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Discrete breather energy thresholds in Discrete Nonlinear Schrodinger (DNLS) systems Discrete breather energy thresholds in Discrete Nonlinear Schrodinger (DNLS) systems JUN ZHOU, JEROME DORIGNAC, DAVID CAMPBELL, Boston University — The DNLS equation has been used successfully to model physical systems as varied as the Holstein polaron, the Davydov soliton, local modes of small molecules and, more recently, optical wave guide arrays and Bose-Einstein condensates trapped in optical lattices. In addition, the DNLS also governs the slow modulations of plane waves in Klein-Gordon systems (network of oscillators). In one dimension and for a cubic nonlinearity, the DNLS is known to support discrete breather solutions - time-periodic, spatially localized excitations - with arbitrary low energy (or norm). In contrast, for higher nonlinearities or in higher dimensions, an energy (norm) threshold is known to exist, below which discrete breathers cannot be found. Using two different approaches to treat the DNLS equation–namely, an exponential ansatz and the so-called "single nonlinear impurity" approximation– we derive analytical expressions for these energy thresholds and compare them to the exact numerical solutions.

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