Quantum impurities and resultant two-channel Kondo problem in $ZrAs_{1.58}Se_{0.39}$

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Low-T electrical resistivity $\rho(T)$ of the closely related phases $ZrAs_{1.58}Se_{0.39}$ (3% of vacancies within the monoatomic As layers) and $ZrP_{1.54}S_{0.46}$ (the 2a site fully occupied with P atoms) has been investigated along the c axis down to $T \gtrsim 0.08$ K and in $B \leq 14$ T. Whereas for both systems a $-AT^{1/2}$ term in $\rho(T)$ was observed below $T \approx 15$ K, their response to the magnetic field was found to be *qualitatively* different: for the As-based compound, a coefficient A ($= 0.167\ \mu\Omega\mathrm{cmK}^{-1/2}$) remains virtually unchanged even in the highest available magnetic fields. For the P-based compound, however, the A-coefficient value is linearly reduced from 0.038 to 0.008 $\mu\Omega\mathrm{cmK}^{-1/2}$ with increasing B up to 14 T, *i.e.*, by factor nearly 5. These distinctly different observations indicate *qualitatively* different phenomena occurring in the material with ($ZrAs_{1.58}Se_{0.39}$) and without ($ZrP_{1.54}S_{0.46}$) broken pnictogen-pnictogen chemical bonds: a $\rho(T, B)$ behavior of the latter system is characteristic for the 3D electron-electron interactions, while the B-independent $-AT^{1/2}$ term points at a two-channel Kondo problem derived from two-level states triggered by non-magnetic quantum impurities in the As layers.

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