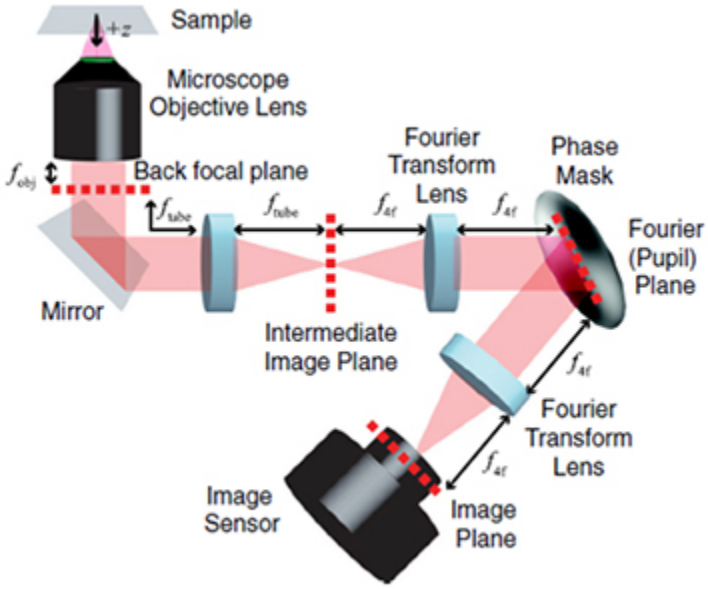
Docket #: S15-038

Tetrapod Phase Mask Microscopy

Stanford researchers at the Moerner Lab have designed a family of point spread functions (PSFs), the Tetrapod PSFs, for high precision three-dimensional position measurement of individual particle positions over a large, customizable depth range in optical microscopy. These designs have a tunable depth range up to an unprecedented 20 ?m, which is over 7x larger than current state of the art.

As proof-of-concept, the team performed flow profiling in a microfluidic channel and showed scan-free tracking of single quantum-dot-labeled phospholipid molecules on the surface of living, thick mammalian cells. This invention is primarily aimed at researchers in the life sciences.

Figure



Phase Mask can be simply implemented with a tilted light-sheet microscope (LSM)

Stage of Research

- **Proof of concept** Demonstrated experimentally the applicability of these Tetrapod PSFs in micro-fluidic flow profiling over a 20um z range, and in tracking under noisy biological conditions.

Applications

- **Thick tissue super-resolution microscopy:**
  - Sub-wavelength imaging
  - Simultaneous multiple particle tracking
- Microfluidics - flow profiling
- Simple, tunable depth of field microscopy
- Bio-film (thick sample) imaging
- Background reduction – light sheet microscopy
- Microscope calibration (for depth induced aberrations)

Advantages

- New phase masks with **extremely large depth range up to 20?m** (about 7 times larger than current state of the art)
- Allow simple **z range tunability**
- **Easily tailored and optimized** to a required depth range.
- **Simple implementation** with a tilted light-sheet microscope (LSM)

Publications

- U.S. Published Patent Application 20160301915, "APPARATUSES AND METHODS FOR THREE-DIMENSIONAL IMAGING OF AN OBJECT".
- Shechtman, Yoav, Lucien E. Weiss, Adam S. Backer, Steffen J. Sahl, and W. E. Moerner. "Precise 3D scan-free multiple-particle tracking over large axial ranges with Tetrapod point spread functions." Nano letters (2015).
- Anna-Karin Gustavsson, Petar N. Petrov, Maurice Y. Lee, Yoav Shechtman, W. E. Moerner. "3D Single-Molecule Super-Resolution Microscopy With A Tilted Light Sheet". The Preprint Server for Biology.

Patents

- Published Application: 20160301915
- Issued: 10,187,626 (USA)
- Issued: 10,638,112 (USA)

Innovators

- Yoav Shechtman
- William Moerner
- Lucien Weiss
- Steffen Sahl

Licensing Contact

Evan Elder

Senior Licensing Associate

Email