

Department of Physics and
Astronomy

Physics & Astronomy Colloquium

Presents

Sarah Keller

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Thursday, September 20, 2018
4:10 pm, Webster Room 17

“2-dimensional phase separation in cell membranes: How yeast harness physics to organize proteins and lipids”

For decades, scientists have argued about how living cell membranes acquire and maintain regions enriched in particular lipid and protein types. One of the more contentious theories has been that lipids and proteins spontaneously phase separate within the plane of the membrane to create liquid regions that differ in their composition. Physicists have long observed this type of demixing in simple artificial membranes. Clear identification of the same transition in a living biological system has heretofore been elusive. Here, by directly imaging micron-scale membrane domains of yeast organelles both in vivo and cell-free, we show that domains merge quickly, consistent with fluid phases. Moreover, the domains appear at a distinct miscibility transition temperature. Hence, large-scale membrane organization in living cells under physiologically relevant conditions can be controlled by tuning a single thermodynamic parameter. Interesting physical questions underlie this phenomenon. For example, asking how domains are coupled across the two faces of the membrane led to the first measurement of the interleaflet coupling parameter. Similarly, asking how sub-micron composition fluctuations might arise in a lipid membrane near a critical point led to our determination of the membrane's effective critical dynamic exponent -- the first successful systematic measurement of this fundamental physical parameter in any 2 dimensional Ising system with conserved order parameter. Asking how groups of lipids diffuse within a membrane led to our measurement of growth exponents for membrane domains.

*Please meet our guest speaker and share in refreshments,
3:45-4:10 p.m. in the foyer on floor G above the lecture hall*

Host: Dr. Brian Saam