Unconventional temperature-enhanced magnetism in $Fe_{1.1}Te$

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There are two common scenarios used to describe the magnetism in the families of Fe-based superconductors. In one, the magnetism originates from local atomic spins, while in the other it corresponds to a cooperative spin-density-wave instability (SDW) behavior of conduction electrons. Both assume clear partition into localized electrons, giving rise to local spins, and itinerant ones, occupying well-defined, rigid conduction bands. We have used inelastic neutron scattering to characterize both the static and the dynamic magnetism in a crystal of $Fe_{1.1}Te$, parent to $Fe_{1+y}Te_{1-x}Se_x$ family of superconductors.[1] In contrast to the simple pictures, we find that localized spins and itinerant electrons are coupled together. In particular, we have evaluated the effective magnetic moment by integrating both the elastic and inelastic magnetic scattering. The effective spin per Fe at $T \approx 10$ K, in the antiferromagnetic phase, corresponds to $S \approx 1$, consistent with the recent analyses that emphasize importance of Hund's intra-atomic exchange. However, it grows to $S \approx 3/2$ in the disordered phase, a result that presents a challenge to current theoretical models.

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[1] I. A. Zaliznyak, *et. al.* arXiv:1103.5073