复旦大学物理系物质科学报告

Physics Department Colloquium

Novel phenomena of ultracold atoms in an optical super-lattice

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Abstract: A system of ultracold atoms in an optical lattice is an ideal quantum simulator of a strongly correlated quantum many-body system and also a topological quantum system due to the high-controllability of system parameters. In this talk, I will report our recent quantum simulation experiments using ytterbium quantum gases loaded into optical super-lattices. The first one is the investigation of behaviors of ultracold atoms in an optical Lieb lattice which has a novel band structure with a Dirac cone and a flat band. In particular, a flat band is important for generating novel quantum states such as a flat band ferromagnetic state for fermions and a super-solid state for bosons. We successfully load ultracold bosons into a flat band and study the dynamics characteristic of the flat band. Novel phenomenon of spatial adiabatic passage is also demonstrated using fermions. The second is a study of topological charge pumping of ultracold fermions in a dynamical optical super-lattice. With this setup, we can simulate a Rice-Mele model in which time-dependent potential depths and hopping strengths are introduced in a staggered form. Charge pumping is directly measured as a shift of an atom cloud. In particular, a topological nature of this charge pumping scheme is revealed by the measurements with various trajectories of system parameters. The effect of atomic interaction and disorder is also investigated.

Other topics such as non-equilibrium quench dynamics will be also briefly mentioned.

Time： 2:00pm, Tuesday, June 20, 2017

Location： Physics Building, Room 221B

(Cookies and coffee are served from 1:30 pm)