

## PHYSICS AND ASTRONOMY COLLOQUIUM (In Person Only)

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"Tunneling through the Cell: Structure and Transport in Organelle Networks"

## <u>Abstract</u>

Living cells organize their interior into systems of interacting membrane-bound organelles. In this talk we will explore two organelles that form extensive networked architectures spanning across the cell: mitochondria and the endoplasmic reticulum (ER). While functionally distinct, both of these organelles give rise to fundamental physical questions: How are network structures formed and maintained? How do the morphology and dynamics of these organelles allow them to facilitate transport throughout the cell? We will show that the peripheral ER can be approximated as a 'liquid network' whose dynamic rearrangements are driven by tension and tubular growth. Mitochondria, by contrast, undergo fusion and fission to form morphologies ranging from highly fragmented 'social' networks to highly branched tubular structures. Using dynamic network models, we explore the rate of material transport in different mitochondrial network structures and in the interconnected tubular mesh of the ER, highlighting the key physical features that govern the rate of dispersion and delivery. Along the way, we will see how emergent complex structures in living cells motivate new questions in network physics, and how a physical perspective on transport illuminates biological function.

> Wednesday, March 26, 2025 3:30pm PST BWC A104