Dispersive high-energy spin excitation in iron-based superconductors

K. J. Zhou[a], Y. B. Huang[b], C. Monney[a], N. L. Wang[b], P. C. Dai[b], X. Dai[b], J. van den Brink[c], H. Ding[b], and T. Schmitt[a]

[a]Paul Scherrer Institut, CH-5232 Villigen PSI, Switzerland
[b]Beijing National Laboratory for Condensed Matter Physics, and Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China
[c]Institute for Theoretical Solid State Physics, IFW Dresden, 01171 Dresden, Germany

The discovery of iron-based high temperature superconductivity has triggered tremendous research efforts in searching for novel high-Tc superconductors (SC) and understanding the related fundamental physics. Unlike the cuprate parent compounds which are AF Mott insulators, the iron-based parent compounds are 'spin-density wave' metals with delocalized electronic structure and more itinerant magnetism. There are cumulative evidence suggesting that the superconductivity in the iron-based SC may be connected with interband pair scattering between quasi-nested Fermi surfaces. However, the observation of spin fluctuations in these materials recommends a compelling hypothesis that they may share a common pairing mechanism with cuprates. Recent developments of high-resolution resonant inelastic X-ray scattering (RIXS) have enabled exploring magnetic excitation in cuprates which show excellent agreement with results from inelastic neutron scattering. Here we demonstrate RIXS can be used to measure collective magnetic excitation in iron-based SC despite their much stronger itinerancy compared to cuprates. The persistence of high-energy spin excitations in doped SC strongly suggests a spin-mediated pair mechanism.