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Fast holographic scattering compensation for deep tissue biological imaging

Scattering in biological tissues is a major barrier for in-vivo optical imaging. It can be corrected by shaping the excitation wavefront to redirect power into a single point in the imaging plane but fast, non-invasive determination of the required wavefront compensation remains challenging. Here, we introduce a new scattering compensation algorithm, termed DASH, in which holographic phase stepping interferometry enables new phase information to be updated after each measurement. This enables rapid improvement of the wavefront correction, achieving 10x higher signal enhancement at this stage than the previous state-of-the-art. Using DASH, we demonstrate two-photon fluorescence imaging of microglia cells in mouse hippocampal tissue down to a depth of 530.

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