

Department of Physics & Astronomy

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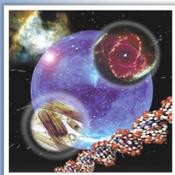
Time: 3:15 p.m. -4:15 p.m.

BB 3.04.18

Optical Approaches for Chemical and Biological Sensing: Whispering Gallery Modes and Stimulated Raman Scattering

This presentation will discuss two methods of chemical and biological sensing: whispering gallery modes (WGMs) and stimulated Raman scattering (SRS). WGMs arise from total internal reflection of light at the internal surface of a high index microsphere within a low index medium and produce an evanescent field that extends into the surrounding medium. The WGMs produce multiple narrow spectral peaks that shift position with variations in the local index of refraction sampled by the evanescent tail of the WGMs. To excite these WGMs, we embed quantum dots (QDs) in the periphery of polystyrene microspheres to serve as local light sources. By coupling emission from the QDs to the WGMs, the sensors can be excited and interrogated remotely and, by monitoring the shift of multiple resonance modes, may provide higher sensitivity and accuracy compared with similar techniques. The high refractometric sensitivity of the WGMs offers potential for trace detection of molecules adsorbed onto or bound to the microsphere sensor elements.

Stimulated Raman scattering (SRS) is a powerful tool for obtaining background-free chemical information about a material without extrinsic labeling. Background-free spectra are particularly important in the fingerprint region (~ 800 to 1800 cm^{-1}) where peaks are narrow, closely spaced, and may be in abundance for a particular chemical. We demonstrate a method for obtaining SRS spectra using a single femtosecond laser oscillator. A photonic crystal fiber is used to create a supercontinuum to provide a range of Stokes shifts from ~ 300 to 3400 cm^{-1} . This SRS approach provides for collection capabilities that are easily modified between obtaining broadband spectra and single-frequency images.

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