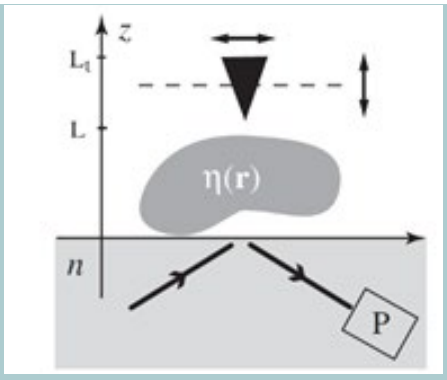
PENN CENTER FOR INNOVATION



Method for near-field optical imaging

Phase-less optical near-field tomography with sub-wavelength resolution in three dimensions

Inventor

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STATE OF DEVELOPMENT

Feasibility testing; generation of tomographic image slices

INTELLECTUAL PROPERTY

USSN 8,695,109

REFERENCE MEDIA

Govyadinov AA et al. Phys. Rev. Lett., 2009, 103, 213901.

DESIRED PARTNERSHIP

- License

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Technology

This invention embodies a system and method for optically imaging a sample at nanometer resolution using a position-controlled light scattered in the near field of a sample. The extinguished power from an incident field, which illuminates both the sample and the controlled scatterer, is measured and mathematically reconstructed to form a three-dimensional image of the sample. More specifically, there are two modalities of the proposed method that are numerically simulated. The first modality measures the extinguished power for a set of fixed tip positions distributed volumetrically above the sample. The second modality is specifically designed to work with an atomic force microscope (AFM) operating in tapping mode, where the tip oscillates in the vertical dimension; the data are collected as the oscillating tip scans the volume above the sample. Most current optical imaging methods can acquire only 2D projection images, whereas this technique can provide a tomographic 3D image of the object of interest.

Advantages

- 3D tomography at sub-wavelength resolution of thin samples
- Can be integrated with existing near-field microscopy equipment

Applications

- High-resolution tomography
- Atomic force microscopy
- Study nanostructures and molecular structures
- Inspection of semiconductor devices
- Assessment of biological samples

Image Caption: Experiment illustration from Govyadinov et al, 2009. The tip scatters the incident evanescent field and modifies the interference pattern in the sample, which has dielectric susceptibility η(r). The power P extinguished from the illuminating field is measured as the tip is scanned on a 3D grid in the near zone of the sample.