Seminar

Novel topological lattices for ultracold atoms

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Venue: Room W563, Physics Building, Peking University

地点：北京大学物理楼 西563

Abstract

In the initial part of the talk we shall present a novel topological lattice relying on a combination of a magnetic field gradient and a multi-frequency laser radiation propagating in a perpendicular direction. This creates effectively a square optical lattice affected by a non-staggered magnetic flux. By properly tuning the parameters of the system, the energy bands of the lattice can be characterized by unit Chern numbers [1]. Subsequently we shall discuss another possibility of producing topological optical lattices by using a set of long lived atomic internal states representing the sites in an extra (synthetic) dimension [2,3]. By taking the usual one-dimensional (1D) optical lattice and inducing laser-assisted transitions between the sites of the "extra dimension", one can effectively engineer a topological 2D lattice involving both real and synthetic dimensions. We shall consider a novel semi-synthetic lattice characterized by a non-square geometry and discuss its single and many-body properties [4].

1. T. Andrijauskas, I. B. Spielman and G. Juzeliūnas, New J. Phys. **20**, 055001 (2018).
2. O. Boada, A. Celi, J. I. Latorre and M. Lewenstein, Quantum Simulation of an Extra Dimension, Phys. Rev. Lett. **108**, 133001 (2012).
3. A. Celi, P. Massignan, J. Ruseckas, N. Goldman, I. B. Spielman, G. Juzeliūnas and M. Lewenstein, Synthetic Gauge Fields in Synthetic Dimensions, Phys. Rev. Lett. **112**, 043001 (2014).
4. E. Anisimovas, M. Račiūnas, C. Str ̈ater, A. Eckardt, I. B. Spielman and G. Juzeliūnas, Phys. Rev. A **94**, 063632 (2016).

About the Speaker

Gediminas Juzeliunas is a Professor and Principal Researcher at the Institute of Theoretical Physics and Astronomy of Vilnius University, Lithuania. He has just finished a five year term (2013-2018) serving as a Director of the Institute. Dr. Juzeliunas completed a Ph.D. in 1986 in theoretical condensed matter physics at Vilnius University, studying optical properties of excitons. Then he held a postdoctoral appointment at the University of East Anglia, England, shifting his research area towards quantum optics. Dr. Juzeliunas was a Humboldt Research Fellow at the University of Ulm, Germany (1997–1998) and a Fulbright Scholar at the University of Oregon in the US (2000–2001). Dr. Juzeliunas received a National State Prize for Science of Lithuania in 2008, a Vilnius University Rector's award in 2010 and a Jucys Prize for Theoretical Physics of the Lithuanian Academy of Science in 2013. His current research focuses on ultracold atomic gases and slow light. In particular, this includes a pioneering theoretical work on light-induced gauge potential for ultracold atoms.