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Adaptive Optics for Dynamic Optical Traps

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Poster Presentation P25

ADAPTIVE OPTICS FOR DYNAMIC OPTICAL TRAPS

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Holographic Optical Tweezers were first demonstrated by Fournier, *et al*[1], using a commercial hologram. A complete recipe for making *tailored*, planar arrays of optical traps using Diffractive Optical Elements (DOE) was laid out in the IWU – Univ. of Chicago collaboration, "Computer-Generated Holographic Optical Tweezer Arrays."[2] While this original "HOT" recipe dealt with two-dimensional arrays, several generalizations have been demonstrated which extend the basic method to three-dimensions[3, 4]. That said, three-dimensional studies remain in their infancy. Furthermore, even for lower-dimensional arrays, both errors in the DOE and aberrations in the optical system can compromise trap performance. We will report on our progress in using a Programmable Phase Modulator (an optically addressable DOE) to provide a reconfigurable, self-calibrating DOE, and to correct for aberrations. Our approach involves modifying the "HOT" algorithm in order to provide a feedback mechanism between the input optical array and output optical array.

[1]   J.-M. R. Fournier, M. M. Burns, and J. A. Golovchenko, Proceedings SPIE — The International Society for Optical Engineering **2406**, 101 (1995).

[2]   E. R. Dufresne, G. C. Spalding, M. T. Dearing, et al., Review of Scientific Instruments **72**, 1810 (2001).

[3]   H. Melville, G. F. Milne, G. C. Spalding, et al., Optics Express (2003).

[4]   J. Leach, G. Sinclair, P. Jordan, et al., Optics Express **12**, 220 (2004).