UCLA Department of Physics & Astronomy

COLLOQUIUM

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Biological Physics: Looking for new physics in the living world

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Biological physics seeks not only to use physics to understand biological phenomena, but also to mine the living world for new physics. The latter goal is made possible by the fact that life creates uniquely ordered structures and drives them into particular, controlled, and long-lived nonequilibrium states. In this talk, I present two stories of looking for new physics in the living world. The first is based on studies of the filament networks that pervade both the interior of our cells (the cytoskeleton) and in the spaces between those cells in our tissues (the extracellular matrix). I will discuss the formation of filament bundles driven by thermal Casimir interactions between cross-linkers in filament bundles and the role of topologically-protected defects, such as braids in them. In the second story, I highlight the hair cell oscillators of the inner ear (as investigated by the Bozovic group) as an exemplar of controlled nonequilibrium states in biology. These cells make hearing possible. They also provide an interesting playground to study fluctuation-dissipation relations in nonequilibrium steady states under feed-back based control. Can we use the failure of various relations between fluctuations and response as a probe of not just nonequilibrium states in nature, but of particular classes of nonequilibrium states under different types of homeostatic control?

Undergraduates Welcome!