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A new ytterbium experiment for single-atom resolved quantum impurity problems

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Recent advances in the microscopic optical manipulation of cold atomic systems have extended our experimental control capabilities down to the level of single particles or single excitation quanta, providing exciting opportunities to explore quantum many-body problems with a novel bottom-up perspective. Here, I will describe ongoing work to develop a modern experimental apparatus in Trieste, aiming to trap, control and detect individual ytterbium atoms to rapidly assemble mesoscopic many-particle systems with low entropy. Ytterbium presents several key features which make it an excellent system to investigate open questions in strongly correlated matter, especially regarding quantum impurities and their mediated long-range interactions. Equipped with the precise atomic clock toolbox of two-electron atoms, we will target the dynamical formation of Fermi polarons and Kondo resonances by controllably embedding individual orbital impurities in an itinerant fermionic band, towards a programmable two-orbital fermionic quantum simulator.

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