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Light wavefront engineering to modulate neuronal activity at cell resolution

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Light wavefront engineering represents a valuable tool to control the electric field intensity distribution at the sample volume by modulating the phase and/or the amplitude of the light wavefront in a conjugated space. For imaging purposes, this approach has been traditionally adopted on one side to compensate for optical aberrations due to the sample or the medium so as to improve either the resolution or the signal-to-noise ratio; on the other side, to achieve particular illumination spatial profiles so as to increase the background rejection. Along with novel applications for imaging, in the last ten years wavefront engineering has become a fundamental tool in neuroscience research when light is used not to record but also to control the neuronal circuit activity, taking advantage from the development of light sensitive ion channels rendering light sensitive the activity of the cells in the brain. Following a brief background, I will present the methods and the application for applying these methods in neuroscience research.

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