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Nanoparticle Detection and Refractive Index Sensing in Whispering Gallery Mode Microresonators

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Whispering gallery mode resonators (WGMRs) are microscopic structures with an axisymmetric cross-section. In WGMRs, light is confined for a long time in a small volume by total internal reflection from inner boundary of cavity. WGMRs have shown the lowest intrinsic losses among optical microresonators. Thanks to these low losses, light-matter interaction considerably enhanced in WGMRs. This property makes them suitable for a wide range of applications such as nanoparticle detection and ultra-sensitive refractive index sensing.

There are many different WGM geometries in use. The most commonly used WGM microresonators for sensing are microspheres. A less explored geometry is the microbottle resonator (MBR) which has some advantages over microsphere, such as better control over the coupling using tapered optical fibers. The recently introduced hollow MBRs provide exceptional opportunities for optofluidics microresonator sensing.

In this talk, I give an introduction about whispering gallery modes and the importance of low concentration detection. Then I present my PhD thesis results, in which I studied label-free detection of single nanoparticles theoretically and refractive index sensing in the hollow bottle microresonators and microspheres experimentally.