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TOWARDS A MATTER WAVE INTERFEROMETER ON A SOUNDING ROCKET

Abstract

Applications of coherent matter waves are high resolution interferometers for measuring inertial and gravitational forces as well as testing fundamental physics, for which they may serve as a laser like source with mesoscopic quantum features. Out of possible applications, the test of the principle of equivalence in the quantum domain is selected as a target with the highest scientific interest on timescales of a microgravity experiment at the ISS or on a free flyer (ATV, FOTON or other satellites). The QUANTUS project demonstrated the technological feasibility of coherent matter waves in microgravity. As a next step, the consortium will prepare and procure a sounding rocket mission to demonstrate technologies for matter wave interferometry based on the broad experience of former developments with experiments in the droptower. Therefore, the experiment has to withstand strong requirements concerning environmental conditions (Temperature, shock, environmental pressure, etc.) and needs to be designed to fit in a 600 l volume (diameter 35 cm, length 160 cm). It is considered as an important step towards the technology required for the ISS and other platforms. These experiments will give further insights on the potential of inertial sensors based on atom interferometers and the technology is for example of interest for applications in earth observation and geodesy. They could replace classical techniques relying on test masses and promise a further improvement in the accuracy of such devices.