Docket #: S16-332

Light sheet fluorescence microscopy using high speed structured and pivoting illumination

Researchers at the Solgaard Lab have demonstrated that light sheet fluorescence microscopy (LSFM) with structured and pivoting illumination enables fast image acquisition and improved image quality. A one-dimensional spatial light phase modulator, grating light valve (GLV), is used to control the illumination profile at high speed (up to several hundred kHz) in LSFM. Structured and pivoting illumination can be switched without any optical or mechanical adjustments providing a more stable measurement.
To demonstrate the features of the system, the researchers imaged fluorescent beads and biological samples, successfully obtaining optically sectioned images with higher contrast using structured illumination and with reduced shadowing effects using pivoting illumination.

Figure

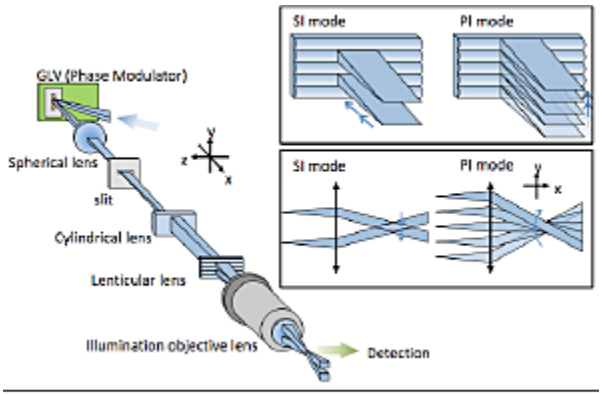


Figure description - Schematic of the optical setup. The light path is in the case of the SI mode.

Stage of Research

- Proof of concept completed

- Obtained high quality images on mouse muscle tissue samples

Applications

- **3D imaging of biological tissue such as:**
  - 3D tumor spheroid observation
  - Assay for pathology
  - Visualization of brain activity
  - Study of embryonic development

Advantages

- Fast image acquisition
- High image contrast with less artifact
- Less photo-bleaching and photo toxicity
- Allows large sample observation with shorter acquisition time
- Incorporates grating light valve (GLV) as a faster switching device, overcoming speed limitation in existing LSFM
- Configuration is flexible, requiring no optical or mechanical adjustments when switching between imaging modalities

Publications

- Ryosuke Itoh, Joseph Russell Landry, Stephen Sanborn Hamann, and Olav Solgaard, "Light sheet fluorescence microscopy using high-speed structured and pivoting illumination," Opt. Lett. 41, 5015-5018 (2016)

Patents

- Published Application: 20180088305
- Issued: 10,310,246 (USA)

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