Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Three-Dimensional Imaging of Polymeric Nanostructures by Molecular Switching in Far Field Fluorescence Microscopy CHAITANYA ULLAL, ROMAN SCHMIDT, ALEXANDER EGNER, BENJAMIN HARKE, JAN KELLER, Max Planck Institute for Biophysical Chemistry, DOUGLAS ADAMSON, University of Connecticut, LARS KASTRUP, STEFAN HELL, Max Planck Institute for Biophysical Chemistry — Morphological studies of self assembled polymeric structures with length scales of interest below 100 nm have typically been conducted either by scattering-based techniques or electron and scanning probe microscopes. These techniques, however, do not provide easy access to truly 3D-structural information. In contrast, Far-field optical methods retain the advantage of simultaneously providing local, dynamic, and *in situ* three-dimensional (3D) structural information. The diffraction limited resolution of its standard variants, however, restricts the minimum feature size that can be examined. We exploit molecular transitions of the fluorophores to circumvent the diffraction barrier and demonstrate the power of emerging far-field fluorescence microscopy with nanoscale resolution for the study of self-assembly. We simultaneously improve both the lateral (x,y) and the axial (z) resolution of stimulated emission depletion (STED) microscopy. The increased 3D resolution is used to unambiguously map the morphology of self assembled polymeric nanostructures in a facile manner.

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Date submitted: 19 Nov 2008 Electronic form version 1.4