Polarization sensitive single particle tracking and super-resolution microscopy in the near-infrared for brain imaging

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Single wall carbon nanotubes (CNTs) are bright emitters in the SWIR domain which propelled them as unique nanostructures for applications in bioimaging or quantum sources. In particular, many applications are based on the possibility to control or detect CNT emission at the single molecule level. Interestingly, the emission dipole of CNTs is mostly linear along their backbones. By leveraging this characteristic, we can gain rotational insights by examining the polarization of the fluorescence emitted by CNTs. Theoretical computations of radially and azimuthally polarized images of CNTs in various orientations reveal diverse intensities and shapes. Based on this, we constructed a radially and azimuthally polarization (raPol) microscope (Figure 1) to obtain two polarized images of CNTs. Through analysis and comparison of these two images, we can extract two-dimensional positional and directional information. We will utilize this system to analyze the rotational diffusion of CNTs.

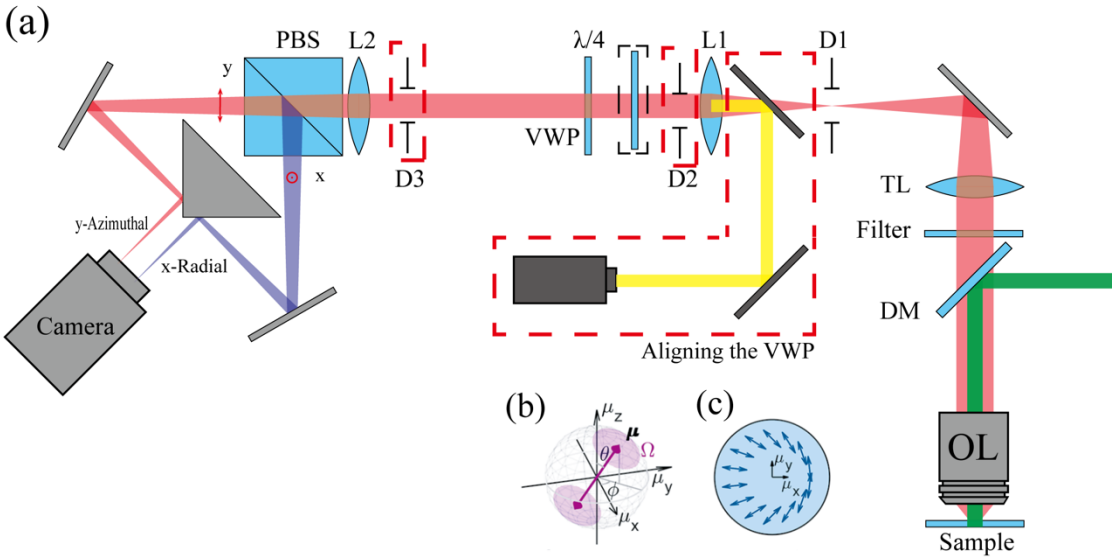

Figure 1 (a) Imaging system schematic.(b) The rotational diffusion of a fluorescent molecule is described using a unit vector μ. (c) A vortex (half) waveplate (VWP).