Crystal structure and magnetic correlations of $Fe_{1+y}Te_{1-x}Se_x$ under ambient and applied pressure

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We will first discuss evolution of the crystal structure and magnetic correlations of $Fe_{1+y}Te_{1-x}Se_x$ as a function of x[1]. Then we will present a recently-found consequence of the complex balance between magnetism and conductivity in the iron chalcogenide, $Fe_{1.02}Se_{0.10}Te_{0.90}$[2]. By performing resistivity, bulk susceptibility and neutron di raction, we show that the both conductivity and magnetism are simultaneously enhanced by the application of external pressure. Surprisingly, the pressure-induced magnetic order is nearly three-dimensional, and incommensurate along both the c-axis and a-axis, in stark contrast to $Fe_{1+y}Te$ under ambient conditions. The correlated conductivity and magnetism is associated with local distortions that increase the bond angle of Te/Se-Fe-Te/Se, and we argue that the local structure play a crucial role in determining the electronic and magnetic properties of iron based compounds. We will also discuss similarities and di erences between iron and other nonconventional superconductors such as ruthernate and cuprates.

[1] S.-H. Lee *et al.*, Phys. Rev. B **81**, 220502(R) (2009); N. Katayama *et al.*, J. Phys. Soc. Jpn. **79**, 113702 (2010)

[2] N. Katayama *et al.* unpublished (2011)