Phase diagram of Fe$_{1+y}$(Te$_{1-x}$Se$_x$): evolution from antiferromagnetism to superconductivity  
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Iron chalcogenide Fe$_{1+y}$(Te$_{1-x}$Se$_x$) is the simplified version of Fe-based superconductors [1,2] and has a unique antiferromagnetic (AFM) structure in the parent compound Fe$_{1+y}$Te [3,4]. In iron pnictide superconductor parent compounds, the AFM wavevector $Q_{AF}$ is along the FS nesting direction [5-7], while in Fe$_{1+y}$Te, $Q_{AF}$ is rotated 45° from the FS nesting direction. Understanding the magnetic and superconducting properties of this system is considered critical [8]. In this talk I will discuss the phase diagram of Fe$_{1+y}$(Te$_{1-x}$Se$_x$) that we recently established. We found that long-range AFM order is gradually suppressed by Se substitution, disappearing near 9% Se, above which short-range AFM order coexists with non-bulk superconductivity (NBSC). Bulk superconductivity (BSC) does not appear until the Se content is greater than 30%. The normal state exhibits distinct properties between the NBSC and BSC regions: metallic behavior is observed above $T_c$ for the BSC region, while the NBSC region exhibits weak localization behavior above $T_c$. These observations, together with our results of neutron scattering studies, suggest that the short-range magnetic order near $Q_{AF}$ leads to weak charge carrier localization, and is thus unfavorable to superconducting pairing.