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Controlling interactions in ultracold fermionic ytterbium-173 MORITZ HÖFER, LUIS RIEGGER, CHRISITIAN HOFRICHTER, DIOGO RIO FERNANDES, IMMANUEL BLOCH, SIMON FÖLLING, Max-Planck-Institut für Quantenoptik — The possibility to tune the interactions of ultracold atomic gases with an external magnetic field has become a vital tool for many quantum gas experiments. For fermionic ytterbium-173 both the $^1S_0$ ground state and $^3P_0$ metastable state have vanishing angular momentum $J = 0$ and therefore no magnetic Feshbach resonances are expected. Here we report on the discovery of a novel type of Feshbach resonance, which was predicted to exist due to orbital-mixing interactions. It occurs universally for all hyperfine-state combinations of ytterbium-173 and is located at experimentally accessible magnetic fields. The scattering properties are characterized by inter-orbital cross-thermalization measurements in the bulk as well as high resolution clock-line spectroscopy in a three-dimensional lattice. Furthermore, we study the dynamics of a strongly interacting two-orbital quantum gas in two dimensions.

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