

Post-doc/PhD positions on high-speed computational Raman imaging of bacteria

Background. Raman microscopy is a label-free chemically-selective technique with superb spatial resolution. Even though technological developments in Raman microscopy are impressive in terms of speed [1], there is still the issue of overwhelmingly large data sets generated, an aspect that fundamentally precludes video-rate microspectroscopy. In recent years, we developed a set of new computational microscopy tools exploiting paradigm shifts in signal processing (Compressive Sensing) in order to achieve chemically selective imaging at high speeds. We coin this set of methods compressive Raman microspectroscopy [2]: we design an experiment which retrieves the same outcome as in traditional Raman imaging, however performing considerably fewer measurements. For that purpose, we develop novel spectrometers layout using fast digital micromirror devices (DMD). Exploiting this emerging technology, we have shown record acquisition speeds and sensitivity in various biomedical systems. Recent outcomes allowed us to reach video-rate speeds for imaging in spontaneous Raman imaging [3].

As a next step, we will further increase the acquisition speed to tackle motile biological systems. In particular, we aim at imaging biofilm formation in bacteria biofilms. The successful applicant will work on a new spectrometer layout, in order to increase the dynamic range for imaging species at low and high concentration levels with compressive Raman imaging. This would allow to observe the formation of bacterial biofilms [4] in real time.

Candidates profile. Various PhD/Post-doc positions are open. Regardless of the position applied, the candidate must be ambitious and highly motivated, have a particular taste for optics and interdisciplinary research. Regarding the PhD position, he/she should have a degree in Physics or closely related area. Regarding the Post-Doc position, he/she should have a PhD in Physics, Physical Chemistry, or closely related area (e.g. Signal Processing, Materials Science), be highly independent (both at the organizational and scientific level) and aspiring supervisor. Programming skills are compulsory. Candidates from Life Sciences are also encouraged to apply. Previous experience with Raman spectroscopy is a plus.

Offer details. The Post-Doc is for 2-year contract (with possibility of renewal). The PhD position is for 3 years. Both positions include all social benefits in France (health care, pension system, unemployment aid etc.). Post-doc gross salary will vary depending on the experience. The position is to start as soon as possible, but will stay open until suitable candidates are found.

How to apply. Both positions are part of the activities of the [Complex Media Optics Lab](#), at the Laboratoire Kastler-Brossel, ENS, Paris. Applicants interested within these research activities should submit CV, a brief motivation statement, and at least one contact detail for requesting a recommendation letter, to the point of contact: Hilton Barbosa de Aguiar, h.aguiar@lkb.ens.fr.

References

- [1] J.-X. Cheng and X. S. Xie, *Science* 350(6264), (2015)
- [2] P. Berto *et al*, *Opt. Lett.* 42(9), 1696 (2017); C. Scotté *et al*, *Anal. Chem.* 90(12), 7197–7203 (2018); F. Soldevila *et al*, *Optica* 6(3), 341 (2019); B. Sturm *et al*, *ACS Photonics* 6(6), 1409–1415 (2019)
- [3] Gentner *et al*, *arXiv:2301.07709*
- [4] P. Thomen *et al*, *Soft Matter* 16(2), 494–504 (2020); P. Thomen *et al*, *PLoS One* 12(4), e0175197 (2017)