Imaging Interferometric Microscopy

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(STC Ref. 2007-073 and 2008-039)

Background

Optical or light microscopes use visible light and a set of lenses to acquire and magnify images. The diffraction limits to optical resolution were established over a century ago; the maximum spatial frequency allowed by an optical system is 2NA/λ, giving a resolution limit of λ/4NA, where λ is the optical wavelength and NA is the numerical aperture of the optical system. The quest for optical super-resolution has long been a topic of great scientific and practical interest. Researchers from the University of New Mexico have developed a technology that is based on structural (complex refractive index) contrast, and extends resolution to linear systems limits of λ/4*n* where *n* is the refractive index of a substrate/superstrate that can be as high as ~5; chemical information can be accessed using coherent anti-Stokes Raman (CARS) processes.

Technology Breakthrough

Imaging interferometric microscopy (IIM) is a synthetic aperture approach which uses a low numerical aperture microscope to collect multiple coherent partial images covering different spatial-frequency regions through off-axis illumination and interferometric optics. The partial images are then assembled to form a composite image covering a larger region of frequency space than is available from the low-NA lens.

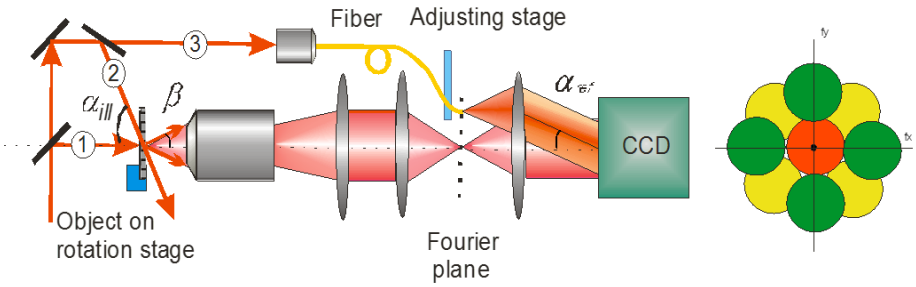
There are several possible implementations of IIM for improving resolution, ultimately using a thin semiconductor layer with a refractive index of ~ 5, IIM will extend microscopy to unprecedented λ/4n ~ λ/20 ~ 25 nm levels, usually associated with electron microscopy. IIM is applicable to existing microscopes with all of the additional optics confined to the front of the microscope objective.

Key Advantages

- *Revolutionary advance in optical microscopy - replaces expensive lenses*
- *Adaptable to current technology such as standard transmission/reflection microscopy configurations*
- *Extends resolution beyond high numerical aperture techniques*
- *Removes phase contrast problem for viewing biological samples*
- *Pushes to the linear system limits of optical microscopy*
- *Chemical identification through CARS techniques*

Intellectual Property

Issued U.S. Patent 7,978,403
Issued U.S. Patent 8,203,782
Issued U.S. Patent 8,115,992
Issued U.S. Patent 8,526,105
Issued U.S. Patent 9,239,455



Imaging interferometric nanoscopy: optical arrangement and frequency space coverage

Contact

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