SUPER-RESOLVING LIGHT FIELDS IN MICROSCOPY: DEPTH FROM DISPARITY

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Abstract:
Single molecule localisation microscopy (SMLM) has opened a new window for imaging fluorescently labelled biological specimens [1]. Despite the success of 3D single molecule imaging there is a need to image larger volumes [2]. Here we demonstrate, through simulation and experiment, the potential of Single Molecule Light Field Microscopy (SMLFM) for extended depth-of-field super-resolution imaging [3].

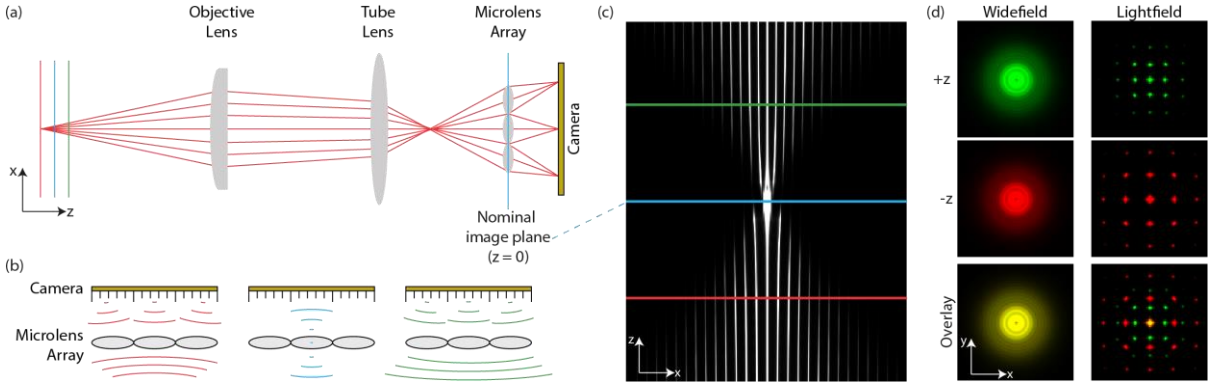

Figure 1: Wavefronts recorded in light field microscopes encode the three-dimensional location of point emitters.

The implementation of LFM employs a refractive microlens array which offers advantages including: large spectral bandwidth, low component cost and high photon throughput. We have developed an algorithm capable of estimating the three-dimensional position of a point source from a light field with sub-wavelength precision. The viability of this method was verified by observing fluorescent microbeads freely diffusing in solution and through detection of single molecule photobleaching events in immunolabeled cells.

References:

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