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A new experimental apparatus for trapping ytterbium atoms in optical tweezer arrays

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Ultracold neutral atoms trapped in optical lattices and optical tweezers have emerged as groundbreaking tools to realize new systems for quantum information processing, precision measurements and quantum simulation. Optical tweezer arrays provide the ability to spatially manipulate ultracold atoms and control tunneling and interaction at the single-particle level, allowing the study of many-body physics phenomena in presence of impurities. The ytterbium atom reveals as a perfect candidate for studying this kind of physics due to its rich level structure providing very low temperature cooling and due to the presence of both bosonic and fermionic isotopes. My PhD project inserts in this context, in an experiment started in 2021 from the collaboration of the University of Trieste (UniTs) and CNR-INO unit of Basovizza (TS). Here, we designed (and at the moment we are realizing) a novel experimental apparatus for trapping ultracold Yb atoms in optical tweezer micro-traps, comprehensive of lasers paths used for cooling, trapping and manipulating atoms, and the UHV vacuum system, which is connected to the science cell.

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