Coherent Interactions Between Discrete Breathers

SERGEJ FLACH

Institute for Basic Science, Daejeon, South Korea

Discrete breathers (DBs) are spatially localized vibrational modes ubiquitous in physical systems. Despite decades of research, their mutual interactions represent a fundamental yet unexplored facet of nonlinear dynamics. Here we uncover quantitative interaction laws for DB pairs, encoded in tunable energy beating whose amplitude provides a direct coupling metric shaped by energy mismatch, phase configuration, and a separation yielding exponentially decaying, parity-sensitive coupling. The coupling can be strongly modulated by frequency locking, which emerges only under restricted excitation conditions. A minimal nonlinear dimer encapsulates all salient behaviors across diverse lattice models. These results promote DBs from static energy traps to versatile elements for engineering energy transport, tailoring vibrational spectra, and generating acoustic frequency combs [1].

References

[1] Chengguan Fang, Lin Deng, Weicheng Fu, Zhigang Zhu, Yisen Wang, Liang Huang and Sergej Flach, *Quantitative Interaction Laws for Discrete Breathers*, to be published