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On-chip Metamaterials for Ultra-sensitive Spectroscopy and Identification of Biomolecules

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Infrared absorption spectroscopy is a unique tool for identifying and characterizing molecular bonds. For most organic and inorganic molecules (such as proteins, chemical toxins and gases), vibrational and rotational modes are spectroscopically accessible within the mid-infrared (mid-IR; 3-20 μm) regime of the electromagnetic spectrum. Characteristic vibrational modes are associated with unique IR absorption spectral bands that are bond-specific. Because of that, the IR wavelength range is also known as "finger print" region. However, because of the Beer-Lambert law, its sensitivity has been limited to perform analytical/functional studies on small samples often available from biological specimens. In this talk we will describe how we use plasmonic metametrials to overcome these challenges. We will introduce tailoring of the resonances to selectively address fingerprint signatures of proteins. We will also describe novel designs and fabrication methods to exploit extreme near-field enhancements in small gaps for vibrational signal enhancements.

In collaboration with In collaboration with Ronen Adato, Serap Aksu, Alp Artar, Arif Cetin, and Boston University.