Avoided Quantum Criticality and Magnetoelastic Coupling in BaFe2-xNixAs2

We study the structural and magnetic orders in electron-doped BaFe2-xNixAs2 by high-resolution synchrotron x-ray and neutron scatterings. Upon Ni doping x, the nearly simultaneous tetragonal-to-orthorhombic structural (Ts) and antiferromagnetic (NT) phase transitions in BaFe2As2 are gradually suppressed and separated, resulting in sNT>T with increasing x, as was previously observed. However, the temperature separation between sT and NT decreases with increasing x for x≥0.065, tending toward a quantum bicritical point near optimal superconductivity at x≈0.1. The zero-temperature transition is preempted by the formation of a secondary incommensurate magnetic phase in the region 0.088≲x≲0.104, resulting in a finite value of NT≈cT+10 K above the superconducting dome around x=0.1. Our results imply an avoided quantum critical point, which is expected to strongly influence the properties of both the normal and superconducting states.

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