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EXPANDING THE POSSIBILITIES OF SPACE BORNE QUANTUM BASED EXPERIMENTS

Abstract

Atom Interferometry today is an established tool for performing precision tests for several fundamental physical effects. Apart from ground based tests of the weak equivalence principle, a cornerstone of Einstein's general relativity, or the determination of physical constants, plans are being made for gravitational wave detection and dark energy investigations. While all of the former experiments suffer from a short atom interrogation time caused by gravity, space born applications promise remarkably higher precisions for all of these tests. Atom interferometry is based on manipulation of cold atoms in the μK-pK regime, produced by several laser cooling techniques followed by a final evaporative cooling step. In the Primus collaboration this last step, in contrast to similar experiments in microgravity, is performed in a pure optical potential, called a dipole trap, providing several advantages over magnetic trapping. Because gravity plays a major role in this form of evaporation its feasibility in the absence of gravity has to be shown. This talk will be about evaporation from an optical potential in the drop tower in Bremen, setting the foundation for cold atom based space exploration. The PRIMUS project is supported by the German Space Agency DLR with funds provided by the Federal Ministry for Economic Affairs and Energy (BMWi) under grant number DLR 50 WM 1642.