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Energy Landscapes and Beyond

PETER G. WOLYNES, University of California at San Diego, WOLYNES GROUP TEAM

To understand many problems in modern science one must cope with a diversity of long-lived states or attractors. The necessary notion is that of an energy landscape. Cluster physics, protein dynamics and protein folding are key examples of problems where a landscape description is essential. In bulk condensed matter e.g. supercooled liquids and glasses, a landscape can only be meaningfully assigned to a small region of the system. Such local landscapes, however, can be constructed and used to describe the unusual slowing as the glass transition is approached and aging phenomena in quenched glasses. The resulting theory is quantitatively successful. Fully quantum glasses may also exist. \Far-from equilibrium systems, such as cytoskeleton and gene networks require going beyond the landscape notion in new ways, which we will briefly describe.