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Gravity sensing using Very Long Baseline Atom Interferometry DENNIS SCHLIPPERT, ÉTIENNE WODEY, CHRISTIAN MEINERS, DOROTHEE TELL, CHRISTIAN SCHUBERT, WOLFGANG ERTMER, ERNST M. RASEL, Institut für Quantenoptik, Leibniz Universität Hannover — Very Long Baseline Atom Interferometry (VLBAI) has applications in high-accuracy absolute gravimetry, gravity-gradiometry, and for tests of fundamental physics. Thanks to the quadratic scaling of the phase shift with increasing free evolution time, extending the baseline of atomic gravimeters from tens of centimeters to meters puts resolutions of 10^{-13} g and beyond in reach. We present the design and progress of key elements of the VLBAI-test stand: a dual-species source of Rb and Yb, a high-performance two-layer magnetic shield, and an active vibration isolation system allowing for unprecedented stability of the mirror acting as an inertial reference. We envisage a vibration-limited short-term sensitivity to gravitational acceleration of $1 \cdot 10^{-8}$ m/s^2/Hz$^{1/2}$ and up to a factor of 25 improvement when including additional correlation with a broadband seismometer. Here, the supreme long-term stability of atomic gravity sensors opens the route towards competition with superconducting gravimeters. 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 of $\leq 10^{-13}$, potentially surpassing the best experiments to date.

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