Chaos assisted many-body tunneling

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We study the interplay of chaos and tunnelling between weakly-coupled Bose-Hubbard dimers. Constructing a double-dimer Bose-Hubbard model, we map the classical mixed phasespace structure and study its manifestaions on the quantum many-body spectrum. The classical phasespace structure exhibits quasi-integrable self-trapping islands for particles and excitations, separated by a chaotic sea. We show that the many-body dynamical tunneling gap between macroscopic Schrödinger cat states supported by these islands is chaos-enhanced. The many-body tunnelling rate fluctuates over several orders of magnitude with small variations of the system parameters or the particle number.