Ultrafast Many-body Electron Dynamics in a Strongly Correlated Ultracold Rydberg Gas

Kenji OHMORI

Institute for Molecular Science, National Institutes of Natural Sciences, Japan

Email: ohmori@ims.ac.jp

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 picosecond laser pulse. We have applied our ultrafast and ultrahigh-precision coherent control with attosecond precision [1-8] to this strongly correlated Rydberg gas, and have successfully observed and controlled its ultrafast electron dynamics [9-11]. Our approach will offer a new platform to observe and manipulate nonequilibrium dynamics of strongly correlated quantum many-body systems on the ultrafast timescale [12].

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