



Fundamentals of molecular spectroscopy

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Abstract

The mid-infrared (mid-IR) spectral range from around 2 to 20 μm is crucial for a host of leading optical technologies, since it contains atmospheric transmission windows (e.g., 3-5 μm and 8-12 μm) relevant for thermal imaging and astronomy as well as the characteristic absorption bands of many biochemical molecules in the so-called fingerprint region (2.5-15 μm), which are essential for spectroscopic sensing.

In this lecture, I will first introduce the fundamentals of molecular spectroscopy with a focus on three core areas: (a) The physical principles of vibrational modes in a broad range of molecules, (b) the unique biochemical information that can be extracted from IR absorption spectra, as well as (c) the function of modern IR spectroscopy devices. In a second part, I will highlight recent high-impact applications of IR spectroscopy from the life sciences, covering diverse research areas including the real-time monitoring of enzymatic reactions and the investigation of protein phosphorylation in living cells.