

Quantum Criticality and Superconductivity in $\text{Ba}(\text{Fe}_{1-x}\text{Co}_x)_2\text{As}_2$ Investigated by Ultrasonic Measurements

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Superconducting phase in iron pnictides is located closely to a magnetic phase, which accompanies a structural change. Such a phase diagram, which is often seen in many systems of oxide superconductors, heavy fermion superconductors and organic superconductors, has been intensively investigated from the viewpoint of superconductivity near quantum critical point (QCP). We have measured elastic constants of $\text{Ba}(\text{Fe}_{1-x}\text{Co}_x)_2\text{As}_2$ for the samples with various concentration from under-doped to over-doped regions. The temperature dependence of the elastic constant C_{66} is particularly interesting. It shows a very large softening toward the structural transition temperature for under-doped samples. The anomaly in C_{66} is very large in under-doped region, and tends to disappear with increasing Co concentration for over-doped region. Such behavior can be understood in the frame of the quantum criticality, which has been well investigated for magnetic systems. For $\text{Ba}(\text{Fe}_{1-x}\text{Co}_x)_2\text{As}_2$, the elastic constant, which is connected to a strain susceptibility, plays the same role as the magnetic susceptibility for the magnetic QCP systems. Our results suggest a strong participation of the structural instability to the superconductivity.

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