

Sparse scanning structured illumination microscopy for 3D visualization of thick samples

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Optical three-dimensional (3D) microscopic imaging thick samples is of great importance in many fields, especially in biology. In this talk, sparse scanning structured illumination microscopy (SS-SIM) will be presented, which provides super-resolution, optically sectioned images for thick samples.

In SS-SIM, structured patterns of different orientations and different phase shifts are generated by resonantly scanning a focused light and modulating its intensity sinusoidally. Three-dimensional optical sectioning is realized by phase-shifting operation of the structured illumination. Furthermore, a pixel-reassignment-based algorithm (PR-SIM) is proposed for super-resolution reconstruction of SS-SIM. Compared to frequency domain based algorithms (FDAs), PR-SIM is much faster and more immune to fringe distortion in that it processes the raw images locally, in the spatial domain. The reconstruction speed of PR-SIM can be enhanced by skipping empty regions in the image, and further enhanced by employing GPU-base parallel calculation. Eventually, super-resolution and optical-sectioned fluorescence imaging with a penetration depth of ~300 micrometers has been performed, implying a great potential for deep tissue imaging.



Short Bio:

Peng Gao, studied Physics and received his Ph.D. at the Xi'an Institute of Optics and Precision Mechanics (XIOPM), CAS, in 2011. He was a "Humboldt Fellow" in University Stuttgart (2012-2014) and Marie-Curie Fellow (IEF) in KIT (2014-2018). He is currently a PI at Xidian University and the director of Super-resolution Optical Microscopy Engineering Research Center at Xi'

an city. His group focuses on developing super-resolution optical microscopy and quantitative phase microscopy techniques for biology. So far, he has

authored over 100 peer-reviewed papers published in journals, including *Nat. Photonics*, *Adv. Opt. Photon.* Some of his publications were highlighted by tens of international media, such as *Science Daily*, *Physics News*, and so on. He is currently one of the associate editors of *Optics and Laser Technology (OLT)* and *Frontiers in Physics*,