#13 Topic: Data, Dynamics, and Transitions

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Abstract:

I will give an introduction to some mathematical methods for problems in complexity. These methods address two problems: (1) how can I extract information about an underlying (possibly unknown) dynamical system from measurement data (possibly noisy) of that system? and (2) how can I estimate the likelihood of a tipping point in a stochastic system? Both approaches are based on spectral analysis of diffusion operators. Diffusion maps provide a means to estimate leading eigenvectors of the generator of a stochastic process based on data observed from the system. Projecting onto these eigenvectors also gives a natural reduced model. Information about the topology of the underlying attractor is also revealed using this technique.

To address the second question I will also discuss the potential theory of Bovier and den Hollander, which provides an efficient approach to computing probabilities of transitions (tipping points) in metastable dynamics.