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The Statistics of Energy States of a Hookean Model for Proteins

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Abstract: A generic model of a random polypeptide chain, with discrete torsional degrees of freedom and Hookean springs connecting pairs of hydrophobic residues, reproduces the energy probability distribution of real proteins over a very large range of energies. We show that this system with harmonic interactions, under dissipative dynamics driven by random noise, leads to a distribution of energy states obeying a modified one-dimensional Ornstein-Uhlenbeck process with reflecting boundary conditions, and giving rise to distributions of the Wigner or inverse Gaussian form. A continuum approximation leads to a path integral formulation of the problem. PACS 5.65+b,5.70Ln,87.17.Aa

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