First-Passage Processes in Statistical Physics, with Application to Molecular Evolution

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Understanding properties of stochastic transport in complex networks and on multidimensional landscapes is crucial for quantitative analysis of numerous biological, physical, social and technological systems, from protein-protein interactions in biology to the World Wide Web. While random walks on networks with unweighted edges can be described using scaling techniques, few analytical results are available for weighted networks, which appear naturally in the studies of evolutionary dynamics, chemical reactions, and many other fields. In this colloquium I will give a general introduction to the physics of first-passage processes on networks, including an efficient recursive approach we have developed to study first-passage path ensembles. After demonstrating the recursive approach on several examples from physics, I will apply it to the problem of protein evolution. Specifically, I will investigate how structural coupling between protein folding and binding (the fact that most proteins can only function when folded) gives rise to evolutionary "spandrels" (features that appear through adaptation, even though the feature itself does not contribute to the organism’s fitness).

TIME: 3:45-4:35 pm, Thursday, November 9, 2017
(refreshments: 3:30 pm)
PLACE: B-1220 Lehman Auditorium, SEH building, GWU
800 22nd Street, NW (use 22nd street entrance)
METRO STATION: GWU/FOGGY BOTTOM (BLUE, ORANGE & SILVER LINES)