

Broadband Coherent Raman Microscopy: need for speed and spectral coverage

Interviene

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Abstract

Raman microscopy can provide detailed functional information on tissues and cells. It is a non-contact, non-invasive and non-destructive method, as it does not require any sample labelling/staining. Every component of a biological specimen is characterized by a vibrational spectrum that reflects its molecular structure and provides an endogenous and chemically specific signature that can be exploited for its identification.

Spontaneous Raman suffers from very weak scattering cross section (10-12 orders of magnitude lower than absorption), making it difficult to probe dilute species and image dynamical processes in living organisms. **Coherent Raman Scattering** (CRS), setting up a coherent superposition of vibrational responses, enhances the Raman signal by many orders of magnitude, enabling high imaging speeds.

Current state-of-the-art CRS, however, provides **limited chemical selectivity**, delivering information at just a single vibrational frequency. This is not sufficient to distinguish the different components within complex heterogeneous systems, such as cells and tissues, with spectrally overlapped chemical species. Another unsolved issue is the **narrow spectral coverage**, typically restricted to the high wavenumber window (2700-3600 cm^{-1}) displaying a high density of vibrational oscillators. Few reports exist on probing the more informative fingerprint region ($\approx 600\text{-}1800 \text{ cm}^{-1}$), due to the weaker Raman signatures. Possible solutions to overcome these issues will be presented, illustrating a roadmap to realize a **broadband coherent Raman microscope** for real-time characterization of cells and tissue states with the most detailed functional information. This requires parallel advances in different fields: femtosecond/picosecond fiber laser development, multi-channel detectors, light-matter interaction, data acquisition, handling and manipulation and information retrieval.

Seminario

Venerdì 13 marzo 2015

Sala Riunioni, ore 12.00

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