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Electronic disorder and magnetic-field-induced superconductivity enhancement in $\mathbf{Fe_{1+y}(Te_{1-x}Se_x)}$ JIN HU, TIJIANG LIU, BIN QIAN, ZHIQIANG MAO, Department of Physics and Engineering Physics, Tulane University — The iron chalcogenide $Fe_{1+y}(Te_{1-x}Se_x)$ superconductor system exhibits a unique electronic and magnetic phase diagram distinct from those seen in iron pnictides: bulk superconductivity does not appear immediately following the suppression of long-range (π,0) AFM order. Instead, an intermediate phase with weak charge carrier localization appears between AFM order and bulk superconductivity (Liu *et al.*, Nat. Mater. **9**, 719 (2010)). In this talk, we report our recent studies on the relationship between the normal state and superconducting properties in $Fe_{1+y}(Te_{1-x}Se_x)$. We show that the superconducting volume fraction V_{SC} and normal state metallicity significantly increase while the normal state Sommerfeld coefficient γ and Hall coefficient R_H drop drastically with increasing Se content in the underdoped superconducting region. Additionally, V_{SC} is surprisingly enhanced by magnetic field in heavily underdoped superconducting samples. The implications of these results will be discussed. Our analyses suggest that the suppression of superconductivity in the underdoped region is associated with electronic disorder caused by incoherent magnetic scattering arising from (π,0) magnetic fluctuations.

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