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Hall effect study of iron chalcogenide $\mathbf{Fe}_{1+y}(\mathbf{Te}_{1-x}\mathbf{Se}_x)$ T.J. LIU, J. HU, B. QIAN, Z.Q. MAO, Department of Physics and Engineering Physics, Tulane University, New Orleans, LA 70118 — Our previous work reveals three composition regions with distinct physical properties in the phase diagram of $Fe_{1+y}(Te_{1-x}Se_x)$ (Liu *et al.*, Nature Materials **9**, 719 (2010)). Region I ($0 \leq x \leq 0.09$) exhibits long range $(\pi, 0)$ antiferromagnetic (AFM) order, while Region II ($0.09 < x < 0.29$) displays short range $(\pi, 0)$ magnetic correlations and is characterized by a weakly localized electronic state. Only in Region III ($x \geq 0.29$) do we find evidence of bulk superconductivity. In this talk, we will report Hall effect studies of this system. In the AFM state of Region I, we find that the inverse Hall angle (IHA) exhibits a quadratic temperature dependence, consistent with the Fermi liquid behavior probed by resistivity and specific heat measurements. In the weakly localized state of Region II, however, the IHA shows a linear temperature dependence, implying that the quasiparticle scattering rate in this region changes significantly compared with the AFM phase. We will discuss how quasiparticle scattering is associated with $(\pi, 0)$ magnetic fluctuations.

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