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Resonant quantum impurities in a Fermi gas: From the classical limit to Fermi polarons ZHENJIE YAN, BISWAROOP MUKHERJEE, PARTH PATEL, AIRLIA SHAFFER-MOAG, CEDRIC WILSON, LEV KENDRICK, RICHARD FLETCHER, Massachusetts Inst of Tech-MIT, JULIAN STRUCK, Ecole Normale Suprieure / PSL Research University, MARTIN ZWIERLEIN, Massachusetts Inst of Tech-MIT — The fate of impurities immersed in a quantum environment is a paradigmatic problem in many-body physics. We prepare a highly imbalanced, homogeneous spin mixture of fermions with resonant interactions and study the emergence of Fermi polarons upon cooling. The energy, lifetime and coherence of the Fermi polarons are extracted from radio-frequency spectra. Upon cooling the gas from non-degenerate temperatures, we first observe an increase in the spectral width of the impurity particles, revealing their shortened mean-free path. As impurities dress into Fermi polarons, the spectra narrow again. Furthermore, we measure the pressure temperature relation of these imbalanced spin mixtures. The equation of state shows a good agreement with a simple Fermi liquid pressure ansatz at low temperature while it can be described by a Virial expansion in the high temperature regime.

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