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3D Light-driven Micro-tools with Nano-probes

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At DTU Fotonik in Denmark, we have previously proposed and demonstrated microtargeted light-delivery [1] and the opto-mechanical capabilities of so-called wave-guided optical wave-guides (WOWs) [2]. As the microscopic WOWs are optically trapped and maneuvered in 3D-space, it is important to maintain efficient light-coupling through these free-standing waveguides within their operating volume [3]. We propose the use of dynamic diffractive techniques to create focal spots that will track and couple to the WOWs during full volume operation and with six-degrees-of-freedom. This is done by using a Hamamatsu Photonics LCoS-SLM to encode the necessary diffractive phase patterns to generate the multiple and dynamic coupling spots. The method is initially tested for a single WOW and we have demonstrated dynamic tracking and coupling for both lateral and axial displacements on our proprietary Biophotonics Workstation.

References

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3. D. Palima and J. Glückstad, "Gearing up for optical microrobotics: micromanipulation and actuation of synthetic microstructures by optical forces," Laser Photon. Rev. 7, 478–494 (2013).