Whispering Gallery Mode resonators based on Silicon nanocrystal in a Silicon Oxide host.

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High quality monolithic resonators such as micro-disks, rings and toroids are triggering an intensive and rapidly evolving research. In such structures, due to total internal reflection, the light propagates in azimuthally simmetric mode, called whispering-gallery modes (WGM). Optically passive microdisks, based on transparent materials with negligible absorption losses, lead to extremely high quality factors (Q $\sim 10^6$ to 10^{10}), offering applications in spectroscopy and sensing. On the contrary, optically active resonator systems, such as III-V semiconductor quantum dot microdisk lasers, report active Qs of 10^3-10^4 in the visible and near infrared wavelength range.

The recent challenges in silicon photonics towards using nanocrystalline Si (nc-Si) as an integrated light source have boosted an intensive research in the last decade. The aim of this research is to exploit the Si-nc as emitters embedded in a WGM microdisk active resonator, enabling an easy energy charge of the cavity due to the strong photoluminescence of the Si quantum dots in the visible range.

This particulat system offers various possibilities of investigation both in terms of fundamental and applied physics.
Rather appealing is the possibility of change the respective weights of radiative and material losses inside the cavity: this can be done inducing stress in the structure by depositing materials with slightly different lattice constant, leading to so-called "kylix (chalice)" microresonators. Controlling the degree of stress is possible to realize an effective tuning of the "Q-factor" band, mantaining about the same Free Spectral Range of a classical, flat microdisk.
Finally, we will show room temperature measurements of Purcell enhancement, demonstrating that our resonators are good platform for Cavity Quantum ElectroDynamics (CQED) experiments in weak coupling regime.