Exploring pathways of rare events and order-disorder of space-time, throwing ropes over rugged mountain passes, in the dark

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This lecture discusses transition path sampling. It is an importance sampling of trajectory space, and it can be used to discover kinetic mechanisms in complex systems. Further, transition path sampling provides a numerical realization of Ruelle's thermodynamic formalism of space-time. Associated space-time partition functions, known as "large fluctuation functions," exhibit singularities at conditions of coexistence between extensively different sub-ensembles of trajectories. In equilibrium statistical mechanics, coexistence can be gleaned numerically from applications of Monte Carlo sampling of micro-states. The corresponding transition path sampling technique allows the study non-equilibrium order-disorder transitions in general and structural glass transitions in particular.