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Second sound and the superfluid fraction in a resonantly interacting Fermi gas LEONID SIDORENKOV, MENG KHOON TEY, RUDOLF GRIMM, Institut für Quantenoptik und Quanteninformation (IQOQI), Österreichische Akademie der Wissenschaften, 6020 Innsbruck, Austria, YAN-HUA HOU, LEV PITAEVSKII, SANDRO STRINGARI, Dipartimento di Fisica, Università di Trento and INO-CNR BEC Center, 38123 Povo, Italy — Key signatures of superfluidity, like the absence of viscosity and the formation of quantized vortices, have already been observed in ultracold gases. Surprisingly, a direct observation of second sound has so far remained elusive. Second sound is an entropy wave, characterized by local out-of-phase oscillation of the normal and the superfluid component. Here we report on the first observation of second sound propagating in a superfluid Fermi gas. The ability to measure the speed of second sound allows us to extract the temperature dependence of the superfluid density. So far this quantity has been inaccessible in strongly interacting Fermi gas. Our results complement recent measurements of the equation of state for resonantly interacting Fermi gas and provide valuable information for understanding the elementary excitation spectrum of this system.

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