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Fermion superuid with hybridized s- and p-wave pairings LIHONG ZHOU, Institute of Physics, Chinese Academy of Sciences, WEI YI, University of Science and Technology of China, XIAOLING CUI, Institute of Physics, Chinese Academy of Sciences, UNIVERSITY OF SCIENCE AND TECHNOLOGY OF CHINA COLLABORATION — Ever since the pioneering work of Bardeen, Cooper and Schrieffer in the 1950s, exploring novel pairing mechanisms for fermion superfluids has become one of the central tasks in modern physics. Here, we investigate a new type of fermion superfluid with hybridized s- and p-wave pairings in an ultracold spin-1/2 Fermi gas. Its occurrence is facilitated by the co-existence of comparable s- and p-wave interactions, which is realizable in a two-component 40K Fermi gas with close-by s- and p-wave Feshbach resonances. The hybridized superfluid state is stable over a considerable parameter region on the phase diagram, and can lead to intriguing patterns of spin densities and pairing elds in momentum space. In particular, it can induce a phase-locked p-wave pairing in the fermion species that has no p-wave interactions. The hybridized nature of this novel superfluid can also be confirmed by measuring the s-wave and p-wave contacts, which can be extracted from the high- momentum tail of the momentum distribution of each spin component. These results enrich our knowledge of pairing superfluidity in Fermi systems, and open the avenue for achieving novel fermion superfluids with multiple partial-wave scatterings in cold atomic gases.

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