ESI Erwin Schrödinger International Institute for Mathematics and Physics

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Seminar

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Ultrafast many-body electron dynamics in an ultracold atomic BEC and Mott insulator lattice

Monday, October 21, 2019

at 11:00 h

ESI, Boltzman Lecture Hall

Abstract: Many-body correlations govern a variety of important quantum phenomena including the emergence of superconductivity and magnetism in condensed matter as well as chemical reactions in liquids. Understanding quantum many-body systems is thus one of the central goals of modern sciences and technologies. Here we demonstrate a new pathway towards this goal by generating a strongly correlated ultracold Rydberg gas with a broadband ultrashort laser pulse. We have applied our ultrafast and ultrahigh-precision coherent control with attosecond precision [1] to a strongly correlated Rydberg gas in an optical dipole trap, and have successfully observed and controlled its ultrafast electron dynamics [2-4]. This new approach is now applied to an atomic BEC and Mott insulator lattice to develop into a new platform for quantum simulation of strongly correlated quantum many-body dynamics on the ultrafast timescale [5,6].

References [1] H. Katsuki et al., Acc. Chem. Res. 51, 1174 (2018). [2] N. Takei et al., Nature Commun. 7, 13449 (2016) (Highlighted by Science 354, 1388 (2016); IOP PhyscisWorld.com (2016)). [3] C. Sommer et al., Phys. Rev. A 94, 053607 (2016). [4] C. Liu et al., Phys. Rev. Lett. 121, 173201 (2018). [5] Patent Publication Number: US 2018/0292786 A1; JAPAN 2018-180179, "Quantum simulator and quantum simulation method," H. Sakai (Hamamatsu Photonics K.K.), K. Ohmori (NINS) et al., Publication date: Oct. 11, 2018 (US); Nov. 15, 2018 (JAPAN). [6] M. Mizoguchi et al., arXiv: 1910.05292 (2019).

T. Calarco, E. Sanchez

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