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Electron Correlations and Superconductivity in Iron Pnictides and Chalcogenides

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In the iron pnictides, the bad metal behaviour in the normal state suggests the importance of electron correlations, which is further underscored by the existence of a Mott insulator state in the overall phase diagram of the iron chalcogenides. This has motivated a strong-coupling approach based on a proximity to the Mott transition. In this talk, I will briefly summarize earlier theoretical studies within this approach, which led to the proposal for a quantum critical point in the isoelectronically tuned iron pnictides [1]; this has since been verified in the P-doped iron arsenides. I will in addition show how the approach provides a natural understanding of a major issue in the field, namely the superconducting T_c of the iron chalcogenides is comparably high as in the iron pnictides in spite of their qualitatively distinct Fermi surfaces [2]. I will also consider the multi-orbital aspects of the electron correlations more generally, including a proposed orbital-selective Mott phase [3] in the normal state and implications for gap anisotropy and spin resonances [4] in the superconducting state. Finally, I will discuss how these results expand on the notion [5] that the iron-based superconductivity primarily originates from strong electron correlations, as well as some implications for the general phenomenon of unconventional superconductivity at the border of magnetism.

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