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Breakdown of Landau's Fermi liquid theory in a Strongly Interacting Fermi Gas TARA DRAKE, YOAV SAGI, RABIN PAUDEL, DEBORAH JIN, JILA, NIST and University of Colorado — We present a novel measurement of the single particle spectral function for a homogeneous Fermi gas above the critical temperature throughout the BCS-BEC crossover. We observe that the dispersion can be fitted extremely well by a function composed of two parts: the spectral function of bound pairs and that of a Landau Fermi liquid (FL). We find that already at unitarity, the FL theory is largely unsuited to describe the data, which exhibits a predominantly pair-like dispersion. For diminishing attractive interactions, the spectral function converges to that expected by a FL, from which we get the effective mass of the fermionic quasiparticle. Our data reconciles different past experimental observations by showing how the many-body behavior of fermions in the BCS-BEC crossover changes from a FL to a molecular Bose gas over a rather small region.

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