GENERATION OF LARGE FIELD-OF-VIEW LIGHT SHEET BY SCANNING MULTIPLE FOCUSED SHIFTED GAUSSIAN BEAMS

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KEY WORDS: Light-sheet microscopy, Laser beam shaping, 3D microscopy.

Light-sheet fluorescence microscopy (LSFM) facilitates high temporal-spatial resolution, low photobleaching and phototoxicity for long-term volumetric imaging by using orthogonal illumination and detection pathway [1, 2]. Light-sheets usually generated by focusing an optical beam with a cylindrical lens or rapidly scanning a focused Gaussian beam perpendicular to the propagation direction [3]. The field-of-view (FOV) of LSFM can be extended by reducing the excitation NA at the cost of increasing light-sheet thickness. Here, we propose to generate a large FOV thin light-sheet by scanning multiple focused shifted Gaussian beams. The positions of the beam waists of the multiple Gaussian beams are shifted in both axial and lateral directions in an optimized arranged pattern, and then scanned along the direction perpendicular to the propagation axis to form the light-sheet. An improved fast algorithm based on the Gerchberg-Saxton iterative algorithm is employed to calculate the computer-generated-hologram (CGH) for generating the multiple focused shifted Gaussian beams, which is addressed on a phase-only spatial light modulator. Both simulation and experiment are performed to verify the effectiveness of the proposed method.

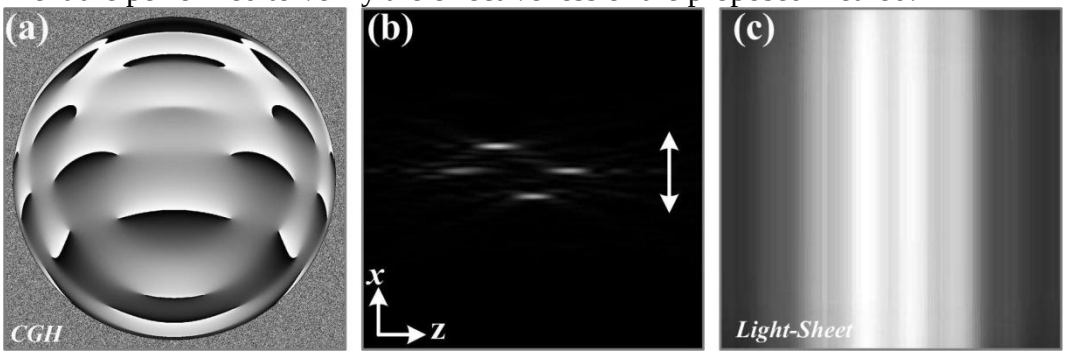

Figure 1: (a) Computer-Generated-Hologram (CGH) for generating the multiple focused shifted Gaussian beams. (b) Intensity distribution of multiple focused shifted Gaussian beams in axial plane. (c) Light-sheet generated by scanning the multiple focused shifted Gaussian beams.

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