

SUMMER SEMESTER 2025

RTG 2756 CYTAC SEMINAR SERIES

TUESDAY, JULY 22  
17:00 IN HS5

CYTAC

RTG 2756

## PROF. DR. MAZI JALAAL

Institute of Physics, University of Amsterdam

### ON LIGHT & LIFE: LIGHT-REGULATED ACTIVE & ADAPTIVE AMORPHOUS MATTER

*Light plays a crucial role in various biological processes, from the mesmerizing bioluminescence of living organisms to photosynthesis. Here, we delve into how organisms adapt to ever-changing light conditions by modifying their photosynthetic apparatus. First, we examine the active motion of discoid chloroplasts in plants and show that dim-light conditions lead to an accumulation into an optimally dense, quasi-2D layer resembling systems near the glass transition. Our study suggests that the metastable caging at this transition in the chloroplast monolayer has physiological relevance: chloroplasts remain spread out to maximize light uptake but can readily fluidize when activity increases, allowing efficient rearrangement into an avoidance configuration. Second, we explore the chloroplast morphodynamics of a single-celled marine alga, whose disordered chloroplast network undergoes dramatic deformation under intense light. We show that this unusual, reticulated morphology exhibits properties similar to auxetic metamaterials, facilitating the rapid, large-scale deformation necessary for light-avoidance movements within the confines of the cell wall. Our study highlights how topologically complex metamaterials are harnessed in critical life-sustaining processes and how simple dynamical rules can govern complex material transport in crowded intracellular environments. In the end, we will present a range of open problems in the field and explain how we plan to address some of them using approaches that span from microscopy to robotics!*