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CJP Best Paper Award: The effect of quasiparticle-self-energy on $\text{Cd}_2\text{Re}_2\text{O}_7$ superconductor

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The magnitude and the temperature dependence of the superconducting order parameter $\Delta(T)$ of single-crystals of $\text{Cd}_2\text{Re}_2\text{O}_7$ ($T_c = 1.02\text{K}$) was measured using point-contact spectroscopy. In order to fit the conductance spectra and to extract the order parameter at different temperatures we generalized the Blonder-Tinkham-Klapwijk theory by including the self-energy of the quasiparticles into the Bogoliubov equations.

This modification enabled excellent fits of the conductance spectra.

$\Delta(T)$ increases steeply below the superconducting transition temperature of 1.02 K and levels off below $\sim 0.8\text{K}$

at a value of 0.22(1) meV, $\approx 40\%$ larger than the BCS value.

Our results indicate the presence of a strong electron-phonon interaction and an enhanced quasiparticle damping

and may be related to a possible phase transition within the superconducting region at $\sim 0.8\text{K}$.

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