Summary: Integrable models form pillars of theoretical physics because they allow for full analytical understanding. Despite being rare, many realistic systems can be described by models that are close to integrable. Therefore, an important question is how small perturbations influence the behavior of solvable models. This is particularly true for many-body interacting quantum systems where no general theorems about their stability are known. Here, we show that no such theorem can exist by providing an explicit example of a one-dimensional many-body system in a quasiperiodic potential whose transport properties discontinuously change from localization to diffusion upon switching on interaction. This demonstrates an inherent instability of a possible many-body localization in a quasiperiodic potential at small interactions. We also show how the transport properties can be strongly modified by engineering potential at only a few lattice sites.

MSC:
81V19 Other fundamental interactions in quantum theory
70K43 Quasi-periodic motions and invariant tori for nonlinear problems in mechanics
82C22 Interacting particle systems in time-dependent statistical mechanics

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