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Gravity sensing with Very Long Baseline Atom Interferometry DENNIS SCHLIPPERT, HENNING ALBERS, LOGAN L. RICHARDSON, DIPANKAR NATH, CHRISTIAN MEINERS, ETIENNE WODEY, CHRISTIAN SCHUBERT, WOLFGANG ERTMER, ERNST M. RASEL, Institut fuer Quantenoptik, Leibniz Universitaet Hannover — Very Long Baseline Atom Interferometry (VLBAI) has applications in high-accuracy absolute gravimetry, gravity-gradiometry, and for tests of fundamental physics. Extending the baseline of atomic gravimeters from tens of centimeters to meters opens the route towards competition with superconducting gravimeters. The VLBAI-test stand will consist of a 10m-baseline atom interferometer allowing for free fall times of seconds. In order to suppress environmental noise, the facility utilizes a state-of-the-art vibration isolation platform and a three-layer magnetic shield. We envisage a resolution of local gravitational acceleration of $5 \cdot 10^{-10}$ m/s^2 with sub-ppb inaccuracy. Operation as a gradiometer will allow to resolve the gravity gradient at a resolution of $5 \cdot 10^{-10}$ 1/s^2. The operation of VLBAI as a differential dual-species gravimeter using ultracold mixtures of Yb and Rb atoms enables quantum tests of the universality of free fall (UFF) at an unprecedented level, with the potential to surpass the accuracy of the best experiments to date. We report on a quantum test of the UFF using two different chemical elements, ^{39}K and ^{87}Rb, reaching a 100 ppb inaccuracy and show the potential of UFF tests in VLBAI at an inaccuracy of 10^{-13} and beyond.

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