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# Bioimaging of exo - or endocytosis with interference microscopic imaging

We integrate a rigorous scattering model for cellular exo- or endocytosis, taking into account lipid-induced optical anisotropy, with a rigorous model of Differential Interference Contrast (DIC) image formation (Figures 1&2). Hereby we provide a theoretical proof for the first time to a well-known experimental fact in DIC microscopy, namely, that a bias of 1/100 of the wavelength of light is optimal for the observation of intracellular components.

Some implementations of interference microscopy imaging use digital holographic measurements of complex scattered fields to reconstruct three-dimensional refractive index maps of weakly scattering, semi-transparent objects, frequently encountered in biological investigations. Reconstruction occurs through application of the object scattering potential which assumes an isotropic refractive index throughout the object. Here, we demonstrate that this assumption can in some circumstances be invalid for biological imaging due to the presence of lipid-induced optical anisotropy. We show that the nanoscale organization of lipids in the observation of cellular endocytosis with polarized light induces a significant change in far field scattering. We obtain this result by presenting a general solution to Maxwell's equations describing light scattering of core-shell particles near an isotropic substrate covered with an anisotropic thin film. By applying our solution to study light scattering by a lipid vesicle near a lipid bilayer, whereby the lipids are represented through a biaxial optical model. We conclude that effective amounts of lipid-induced optical anisotropy significantly alter far-field optical scattering in respect to an equivalent optical model that neglects the presence of optical anisotropy.

## Figures

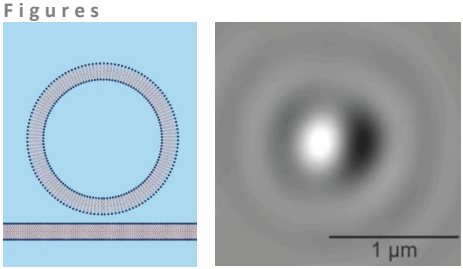


**Figure 1:** DIC microscopy modelling of a lipid vesicle approaching a lipid bilayer.

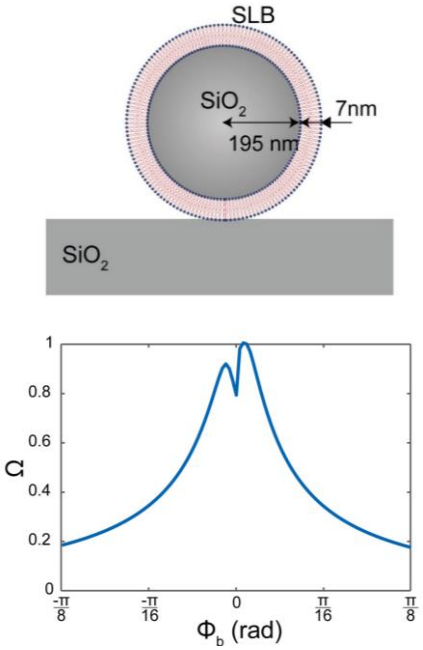


**Figure 2:** Influence of DIC bias on the contrast achieved for a nanoparticle surrounded by a lipid bilayer