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Ytterbium Fermi gases for impurity physics OSCAR BETTERMANN, NELSON DARKWAH OPPONG, GIULIO PASQUALETTI, LUIS RIEGGER, IMMANUEL BLOCH, SIMON FOELLING, LMU, Munich, Germany; MPQ, Garching, Germany — As an alkaline-earth-like atom, Ytterbium features two long-lived states without angular momentum, the ground state and a metastable "clock" state, allowing for the realization of Fermionic gases with an additional orbital degree of freedom. This orbital degree can be used to implement different types of impurity systems. In Ytterbium-173, an interorbital Feshbach resonance between the ground state and the clock state enables the study of strongly interacting two-orbital many-body systems. Using a one-dimensional optical lattice, we study the resulting Fermi polarons in two dimensions. We find clearly defined polarons both on the repulsive and the attractive side of the resonance, with a long lifetime of the repulsive 2D polaron. The metastable state also enables state-dependent potentials, which was proposed for studying Kondo-type impurity physics, or the Kondo lattice model. For this, the existence of a spin-exchange interaction is crucial. We investigate the interaction properties of Ytterbium-171, and find an antiferromagnetic inter-orbital spin exchange, in contrast to the known ferromagnetic coupling in Ytterbium-173. This should enable future orbital physics implementations to access both the ferro- and the antiferromagnetic regime.

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