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Electron correlations and magnetism in iron-based superconductors[1]

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We have carried out a comprehensive study of the phase diagram, structures and phase transitions in the system RbxFeySe2-zSz. We find that the iron content is crucial in stabilizing the stripe antiferromagnetic (AF) phase (y˜1.5), the block AF phase (y˜1,6) and the iron vacancy-free metallic phase (y˜2). These phases are separated by first order transitions.(1). In going from superconducting Rb0.8Fe2Se2 to non-superconducting Rb0.8Fe2S2 we observe in our ARPES experiments little change in the Fermi surface topology but an increase in the overall bandwidth by a factor of 2, hence demonstrating that moderate correlation is essential in achieving high Tc.(2). We show also using neutron scattering that for z=0 there is a sharp magnetic resonance mode well below the superconducting gap which is replaced by a broad hump structure above the gap for z˜1. (3). This is accompanied by an insignificant change in Tc. This implies a concomitant change from sign-reversed to sign preserved Cooper-Pairing symmetry driven by the change in electron band width. In this talk we will discuss the overall significance of this rich behavior observed in this alkali Fe-chalcogenide system.

1. Meng Wang et al., Phys. Rev. B 93, 075155 (2016)

2. M. Yi et al., PRL 115, 256403 (2015)

3. Qisi Wang et al., PRL 116, 197004 (2016)

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