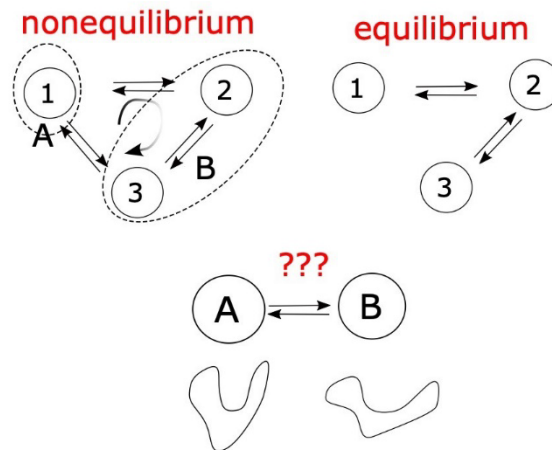


PHYSIKALISCHES KOLLOQUIUM

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ALGORITHMS FOR DISCERNING THE TIME ARROW IN MICROSCOPIC PHENOMENA

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Life phenomena are irreversible: nobody gets younger. Yet when observed at a microscopic scale, such irreversibility is often subtle and hard to detect. If we observe the trajectory of a tracer particle inside a cell, can we tell whether the cell is alive or whether the particle simply undergoes random Brownian motion? In this talk I will first describe some of the challenges that one faces when attempting to discern the directionality of molecular machines when observing them at a single-molecule level. I will then discuss how ideas from information theory can be applied to analyze single-molecule trajectories in a manner similar to Shannon's analysis of the printed English. Finally, I will discuss how the heat generation/entropy production by molecular machines can be estimated, in practice, by computing an information-theoretical measure of time reversibility, the Kullback-Leibler divergence between the distributions of forward trajectories and of their time reverses.