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Spontaneous vs. Coherent Raman Scattering: A Comparison Under Biologically Relevant Conditions SARAH R. NICHOLS, BRANDON R. BACHLER, MENG CUI, Dept. of Physics, University of Michigan, JENNIFER P. OGILVIE, Dept. of Physics and Biophysics, University of Michigan — Coherent anti-Stokes Raman scattering (CARS) microscopy has become an active field of research due to the intrinsic molecular contrast it provides. Coherent signals such as CARS have been shown to be orders of magnitude larger than those obtained with spontaneous Raman scattering under certain conditions. However, under conditions appropriate for biological imaging, there has been a lack of systematic comparison between spontaneous and coherent Raman scattering signals. We perform such a comparison imaging study on polystyrene beads and find comparable signal levels for coherent Stokes Raman scattering (CSRS) and spontaneous Stokes scattering, contrary to many reports in the CARS microscopy literature. We present calculations to support the measurements, and discuss the implications for biological imaging. The advantages provided by coherent methods are mitigated in biological samples by the low incident power ($\sim 1\text{mW}$), short interaction lengths, and low concentrations. The nature of the sample and the necessary imaging conditions must be considered when choosing between coherent and spontaneous Raman methods.

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