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Electronic structure of the heavy-fermion superconductor $PuCoGa_5$ probed via the dynamics of photoinduced quasiparticles. DIYAR TALBAYEV, Yale University, K.S. BURCH, University of Toronto, E.E.M. CHIA, Nanyang Technological University, S.A. TRUGMAN, J.-X. ZHU, E.D. BAUER, J.A. KENNISON, J.N. MITCHELL, J.D. THOMPSON, J.L. SARRAO, A.J. TAYLOR, Los Alamos National Laboratory — We studied the relaxation of photoinduced quasiparticles in the heavy-fermion superconductor $PuCoGa_5$ using pump-probe spectroscopy. The relaxation time of photoinduced reflectance in the normal state allows an estimate of the electron-phonon coupling constant λ =0.20-0.26, which is incompatible with the measured T_c and speaks against phonon-mediated superconducting pairing. Upon lowering the temperature in the normal state ($T>T_c$), we find an order-of-magnitude increase of the relaxation time – evidence for the presence of a hybridization gap in the electronic density of states. The relaxation slows down due to a coupling of quasiparticle population to a slowly decaying non-equilibrium high-frequency phonon population. A kinetic model that describes the coupled quasiparticle and phonon populations allows the estimate of the hybridization gap magnitude to be ∼90 K. Our measurement provides the first evidence for the presence of a hybridization gap in $PuCoGa_5$. The observed dynamics in the superconducting state confirms that the heavy quasiparticles detected in the normal state also participate in the superconducting pairing.

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