Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Orbital and spin signatures in the ultrafast lattice vibrations of a Mott insulator Ca_2RuO_4 MIN-CHEOL LEE, CHOONG H. KIM, INHO KWAK, Institute for Basic Science (IBS), C. W. SEO, Y. S. LEE, Chungbuk National Univerity, C. H. SOHN, IBS, F. NAKAMURA, Kurume Institute of Technology, C. SOW, Y. MAENO, Kyoto University, E.-A. KIM, Cornell University, T. W. NOH, IBS, K. W. KIM, Chungbuk National Univerity — Only within a short period of a decade, ultrafast spectroscopy has dramatically expanded its field in physics. Its unique ability to investigate time-resolved dynamics offers new insight into an interaction between quantum degrees of freedom, such as charge, lattice, orbital and spin. As one of the most interesting ultrafast features, coherent phonon oscillations provide oscillation-*phase* resolved information revealing a coupling of lattice to various order parameters. However, the oscillation-*phase* itself has been overlooked because it has been believed to be robustly determined by generation mechanism. In this talk, I will discuss a novel response from the coherent phonon oscillation depending on the orbital and spin degrees. Surprisingly, the orbital and spin orders in Ca_2RuO_4, one of the best known $4d$ Mott insulator, influence a coherent A_g phonon mode with dramatic changes of its *phase* such that the oscillation even flips across the orbital order. DFT calculations and a careful inspection of the crystal structure indicate that an unusually large antipolar distortion of apical oxygen is an essence of the orbital order and the extraordinary *phase* variations. We suggest that such *phase* observation in the ultrafast lattice vibrations can offer a new opportunity to single out a crucial but veiled aspect of the lattice.

Min-Cheol Lee
Institute for Basic Science (IBS)

Date submitted: 09 Nov 2016 Electronic form version 1.4