

## **High speed biological imaging at and beyond the diffraction limit**

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**Keywords:** Structured illumination microscopy, light sheet microscopy, adaptive optics, neurodevelopment, developmental biology

I will discuss our efforts to improve structured illumination microscopy (SIM) and light-sheet microscopy. SIM doubles the spatial resolution of light microscopy, requiring lower light intensities and acquisition times than other super-resolution techniques. I will present SIM implementations that enable resolution doubling in live volumes  $> 10\text{-}20\times$  thicker than possible with conventional SIM, as well as hardware modifications that enable effectively ‘instant’ SIM imaging at rates  $10\text{-}100\times$  faster than other SIM. New applications of instant SIM, including combination with total internal reflection (TIRF) and with adaptive optics will also be discussed.

The second half of the talk will focus on the development of inverted selective plane illumination microscopy (iSPIM), and subsequent application to the noninvasive study of neurodevelopment in nematodes. I will discuss progress that quadruples the axial resolution of iSPIM by utilizing a second specimen view, thus enabling imaging with isotropic spatial resolution (dual-view iSPIM, or diSPIM). Newer multiview results with more objectives and more views, further improving spatial resolution, will also be shown. Applications of these technologies will be presented, including computational methods for untwisting worm embryos.