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Observation of heat transport in Unitary Fermi gases ZHENJIE YAN, PARTH PATEL, BISWAROOP MUKHERJEE, CEDRIC WILSON, AIRLIA SHAFFER-MOAG, RICHARD FLETCHER, MARTIN ZWIERLEIN, Massachusetts Institute of Technology MIT — Understanding heat transport in strongly correlated quantum matter has proven to be both experimentally and theoretically a challenging task as it involves detecting local temperature variations. Here, we demonstrate experimentally a method to create and probe a local temperature disparity in a unitary Fermi gas. In order to create a local hot spot, we modulate a spatially periodic optical potential on part of the atomic cloud to create fast decaying high energy phonons. Using a radio frequency pulse as a temperature sensitive probe allows us to map out the spatial temperature distribution of the atomic gas. We observe two distinctive modes for the transfer of heat in unitary fermi gases: heat propagates diffusively above the superfluid transition, while a wave-like motion happens below the critical temperature. Measuring the time scale of thermal evolution processes allows us to extract the thermal diffusivity as well as the superfluid fraction below transition temperature to superfluid.

Zhenjie Yan
Massachusetts Institute of Technology MIT

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