An Optical-Cavity Microbalance for Surface-Plasmon-Resonance Bio-Chemical Sensing

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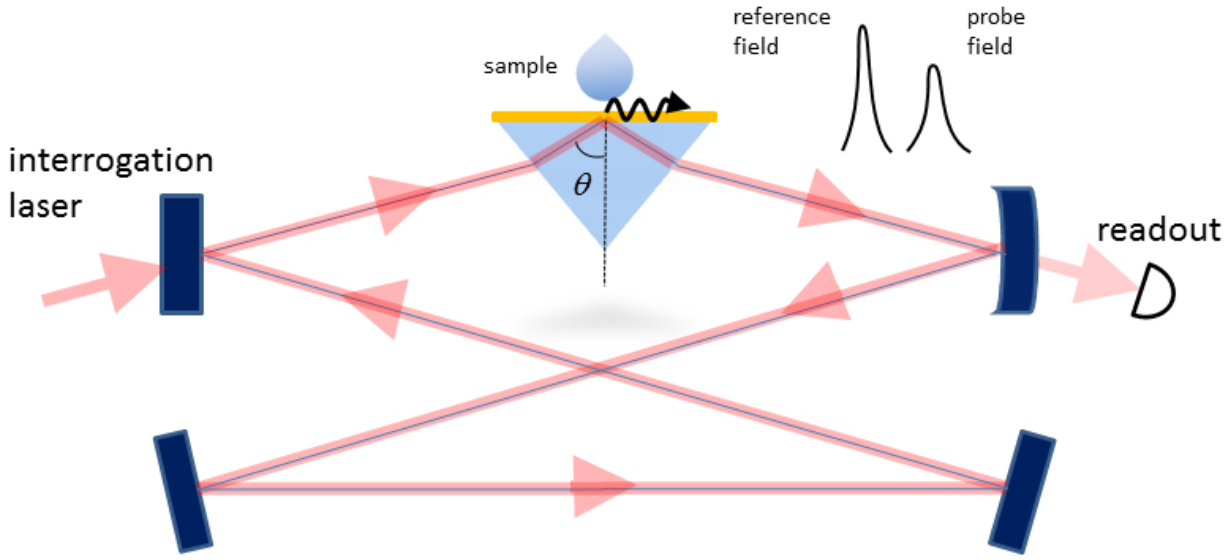
Surface Plasmon Resonance (SPR) based sensors play a leading role in chemical and biochemical sensing due to their high sensitivity and the ability to implement real-time label-free, selective sensing protocols. Plasma waves can be coupled at the interface between a metal layer and a dielectric medium under given condition of incidence angle, polarization, wavelength and permittivity. Due to their short penetration depth, near the interface, plasma waves probe directly the surface chemical activity. Although the best techniques can ultimately measure refractive-index changes down to 10-7RIU, detection of low weight molecules (< 400Da) at low concentrations (pM) or low-copy number heavier targets is still challenging. Many efforts have been spent in pushing SPR detection limit further, through improved chip engineering and/or immobilization protocols. The fundamental limiting factor is still represented by the intrinsic light source and detector noise. In this work, we present experimental investigations on new methods for SPR sensors interrogation. The starting point is the integration of the sensing element, mounted on a prism (Kretschmann configuration), as an intermediate mirror of an optical resonator. This setup allows readout of the surface-plasmon coupling changes from new physical observables related to the intracavity radiation, including time, polarization and resonant frequency[1,2]. The work has focused on noise-immune interrogation methodologies based on differential measurements on the orthogonally-polarized SPR fields that are simultaneously resonating in the cavity.



References
[1] Giorgini, A., et al. "Surface plasmon resonance optical cavity enhanced refractive index sensing." Optics letters 38.11 (2013): 1951-1953.
[2] Giorgini, A., et al. "Cavity-enhanced surface-plasmon resonance sensing: modeling and performance." Measurement Science and Technology 25.1 (2014): 015205.