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Unified Picture for Magnetic Correlations in Iron-Based Superconductors WEI-GUO YIN, CHI-CHENG LEE, WEI KU, Brookhaven National Laboratory — The spin-density-wave mechanism due to Fermi surface nesting is widely used to describe magnetism in the parent compounds of iron-based superconductors; however, the field is puzzled by the different magnetic structure of FeTe, which apparently has similar Fermi-surface topology. Here we propose [1] an orbital-degenerate double-exchange model which includes both itinerant electrons and localized spins. The physical properties of the model are governed by the competition between the antiferromagnetic superexchange and Hund's rule coupling. We show that the strength of the effective Hund's rule coupling term strongly depends on the anion height from the iron plane, leading to the collinear (C-type) magnetic order with the ferro-orbital order in iron pnictides and the bicollinear (E-type) magnetic order without orbital ordering in FeTe. This shows that the magnetism in iron-based superconductors can be described in a unified picture and may have a universal origin for all of the materials. Our results reveal the crucial role of Hund's rule coupling for the strongly correlated nature of the system and suggest exploring the interplay of the spin, orbital, charge, and lattice degrees of freedom in promoting high-temperature superconductivity. Work supported by US DOE.
[1] W.-G. Yin, C.-C. Lee, and W. Ku, PRL 105, 107004 (2010).

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