

Application of Spiral Phase Plate in Surface Plasmon Microscopy

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In surface plasmon coupled emission microscopy, surface plasmons on a gold coated glass cover slip are excited by a *p*-polarized plane wave and used to excite a fluorescent sample [1]. It is known that the plasmon coupled fluorescence emission is highly directional and radially polarized. The effect of such an imaging modality is that after focusing the emission light through the imaging lens onto a CCD camera, the point spread function becomes a donut shape which has been shown theoretically and experimentally in [2]. In order to remedy the distorted point spread function, a spiral phase plate is placed in the back focal plane of the objective along the infinity corrected detection path of the microscope as shown in figure 1.

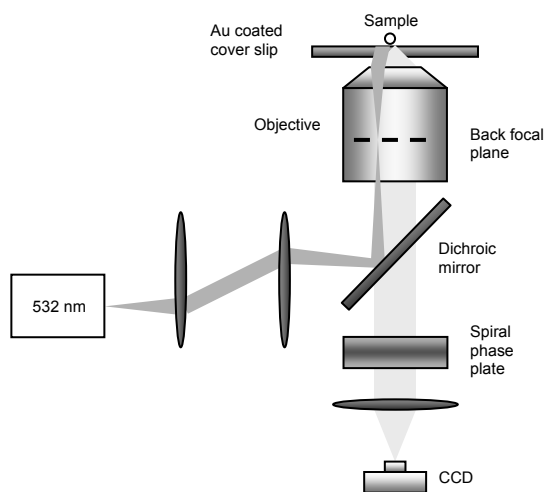


Figure 1

The effect of the spiral phase plate is to superimpose a helical wavefront to the emission light in order to modify the polarization properties at the back focal plane. In effect, the spiral phase plate causes polarization vectors within each meridional plane to be in phase, thereby resulting in constructive interference at the focal point when refocused by an imaging lens. As a consequence, the point spread function is engineered from a donut shape to an Airy-disk like structure which is preferable for imaging. Such an application is also useful in confocal microscopy [3].

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