

Hilton B. de Aguiar¹

¹Laboratoire Kastler Brossel, ENS-Université PSL, CNRS, Sorbonne Université, Collège de France, 24 rue Lhomond, 75005 Paris, France

h.aguiar@lkb.ens.fr

From High-Speed to Ultrafast Sensing Enabled by (Spontaneous) Compressive Raman Technology

Spontaneous Raman scattering provides label-free molecular contrast with inexpensive optics, yet its weak cross-section and traditional detection architecture have long confined spectral imaging to millisecond pixel dwell times, far from the video-rate regime needed in several applications. Compressive Raman microspectroscopy overcomes this limitation by compressing the hyperspectrum at the acquisition stage exploiting a programmable spectrometer to code information in the measured spectrum with single-photon sensitivity [1,2,3]. I will review this computational microscopy framework and show how we recently enabled video-rate-compatible imaging speeds [4] and present its latest developments toward ultrafast spectral imaging with a simple and inexpensive setup.

References

- [1] P. Réfrégier, C. Scotté, H. B. de Aguiar, et al., J. Opt. Soc. Am. A 35 (2018) 125.
- [2] F. Soldevila, J. Dong, E. Tajahuerce, S. Gigan, H. B. de Aguiar, Optica 6 (2019) 341.
- [3] B. Sturm, F. Soldevila, E. Tajahuerce, et al., ACS Photonics 6 (2019) 1409.
- [4] C. Gentner, S. Burri, E. Charbon, C. Bruschini, H. B. de Aguiar, Opt. Lett. 49 (2024) 6573.

Figures

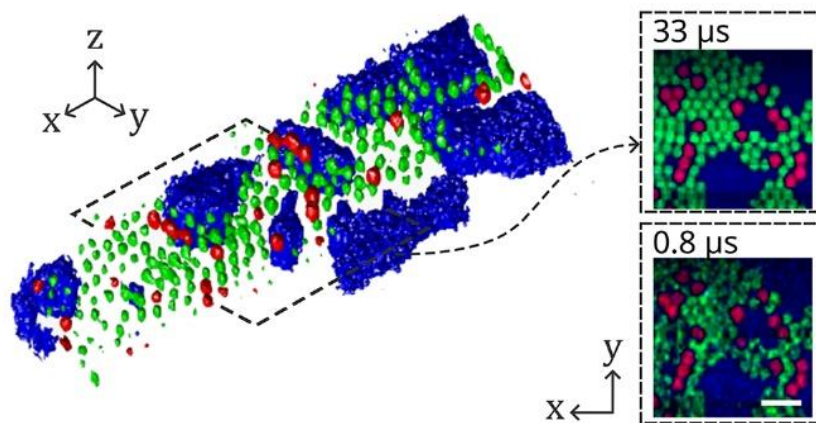


Figure 1: Parallelized compressive Raman imaging of polystyrene (red) and PMMA (green) beads in water (blue): 3D image at 33 μ s (left) and slices at 33 μ s and 0.8 μ s effective pixel dwell time (right). Scale bar: 20 μ m. Adapted from [4].