Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Nanoscale Membrane Curvature detected by Polarized Localization Microscopy CHRISTOPHER KELLY, ABIR MAAROUF, XINXIN WOODWARD, Wayne State University — Nanoscale membrane curvature is a necessary component of countless cellular processes. Here we present Polarized Localization Microscopy (PLM), a super-resolution optical imaging technique that enables the detection of nanoscale membrane curvature with order-of-magnitude improvements over comparable optical techniques. PLM combines the advantages of polarized total internal reflection fluorescence microscopy and fluorescence localization microscopy to reveal single-fluorophore locations and orientations without reducing localization precision by point spread function manipulation. PLM resolved nanoscale membrane curvature of a supported lipid bilayer draped over polystyrene nanoparticles on a glass coverslip, thus creating a model membrane with coexisting flat and curved regions and membrane radii of curvature as small as 20 nm. Further, PLM provides single-molecule trajectories and the aggregation of curvature-inducing proteins with super-resolution to reveal the correlated effects of membrane curvature, dynamics, and molecular sorting. For example, cholera toxin subunit B has been observed to induce nanoscale membrane budding and concentrate at the bud neck. PLM reveals a previously hidden and critical information of membrane topology.

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Date submitted: 06 Nov 2015 Electronic form version 1.4