

**Joint Condensed Matter  
and Center for Soft Matter and  
Biological Physics Seminar**

**Tom Burkart  
(LUM, Munich)**

**“Light, proteins, and shape: exploiting protein pattern formation for  
light-controlled oocyte deformations ”**

**Monday, October 24, 2022**

**4:00pm – 5:00pm**

**Zoom Link: <https://virginiatech.zoom.us/j/81125677737>**

To coordinate shape deformations, in particular cell division, cells rely on chemical reaction networks that process spatial and temporal cues, and control mechanical activity. In starfish oocytes, a Rho-GTP protein pattern on the cell membrane regulates actomyosin contractility which induces large-scale cell deformations during meiotic anaphase. By engineering optogenetic activators of Rho-GTP, the native control mechanism can be hijacked to manually trigger the actomyosin contractility and thereby deform the oocyte even before entering meiotic anaphase. We study how such an artificial guiding cue is processed by the mechanochemical machinery in starfish oocytes. We combine simulations of the protein reaction-diffusion dynamics with the dynamic shape deformation of the oocyte to predict spatio-temporal light activation patterns that produce custom cell deformations. These results contribute to the development of an overarching theoretical framework that allows to study and design minimal artificial cells capable of self-regulated and externally controlled shape changes.