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Dispersive high-energy spin excitations in iron pnictide superconductors investigated with resonant inelastic x-ray scattering

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The discovery of iron-based high temperature superconductivity has triggered tremendous research efforts in searching for novel high-Tc superconductors. Unlike the cuprates whose parent compounds are long-range ordered antiferromagnetic Mott insulators, the iron-based parent compounds are 'spin-density wave'metals with delocalized electronic structure and more itinerant magnetism. ARPES studies suggest that superconductivity in iron-based materials may be connected with interband scattering between the quasi-nested electron-hole Fermi surfaces. On the other hand, the observation of spin fluctuations by Inelastic Neutron Scattering (INS) in these materials, similar to those seen in cuprates, suggests that cuprate and iron-based high-Tc superconductors may share a common pairing mechanism.

Recent developments of the high-resolution resonant inelastic X-ray scattering (RIXS) technique [1] have enabled investigations of magnetic excitations in cuprates [2,3], which show excellent agreement with results from INS. In this presentation we demonstrate that RIXS can be used to measure collective magnetic excitations in iron-based superconductors and their parent compounds despite their much stronger itinerancy compared to cuprates. The persistence of high-energy spin excitations even in optimally doped pnictide superconductors of the '122'and '1111'families in a wide range of temperatures strongly suggests a spin-mediated Cooper pairing mechanism as proposed in cuprate superconductors [4].

References
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