FLUORESCENCE EMISSION DIFFERENCE MICROSCOPY BY SUPER-OSCILLATION EXCITATION

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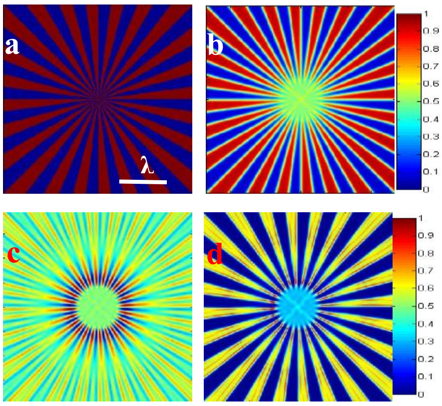
1. PRINCIPLE

The super-oscillation hotspot produced by the radially polarized Laguerre-Gaussian (LG) light beam can improve the resolution of fluorescence imaging [1].

We introduce a new fluorescence emission difference (FED) microscopy [2] excited by the super-oscillation solid and donut spots. Through the super-oscillation breaking the diffraction limit, the spatial resolution of FED microscopy is enhanced. Firstly, the super-oscillation spots are analyzed by vectorial diffraction theory. Then, the effective point spread functions (PSFs) in two confocal imaging modes, the effects of pinhole and subtractive factor on the FED imaging are simulated and analyzed. Finally, the simulation results show that, the FED microscopy excited by super-oscillation spots can realize super resolution. Especially, when the pinhole is small, the contrast of reconstructed image is dependent on the subtractive factor. However, when the pinhole and subtractive factor are both large, multi-view Richardson-Lucy (RL) deconvolution method can decrease the effect of side lobes.

2.SIMULATION RESULTS



Here, we simulate the imaging of a radiation stripe structure [Fig.1(a)] in the FED microscopy. The FED image [Fig.1(b)] with pinhole diameter D=0.5AU (1AU means Airy unite) and subtractive factor C=0.3 almost keeps the same construction as the object under the resolution limit. When D=1.5AU and C=0.9, the FED image [Fig.1(c)] the image takes on some aberration in the low contrast area. However, the reconstructed image [Fig.1(d)] by multi-view RL deconvolution method has better image quality.

Figure 1: The object and images produced by the FED microscopy excited by super-oscillation spots. (a) the object; (b) the image with D=0.5AU and C=0.3; (b) the image with D=1.5AU and C=0,9; (d) the image (c) reconstructed by multi-view RL deconvolution method.

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