Intrinsic Localized Modes: Localizing Energy through Nonlinearity and Discreteness

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Intrinsic localized modes (ILMs), also known as "discrete breathers," have been an appealing theoretical possibility for more than a decade. Roughly speaking, they represent the extension of the continuum concept of "solitons" to spatially extended discrete (lattice) systems. Importantly, theory suggests that ILMs are far more ubiquitous than solitons, in that they can occur in discrete systems in any number of spatial dimensions and with a wide range of nonlinear interactions.

Over the past several years, these theoretical considerations have been dramatically confirmed, and ILMs have been observed experimentally in physical systems as distinct as charge-transfer solids, Josephson junction arrays, photonic structures, and micromechanical oscillator arrays.

In this presentation, we review the historical developments that led to ILMs, present some intuitive arguments for their existence, and discuss the current status, future directions, and possible applications of these novel nonlinear excitations.