QUANTITATIVE INFORMATION EXTRACTION IN COHERENT ANTI-STOKES RAMAN SCATTERING (CARS) SPECTROSCOPY: ERROR ELIMINATION IN NORMALIZED EXPERIMENTAL SPECTRA

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Fast access to the quantitative information is an ultimate goal in coherent anti-Stokes Raman scattering (CARS) microspectroscopy [1]. The phase retrieval algorithms [2, 3] are widely used to transform the tangled Fano-type line-shaped CARS spectra into the chemically specific and quantitatively usable form of the imaginary part of nonlinear susceptibility. However, the modulation error-function, originating from experimental artefacts, obstructs the accurate phase retrieval from the experimental normalized CARS spectrum. One recent proposal to solve this problem consists of the estimation of an error-phase function to the retrieved phase spectrum accompanied by its inverse Hilbert transform resulting in an estimation of an amplitude rescaling function necessary for a quantitative Raman line shape interpretation [4]. In order to circumvent the additional assumptions and the accumulation of additional errors made in each estimation step, in this work, we show how the modulation error function can be estimated and separated in the first place, thus, avoiding the need for subsequent phase and amplitude corrections in retrievable Raman line-shape. The Wavelet prism (WP) algorithm [5] is used to decompose the logarithm of the normalized experimental spectrum into constituents and subtracting those, which do not possess the analytical features. The corrected spectra were shown to produce error-free phases. This approach was tested on experimental CARS data, demonstrating the consistency between the received Raman line-shape spectra and the spontaneous Raman spectra.

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