Novel Ordered Region Preceding The Magnetic And Structural Transition In Underdoped $Ba(Fe_{1-x}Co_x)_2As_2$ And $Fe_{1+y}Te$

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Point contact spectroscopy reveals a novel ordered region above the magnetic and structural transition temperatures for underdoped $Ba(Fe_{1-x}Co_x)_2As_2$ and $Fe_{1+y}Te$. The conductance measured across ballistic nanoscale Ag junctions reveals a coductance enhancement starting as high as 177 K for the parent pnictide ($T_N \sim 132$ K) and with decreasing temperature grows reminiscent of a gap opening. Our data indicates that the iron based superconductors are strongly correlated in their ground state. The energy scale and temperature dependence of the spectrum indicates that it may arise from the orbital ordering that persists above T_N as detected by ARPES[1]. Similar results are observed in the chalcogenides. We construct a modified phase diagram for Co-doped Ba122 showing a new ordered region existing above T_N and T_S for the underdoped regime.

[1]M. Yi et al., PNAS **108**, 6878 (2011).