## Fine-tuning localization in interacting flat band lattices

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Linear wave equations on translationally invariant flat band networks exhibit one or more dispersionless bands in their Bloch spectrum, and host compact localized eigenstates (CLS) with nonzero amplitudes restricted to a finite volume. While yielding remarkable single particle localization features, CLSs are typically highly sensitive to perturbations (e.g. disorder, external fields, interaction). However, the impact of such perturbations strongly depends on the chosen flat band network. In this talk, we focus on the case of interacting flat band networks, and discuss fine tuning protocols involving the interaction terms and the network geometry which yield diverse localization regimes. We show how these fine tuning protocols result in spatially compact time periodic breather solutions in the classical nonlinear case. We then focus on the case of lattices lacking dispersion (i.e. all bands are flat) where fine tuning the interaction leads from paired particle transport to the complete suppression of charged transport (i.e. many-body flat band localization). We also discuss how flat band fine-tuning leads to the implementation of quantum logic gates via adiabatic driving.