

Improved Resolution Fourier Ptychography Scheme Using Oil-Filled Dome-Shaped LED array

Mahdieh Gholami Mayani¹, Nazabat Hussain¹, Dag Breiby², and Muhammad Akram³

¹University of South-Eastern Norway - Campus Vestfold

²Norwegian University of Science and Technology

³University of South-Eastern Norway

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Abstract

Utilizing angular-varied illumination in Fourier Ptychography (FP), the resolution of optical microscopes can be increased and the phase of the sample can also be recovered while maintaining a wide field-of-view. In this work, an FP microscopy imaging setup is demonstrated using a 10X 0.28NA objective lens and a dome-shaped LED array illuminator. By increasing the refractive index of the medium between the sample and light sources using oil filled dome, a synthetic system NA of 0.68 is achieved using only 37 LEDs. The measured resolution of 345 nm at a wavelength of 530 nm closely matches the theoretical prediction. Furthermore, the results of the oil-medium illumination are compared to free-space illumination. The oil immersion on the illumination side effectively enhances the illumination NA as compared to air and reduces the need for far off-axis LEDs. The result is high-resolution FP imaging with relatively fewer LEDs providing both short capture and reconstruction times.

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