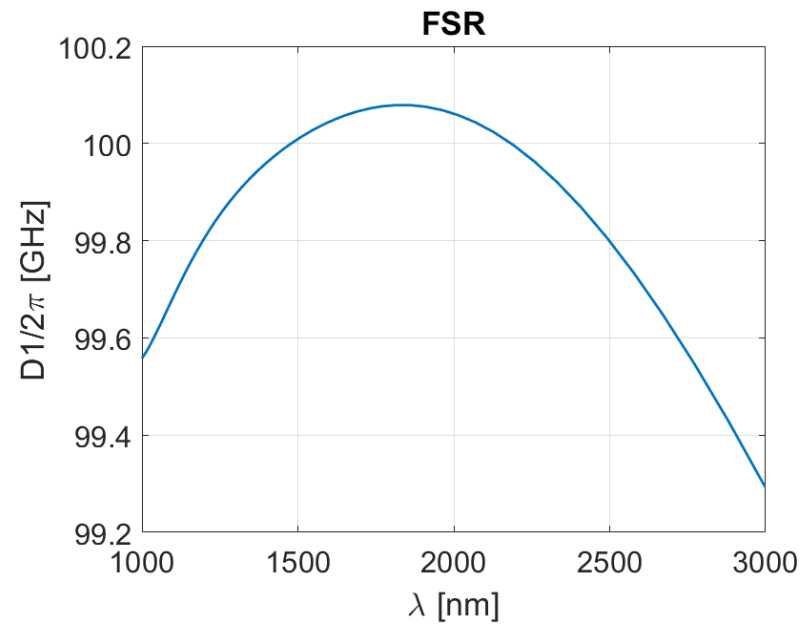
$$2\pi R n = m\lambda$$

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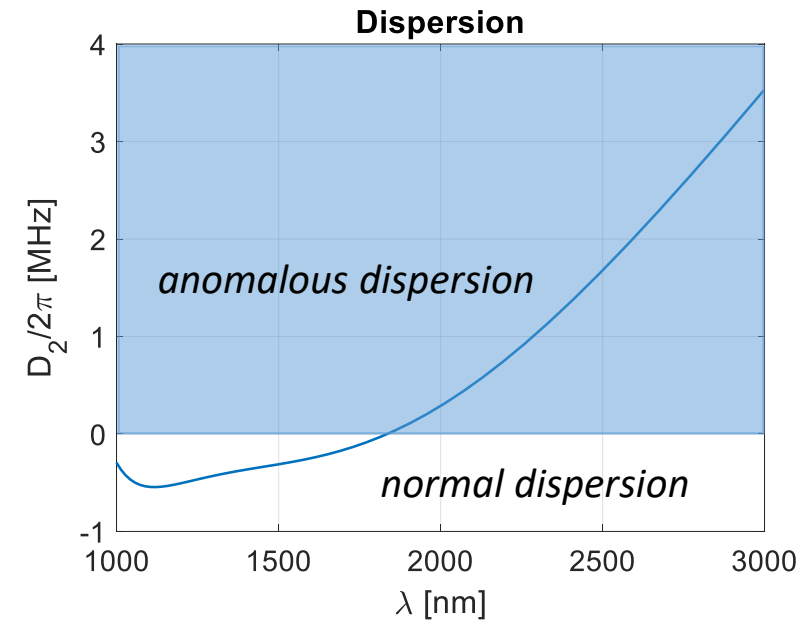
Dispersion analysis



$$\omega = \omega(m) \text{ [rad/s]}$$



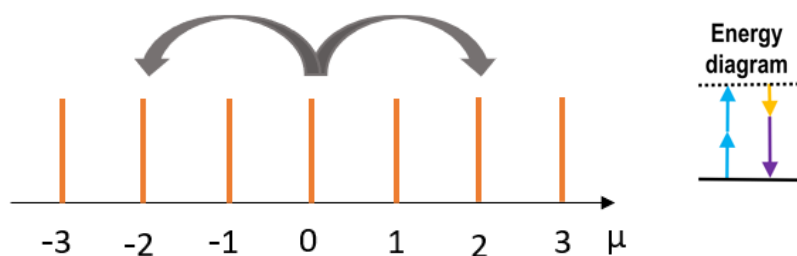
$$FSR = \frac{\partial \omega}{\partial m} \text{ [Hz]}$$



$$D_2 = \frac{\partial^2 \omega}{\partial m^2} \text{ [Hz]}$$

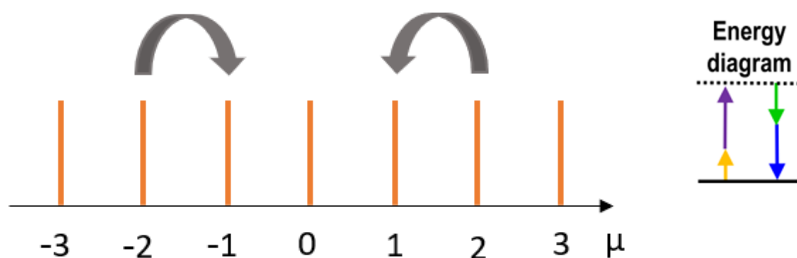
Four-wave mixing

(a) Degenerative Four-wave mixing

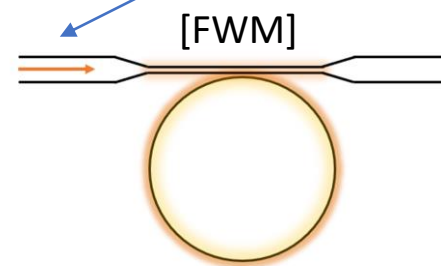


$$2\hbar\omega_0 \rightarrow \hbar\omega_{-2} + \hbar\omega_2$$

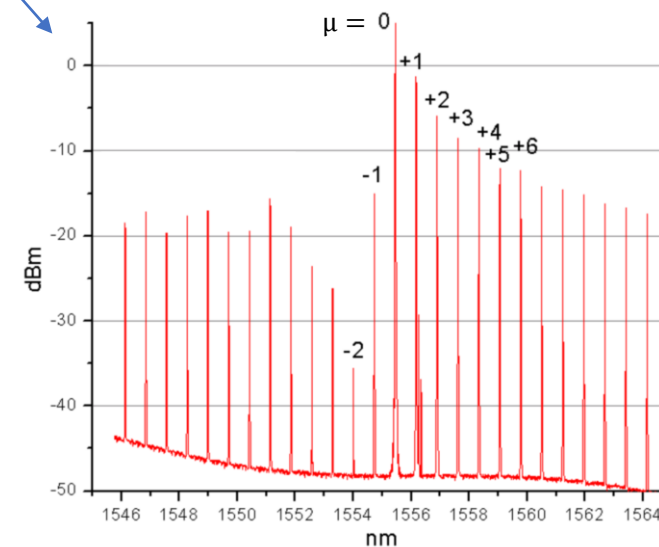
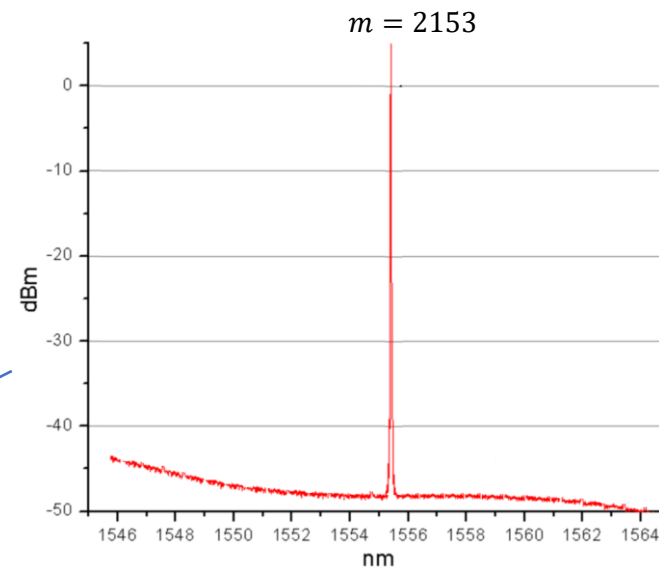
(b) Non degenerative Four-wave mixing



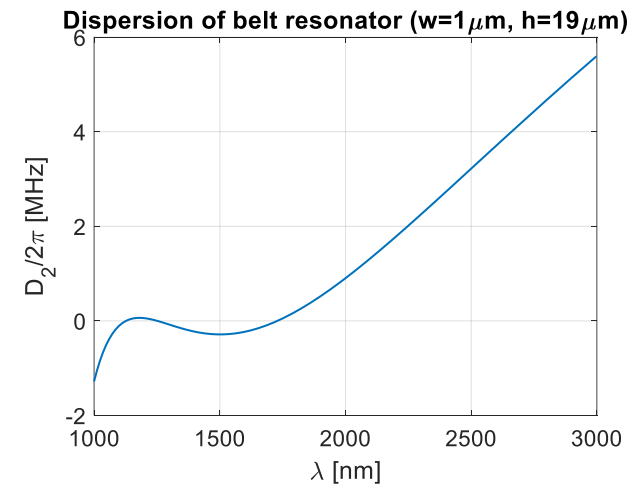
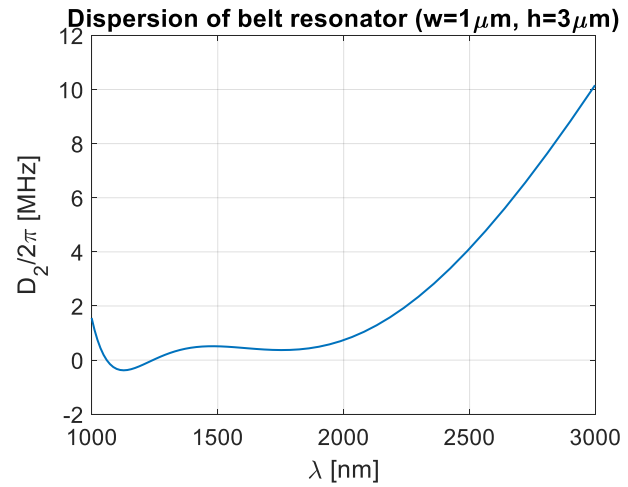
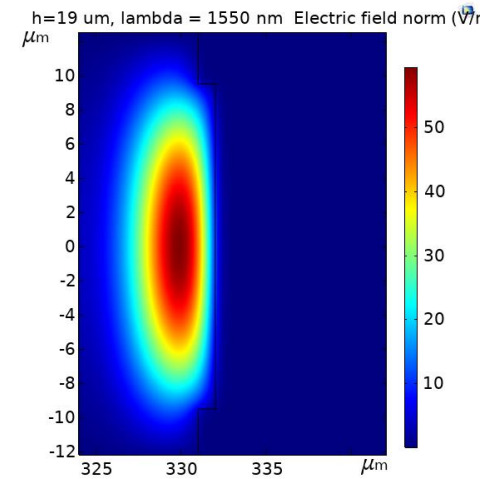
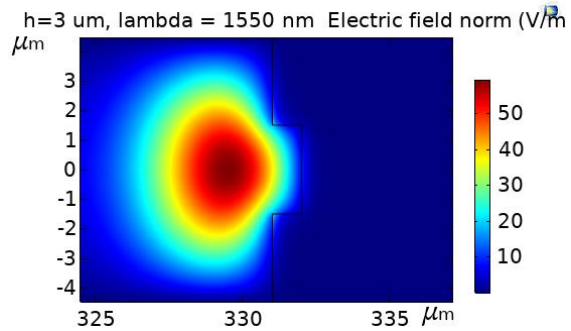
$$\hbar\omega_{-2} + \hbar\omega_2 \rightarrow \hbar\omega_{-1} + \hbar\omega_1$$



$$2\pi Rn = m\lambda$$

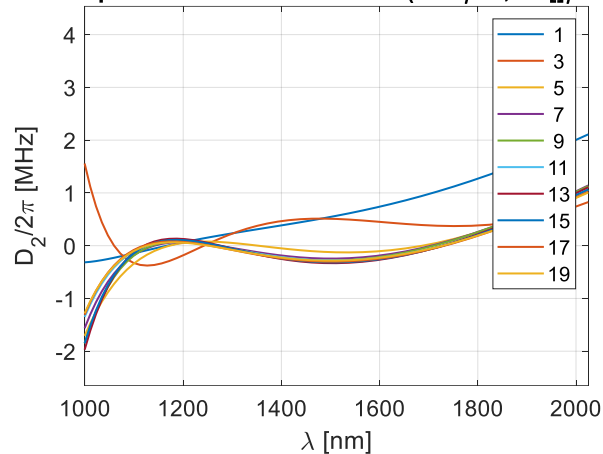


Dispersion engineering

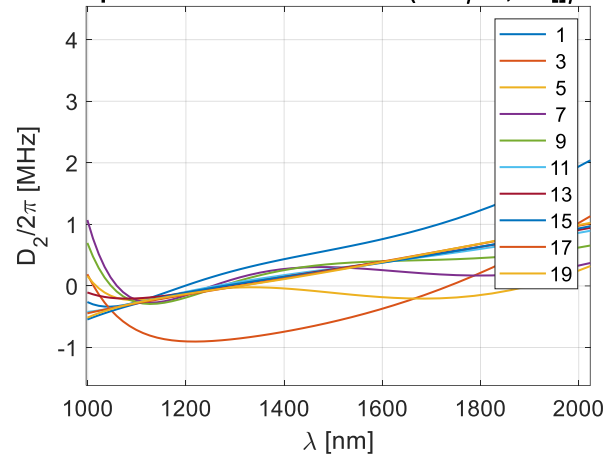


Dispersion engineering

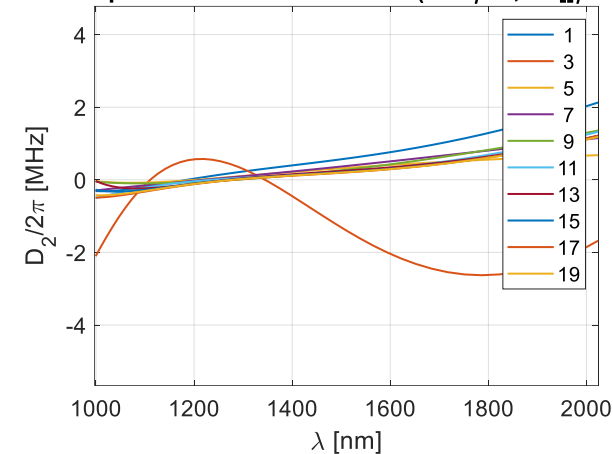
Dispersion of belt resonator ($w=1\mu\text{m}$, $h=[]\mu\text{m}$)



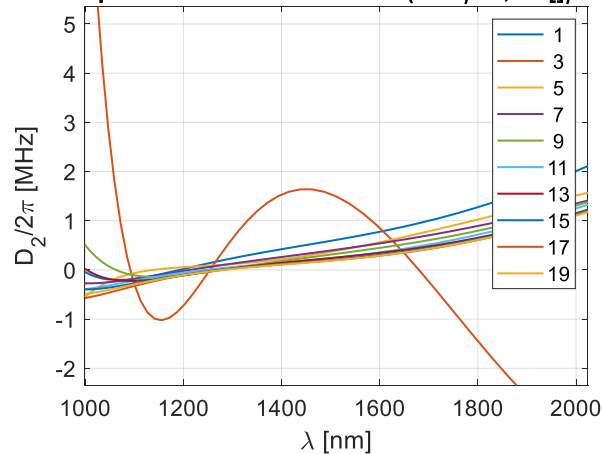
Dispersion of belt resonator ($w=3\mu\text{m}$, $h=[]\mu\text{m}$)



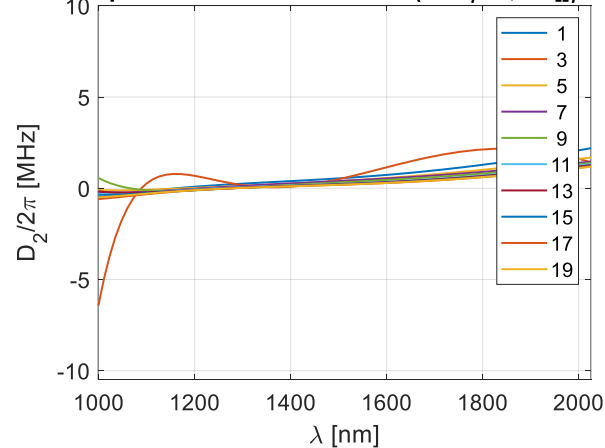
Dispersion of belt resonator ($w=5\mu\text{m}$, $h=[]\mu\text{m}$)



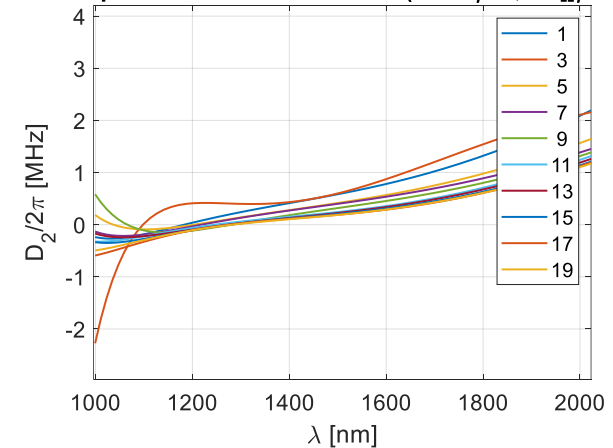
Dispersion of belt resonator ($w=7\mu\text{m}$, $h=[]\mu\text{m}$)



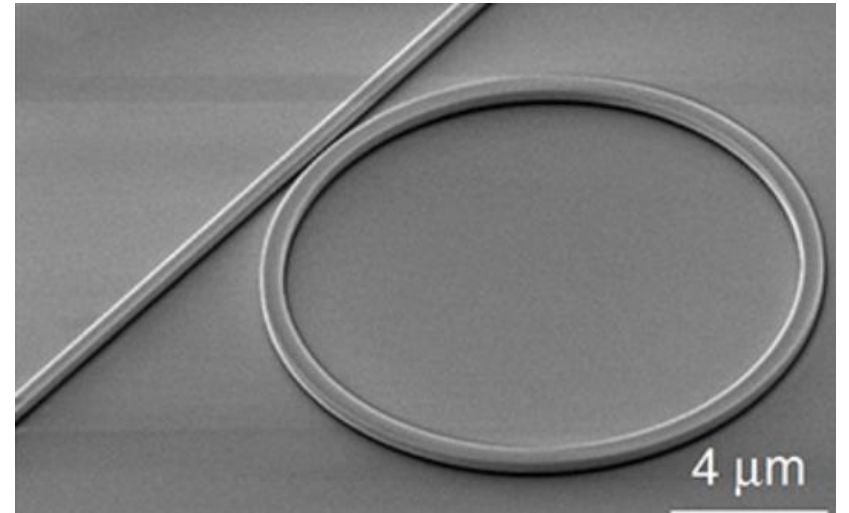
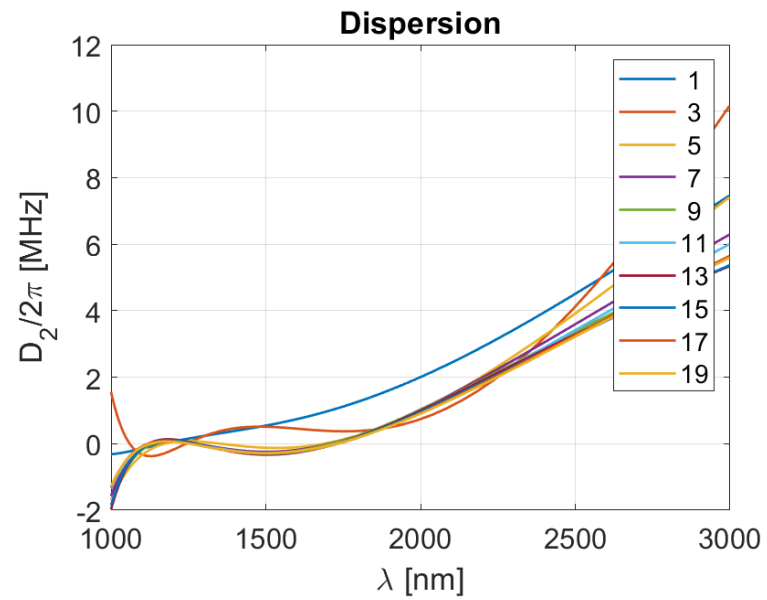
Dispersion of belt resonator ($w=9\mu\text{m}$, $h=[]\mu\text{m}$)



Dispersion of belt resonator ($w=11\mu\text{m}$, $h=[]\mu\text{m}$)



Why do dispersion engineering?



Thank you for attention!

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