Anisotropy in the magnetic state of undoped iron pnictides

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The high temperature superconductors iron pnictides present singular magnetism. The undoped compound is metallic with Q=(pi,0) columnar ordering with low magnetic moment, lower than predicted in ab-initio calculations. A strong anisotropy is found in transport, optical and inelastic neutron experiments. This situation has put forward orbital ordering as a possible theoretical scenario. We calculate the mean field Q=(pi,0) magnetic phase diagram using a five orbital tight-binding model. For intermediate values of the interaction, metallic regimes with low and high magnetic moments arise both with orbital ordering. The low moment state is characterized by on-site antiparallel orbital magnetic moments and it is consistent with the strong exchange anisotropy found in neutron experiments. The orbital ordering found reproduces a large zx weight seen around Gamma in ARPES experiments. We also calculate the ratio of the Drude weight along the x and y directions for different interaction parameters. Large values of orbital ordering favor an anisotropy opposite to the one found experimentally. On the other hand Dx/Dy is strongly dependent on the topology and morphology of the reconstructed Fermi surface. This anisotropy extends to higher frequencies and changes direction as seen in optical experiments. Our results points against orbital ordering as the origin of the observed conductivity anisotropy, which may be ascribed to the anisotropy built by the magnetic state. [1]

[1]E. Bascones, M.J. Calderon, B. Valenzuela, PRL'10; B. Valenzuela, M.J. Calderon, E. Bascones, PRL'10.