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TALKS BY JFR ARCHILLA

TALK 1: Time crystals in modulated systems.

Authors: Juan FR Archilla[1], Masayuki Kimura[2], Yusuke Doi[3], Víctor J. Sánchez-Morcillo[4]
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Abstract:
Dynamic materials are structures that not only change in space but also in time. They can be modulated by electrical, acoustic, electromagnetic or voltage waves that modify the values of physical parameters like permittivity, magnetic permeability and others. A model that can be constructed relatively easily is a cantilever array where the modulation is provided by electromagnets that can be easily tunable. It can also be simulated numerically to test the theory and the experimental data. We study the transformation of the phonon bands in w-q space and obtain breathers is such a system. Their properties are analyzed within the context of the new modulated phonon-spectrum.

References:

[1] F Wilczek (Nobel Price 2004), Crystals in Time. Scientific American 321 (2019) 28
[2] M Kimura, T Hikihara. Coupled cantilever array with tunable on-site nonlinearity and observation of localized oscillations. Phys. Lett. A (2009) 1257.

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TALK 2: Thermalization time of breathers in nonlinear lattices.

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Abstract:
We propose a quantity to monitor the thermalization process, the participation number *P*, and demonstrate that approximately and for weak coupling the thermalization is marked by oscillations around half the number of particles in the system. For other systems it also measures a sufficient approximation to thermal equilibrium. We produce breathers within a thermalized system and observe their route to equilibrium.
For four different nonlinear systems, three Klein-Gordon systems and a fourth model for Josephson junction networks, we observe that the thermalization time varies in quasi-exponential way with the breather energy, in the region of parameters for which breathers exist. Thermalization times have a very large dispersion but the mean averages are very precise for samples of about 10000 simulations. To obtain a good statistics, usually specially for the high-energy breathers long computation times and resources were needed. Long thermalization times may have consequences for tokamak fusion reactors.

References:

[1] JFR Archilla, J Bajārs, S Flach. Thermal lifetime of breathers. Physica D 473 (2025) 134551
[2] FM Russell, JFR Archilla, JL Mas. Quodon current in tungsten and consequences for tokamak fusion reactors. Phys. Status Solidi RRL 18 (2024) 2300297

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