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Quantum dynamics with strongly interacting Rydberg atoms[1]
JING QIAN[2], LU ZHOU, East China Normal University, XINGDONG ZHAO, Henan Normal University, WEIPING ZHANG, East China Normal University, EAST CHINA NORMAL UNIVERSITY COLLABORATION, HENAN NORMAL UNIVERSITY COLLABORATION — Rydberg atoms with high principal quantum number have exaggerated atomic properties, including strong dipole-dipole interactions, long radiative lifetimes and so on. These properties can provide intriguing routes to study attractive quantum many-body dynamics. In this talk, we present three research works with strongly interacting Rydberg atoms. We study quantum non-equilibrium phases of Rydberg atoms in cubic and triangular optical lattices and find exotic quantum phases such as uniform phase, antiferromagnetic phase, and oscillatory phase. In some parameter areas, bi-stability phase can be observable. Except that, in a triangle lattice, we also identify dynamical chaos effect in the strong-interaction limit. Besides, depending on the strong dipole-dipole interactions between Rydberg states, Rydberg blockade effect appears. In a more recent work, we find the effective two-atom-blockade spherical model can reveal anisotropic deformation and shrunken properties when the real number of atoms increases from two to three in few-tom systems. These results will all be discussed in the talk.

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[2]Quantum Institute for Light and Atoms, Department of Physics, East China Normal University, Shanghai, PR China

Jing Qian
East China Normal University

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