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**Emergent Behavior in the Macro World: Rigidity of Granular Solids<sup>1</sup>**

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Diversity in the natural world emerges from the collective behavior of large numbers of interacting objects. The origin of collectively organized structures over the vast range of length scales from the subatomic to colloidal is the competition between energy and entropy. Thermal motion provides the mechanism for organization by allowing particles to explore the space of configurations. This well-established paradigm of emergent behavior breaks down for collections of macroscopic objects ranging from grains of sand to asteroids. In this macro-world of particulate systems, thermal motion is absent, and mechanical forces are all important. We lack understanding of the basic, unifying principles that underlie the emergence of order in this world. In this talk, I will explore the origin of rigidity of granular solids, and present a new paradigm for emergence of order in these athermal systems.

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