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CJP Best Paper Award: The effect of quasiparticle-self-energy on $Cd_2Re_2O_7$ superconductor

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The magnitude and the temperature dependence of the superconducting order parameter $\Delta(T)$ of single-crystals of $Cd_2Re_2O_7$ (T_c = 1.02˜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 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 K.

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