

Wide-field coherent anti-Stokes Raman scattering microscopy using random illuminations. CARS-RIM

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Coherent Raman microscopy is the method of choice for real-time, label-free characterisation of the chemical composition of biomedical samples. The current implementation relies on scanning two tightly focused laser beams across the sample, which often results in sample damage and is slow over large fields of view. The few existing wide-field techniques have limited lateral resolution and do not provide axial sectioning. To overcome these practical limitations, we have developed a robust nonlinear wide-field microscope that combines random illumination microscopy (RIM) with coherent anti-Stokes Raman scattering (CARS) contrast. We will show theoretically how CARS-RIM can provide super-resolved reconstructions and optical sectioning of the sample from the second-order statistics of multiple images acquired under different specular illuminations. We will then experimentally demonstrate the performance of CARS-RIM on a variety of samples such as beads, unstained human breast tissue and a mixture of chemical compounds.

Reference : Fantuzzi, Eric & Heuke, Sandro & Labouesse, Simon & Gudavičius, Dominykas & Bartels, Randy & Sentenac, Anne & Rigneault, Hervé. (2023). Wide-field coherent anti-Stokes Raman scattering microscopy using random illuminations. *Nature Photonics*. 17. 1-8. [10.1038/s41566-023-01294-x](https://doi.org/10.1038/s41566-023-01294-x).