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Quantitative Phase Microscopy of Cellular Fluctuations Modulated by Optogenetic Stimulation BISHORUP BANJARA, NELSON CARDENAS, SAMARENDRA MOHANTY, University of Texas at Arlington — Significant progress has been made in the application of optogenetic stimulation as a means to modulate and control cellular functions within chemically-identical groups of cells. High resolution imaging can detect subtle morphological (shape/refractive index) changes in cells subsequent to optogenetic stimulation. Invasive topographical measurement methods such as mainstream AFM and other scanning probe techniques suffer from low temporal resolution and restricted field of view, resulting in reduced throughput. QPM, integrated with optogenetic stimulation incorporates a wide-field, label-free, non-invasive optical imaging technique for all optical stimulation and detection with high spatial and temporal resolution. We dynamically monitored phase of cells, sensitized with and without ChR2, using quantitative phase microscopy with and without light stimulation. The variation of phase in optogenetically stimulated cells (expressing ChR2) was found to be higher than that of the control cells. We report that our method could potentially evaluate effectiveness of various opsins and stimulation parameters including cellular function under different physiological surroundings via spatially-modulated optogenetic stimulation and wide-field quantitative phase imaging.

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