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Polarization engineering of collected fluorescence for improved determination of the molecular emission dipole orientation in single-molecule spectroscopy ZBIGNIEW SIKORSKI, LLOYD DAVIS, University of Tennessee Space Institute — In some single-molecule spectroscopy experiments we would like to target our measurements to molecules of specific orientation. We propose and numerically investigate phase and polarization engineering of the collected fluorescence field in a high numerical aperture confocal microscope to enable unambiguous detection of a specific molecule orientation. If the molecule is located within a fraction of a wavelength from a planar interface, such as a microscope cover-glass, then emission occurs preferentially into the interface at angles above the critical angle. This so-called forbidden light is in general elliptically polarized. Moreover, the field varies in phase and polarization across the pupil of the lens, no matter what the orientation of the emitting dipole may be. However, spatial light modulators may be used to transform the phase and polarization of the field so that for a selected molecule orientation the polarization becomes spatially homogeneous and linear. A polarizing beam splitter and two detectors are used to determine the polarization of the field. For the selected molecule emission dipole orientation, all photons will pass to one detector, while for other orientations photons will be statistically divided between the detectors.

Lloyd Davis
University of Tennessee Space Institute

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