# A novel optoelectronic platform combining LED-driven pacing and laser optoporation for high-throughput cardiac electrophysiology

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**Abstract**: Reproducing the rhythmic electrical activity of the heart *in vitro* enables systematic investigation of cardiomyocyte (CM) responses to variations in pacing frequency, including alterations in contractile dynamics and electrophysiological behavior. While electrical stimulation remains the established standard, optical stimulation is emerging as a compelling alternative due to its reduced invasiveness and superior spatial and temporal resolution.

In this study, we introduce a high-throughput platform designed for the stimulation of CMs cultured on microelectrode arrays (MEAs). The system is equipped with a laser-based membrane poration module, providing reliable access to intracellular electrophysiological signals without the need for mechanical or chemical perturbation. Additionally, our tool incorporates an optical stimulation module in order to modulate the electrical activity of CM through photoactuators, or more generally optogenetic tools.

Altogether, this work presents a fully integrated and minimally invasive platform for *in vitro* cardiac electrophysiology, offering significant potential for applications in disease modeling, pharmacological screening, and fundamental cardiac research.