

# Optogenetic Cell Control and Systems Engineering

+++ *Master Thesis* +++ *Ph.D. Thesis* +++ *Other* +++

In association with TUD excellence cluster Physics of Life (PoL), the Laboratory MST and the Competence Center BIOLAS offer research at the intersection of laser-optical system engineering and cell biology / biomedicine. This research field is located in optogenetics, where the activity of transgenic cells is controlled by means of light-sensitive trans-membrane proteins. Our aim is to study the genesis and termination of light-induced self-sustaining spiral excitation waves in cardiomyocyte networks and organoids by means of means of optogenetic light stimulation and optical read-out *in-vitro*.

## Your tasks (selection, depending on your preference):

- ❖ set up a holographic 3d two-photon cell excitation system based on fast spatial light modulators (SLM) and an ultra short pulse laser
- ❖ compensate aberrations by adaptive optics to achieve subcellular resolution
- ❖ measure the 3D cardiomyocyte motion using 3D localization microscopy
- ❖ implement methods of image processing / AI / deep neural networks to track the 3D contraction and to determine the excitation wavefront
- ❖ make experiments on cardiomyocyte samples and study the cell motion in dependence of different light excitation patterns; mimic spiral heart waves and learn about arrhythmia mechanisms

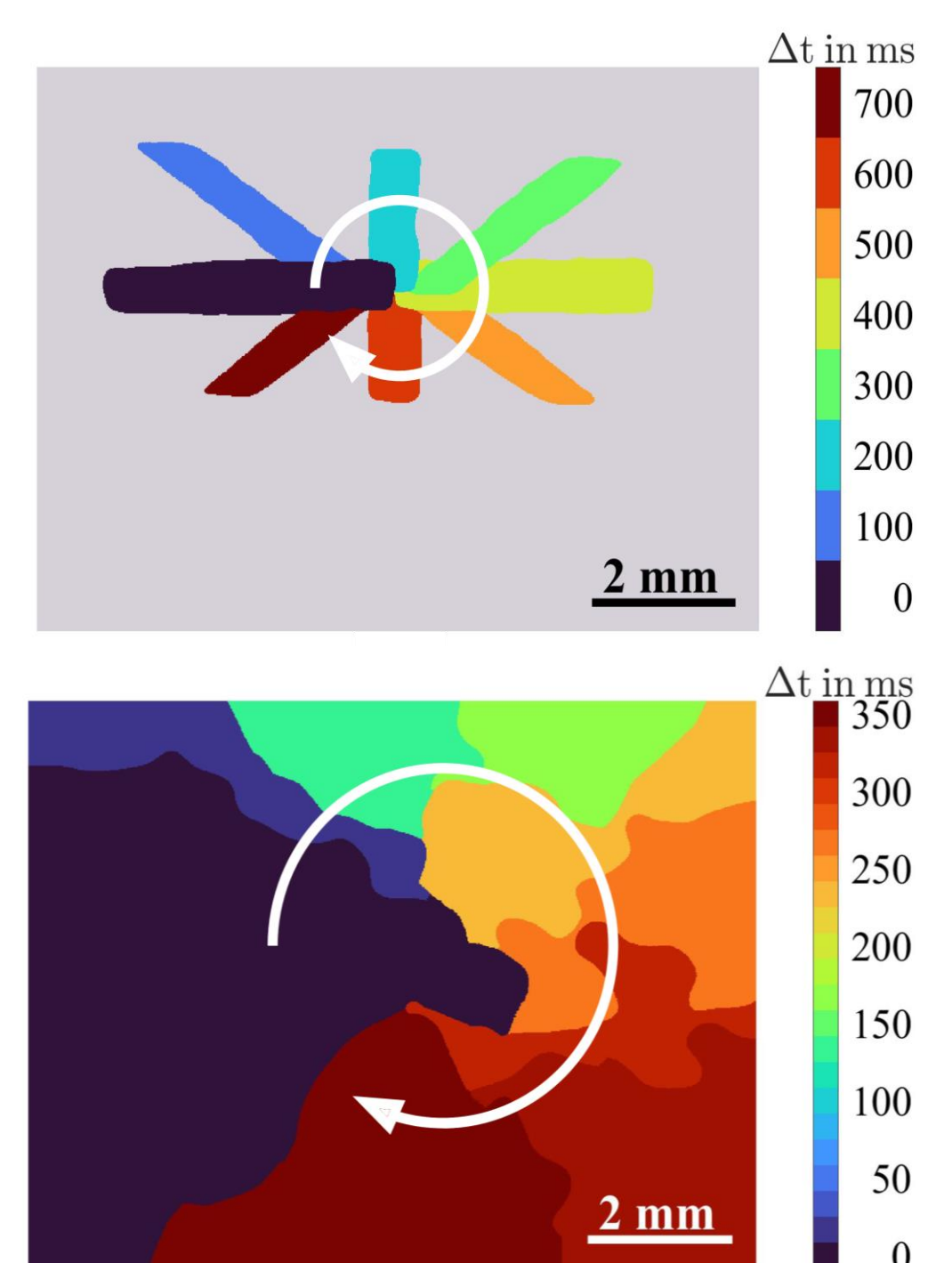
## We offer:

- ❖ a diverse, ambitious, and burning research issue
- ❖ modern laboratories with state-of-the-art equipment
- ❖ an interdisciplinary and international research team
- ❖ creative possibilities with room for self-development and own research interests
- ❖ visits of international conferences

**Your requirements:** Great commitment, analytical thinking, taking joy in practical work and basic research. For Ph.D. applicants: above-average university degree in biophysics or physics, electrical engineering, mechatronics, information technology or similar studies; ability for working autonomously and goal-driven within a team.

Please address topical questions to Lars Büttner (e-mail [lars.buettner@tu-dresden.de](mailto:lars.buettner@tu-dresden.de), phone +49 351 463 35314). Submit your comprehensive application including the usual documents preferably as a single pdf file by mail to:

[grp-mst-sekretariat@msx.tu-dresden.de](mailto:grp-mst-sekretariat@msx.tu-dresden.de) .



*Top: spatio-temporal light pattern stimulating cardiomyocytes that express the light-sensitive protein Chrimson*

*Bottom: induced spiral wave in cardiac tissue*

