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**Exploring an ultracold Fermi-Fermi mixture of  ${}^6\text{Li}$  and  ${}^{40}\text{K}$**

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**Abstract:**

We study the properties of ultracold mixtures of two fermionic species,  ${}^6\text{Li}$  and  ${}^{40}\text{K}$ . We discovered 13 interspecies Feshbach resonances. Interpretation of the measurements unambiguously assigns molecular bound states to the various resonances and fully characterizes the ground-state scattering properties in any combination of spin states. We measured the lifetime of a weakly interacting  ${}^{40}\text{K}$  probe immersed in a strongly interacting  ${}^6\text{Li}$  gas across the  ${}^6\text{Li}$  BEC-BCS crossover. Long lifetimes permit the use of  ${}^{40}\text{K}$  to measure the temperature of the system even on resonance, which so far was only possible using an indirect method.