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Fundamental physics with space and ground atomic quantum sensors

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Matter-wave interferometry has recently led to the development of new techniques for the measurement of inertial forces, with important applications both in fundamental physics and applied research. The remarkable stability and accuracy that atom interferometers have reached for acceleration measurements can play a crucial role for science and technology. Quantum sensors based on atom interferometry had a rapid development during the last two decades and different measurement schemes were demonstrated and implemented. Atom interferometry is used for precise measurements of the gravitational acceleration, Earths gravity gradient, and rotations. Experiments on the validity of the equivalence principle and on the measurement of the gravitational constant G have been performed, while tests of general relativity and of Newton's 1/r^2 law as well as the detection of gravitational waves have been proposed. Accelerometers based on atom interferometry have been developed for many practical applications including metrology, geodesy, geophysics, engineering prospecting and inertial navigation. Ongoing studies show that the space environment will allow us to take full advantage of the potential sensitivity of atom interferometers. The talk will give on overview of state of the art and future prospects of atom interferometry sensors on ground and in space.

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