Interferometry for Life

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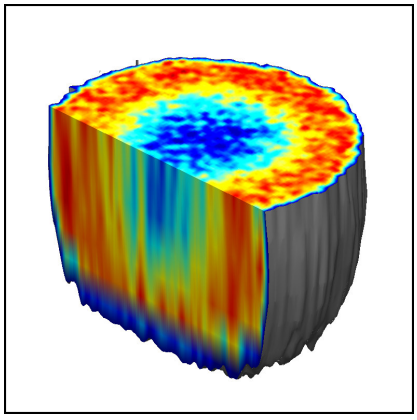
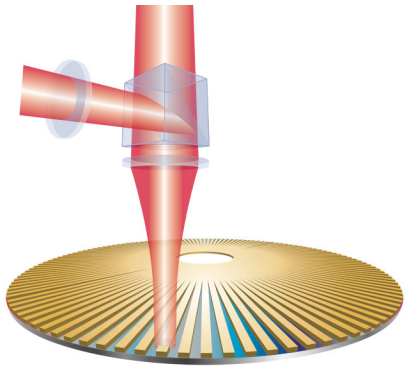
Laser interferometry has unparalleled sensitivity to average displacements smaller than a picometer (the radius of a proton) under ideal conditions. Yet biological systems and environments, with their strong heterogeneity and unruly animation, seem hardly amenable to interferometric investigation. Nonetheless, laser interferometry is providing important insights into biological physics. In this talk, I will describe two complementary applications of biological interferometry. The first is a multi-mode biomedical imaging approach to study the effects of anti-cancer drugs on living tumour tissue. The living motion inside cells and tissues is the intrinsic (endogenous) contrast agent that allows functional imaging "deep" inside strongly scattering tissue. The second application uses single-mode laser scanning to detect molecular films on the surfaces of spinning discs. The "BioCD" platform has the potential to measure many of the important blood proteins in a single medical assay. Each of these applications relies on the physics of dynamic light scattering under heterodyne or homodyne conditions with high sensitivity to optical phase modulation.



Motility-contrast Imaging



The BioCD