

Thursday, November 10th, 2022

Refreshments at 3:45pm in PSF 186

Colloquium from 4:00 PM – 5:00 PM in PSF 101

From Gibbs to biology: Maxwell's demon, nonergodicity, and biological function

Professor Dmitry Matyushov

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Abstract:

Efficiency of biology has both time and energy dimensions: one has to arrive on time while spending less energy. Both are achieved by enzymes accelerating reactions by many orders of magnitude without demanding much free energy input. Can this acceleration be captured by standard recipes of thermodynamics and Gibbsian statistics? It turns out that the observed speed of electron transport in biological energy chains is only possible when Gibbsian statistics are broken by dynamical constraints due to the separation of relaxation and reaction time scales. Enzymes operate as Maxwell's demons selecting proteins that are stuck in specific configurations and cannot relax on the reaction time. The global nonergodic nature of biology, often viewed as a "frozen accident", extends all the way down to the molecular scale.

Biography:

Dmitry Matyushov has been at Arizona State University for more than 20 years. His research interests are in theoretical and computational soft matter physics, physical chemistry, and biophysics.

Host: Prof. Stuart Lindsay

View our Fall 2022 Physics Colloquium schedule at <https://physics.asu.edu/colloquia>