Resonant x-ray scattering as a probe for exotic orders in condensed matter

B. J. Kim
Pohang University of Science and Technology (POSTECH)
Center for Artificial Low-Dimensional Electronic Systems, Institute of Basis Science (IBS)

Condensed matter systems host a diverse array of exotic orders and their associated emergent particles, many of which are difficult to access using conventional probes. Recent developments in x-ray science has revealed many new features of quantum materials not seen by most of other known techniques. In this colloquium, I will review how resonant x-ray scattering can be a powerful tool not only for studies of well-known collective excitations such as spin waves (or magnons), but also for detecting elusive quantum phases of matter and their excitations resulting from strong electron correlations and/or spin-orbit coupling. I will discuss examples from low-dimensional quantum magnets based on 4d and 5d transition-metal oxides: (1) excitonic quasiparticles and their dynamics in Sr2IrO4; (2) Higg mode and a possible new pseudospin nematic phase in Ca2RuO4.