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Mott Time Crystal: Models and Realizations in Cold Atoms[1]
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Time crystals, a phase showing spontaneously breaking of time-translation symmetry, has been an intriguing subject for systems far away from equilibrium. Recent experiments found such a phase both in the presence and absence of localization, while in theories localization is usually assumed a priori. In this work, we point out that time crystals can generally exist in systems without disorder and is not in a pre-thermal state. A series of driven interacting ladder models are proposed to demonstrate this unexpected result in principle. Robust time crystalline orders are found in the Mott regime due to the emergent integrals of motion in the dynamical system, which can be characterized by the out-of-time-order correlators (OTOC). We propose two cold atom experimental schemes to realize the Mott time crystals, one by making use of dipolar gases and another by synthetic dimensions.

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