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# Towards All-optical Light Robotics

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In the Programmable Phase Optics (PPO) group at DTU Fotonik we pioneered the new and emerging research area of so-called Light Robotics including the new and disruptive 3D-printed micro-tools coined Wave-guided Optical Waveguides that can be real-time optically manipulated and “remote-controlled” in a volume with six-degrees-of-freedom. To be exploring the full potential of this new drone-like 3D light robotics approach in challenging microscopic geometries requires a versatile and real-time reconfigurable light coupling that can dynamically track a plurality of “light robots” in 3D to ensure continuous optimal light coupling on the fly. Our latest developments in this new and exciting area will be reviewed in this invited presentation.

- [1] Glückstad, J., "Optical manipulation: Sculpting the object," *Nature Photonics* 5, 7–8 (2011).
- [2] Palima, D., Glückstad, J., “Gearing up for optical microrobotics: micromanipulation and actuation of synthetic microstructures by optical forces,” *Laser and Photon. Rev.* 7, 478–494 (2013).
- [3] Wu, C.W., Palima, D., Novitsky, A; Ding, W., Gao, D., Shukovsky, S., and Glückstad, J., *Nanophotonics* 3, 181-201 (2014).
- [4] Rodrigo, P. J., Gammelgaard, L., Bøggild, P., Perch-Nielsen, I., Glückstad, J., “Actuation of microfabricated tools using multiple GPC-based counterpropagating-beam traps,” *Opt. Express* 13, 6899–6904 (2005).
- [5] Rodrigo, P. J., Kelemen, L., Palima, D., Alonzo, C., Ormos, P., Glückstad, J., “Optical microassembly platform for constructing reconfigurable microenvironments for biomedical studies,” *Opt. Express* 17, 6578–6583 (2009).
- [6] Villangca, M., Casey, D., Glückstad, J., "Optically-controlled platforms for single- and sub-cellular transfection and surgery," *Biophysical Reviews* 7, 379-390 (2015).
- [7] Palima, D., Bañas, A., Vizsnyiczai, G., Kelemen, L., Ormos, P., Glückstad, J., “Wave-guided optical waveguides,” *Opt. Express* 20, 2004–2014 (2012).
- [8] Villangca, M., Bañas, A., Palima, D., Glückstad, J., “Dynamic diffraction-limited light-coupling of 3D-maneuvered wave-guided optical waveguides,” *Opt. Express* 22, 17880–17889 (2014).
- [9] Villangca, M., Bañas, A., Palima, D., Glückstad, J. "Generalized phase contrast-enhanced diffractive coupling to light-driven microtools," *Opt. Engineering* 54, 111308 (2015).
- [10] Palima, D., Bañas, A., Vizsnyiczai, G., Kelemen, L., Aabo, T., Ormos, P., and Glückstad, J., "Optical forces through guided light deflections," *Opt. Express* 21, 581-593 (2013).
- [11] Villangca, M., Bañas, A., Palima, D., Glückstad, J., *Light: Science & Applications*, Nature Publishing Group, *in print* (2016)