

Random illumination nonlinear microscopy

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We revisit wide field multiphoton imaging using speckle field illuminations. We will address first the 2Photon random illumination microscopy technique (2P-RIM) that is able to perform wide field 2-Photon images with $(1/z)$ optical sectioning and improved resolution as compared to a 2P confocal microscope. Then I will address the implementation of random illumination wide field microscopy in coherent Raman. In the proposed scheme we break the CARS coherence using fast varying pump speckle illuminations while keeping static the Stokes speckle. Acquiring a large number of Stokes images enables dynamic speckle illumination (DSI) and random illumination microscopy (RIM). We show that the first one enables quasi-confocal axial sectioning $(1/z)$ while the second one, through post-processing, can retrieve a superior image contrast, noise level and spatial resolution as an important step towards robust nonlinear super-resolution CARS microscopy. Finally I will show our first results to retrieve the phase of an object using random illumination, this opens the route towards SHG phase imaging but also CARS phase imaging that is directly related to the Raman signature.