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Theory of Inelastic X-Ray Resonance Scattering in Iron Arsenides

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It has been recognized that both spin and orbital degrees of freedom are the key to understanding the physics of iron arsenides. Theoretical calculations within the random-phase approximation for a five-orbital Hubbard model have nicely explained spin excitations observed by inelastic neutron scattering experiments for antiferromagnetic (AF) phase [1]. In order to clarify the interplay of spin and orbital degrees of freedom in the energy and momentum spaces, we propose resonant inelastic x-ray scattering (RIXS) tuned for Fe L3 edge [2]. In the AF phase, we find that the magnon excitations predominantly composed of single orbital component appear with a weak intensity as compared with orbital excitations lying just above the magnon excitations. The dominant orbital excitations are found to be accompanied by the spin-flip process, producing composite excitations of the coupled orbital-spin degrees of freedom. We also predict the polarization and momentum dependence of the Fe L3-edge RIXS prior to forthcoming experiments.
[1] E. Kaneshita and T. Tohyama,, Phys. Rev. B 82, 094441 (2010).
[2] E. Kaneshita, K. Tsutsui, , and T. Tohyama, to be published I Phys. Rev. B.

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RIXS

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Talk

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