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ORKA - TOWARDS A CAVITY ENHANCED DIPOLE TRAP FOR ULTRA COLD ATOMS IN SPACE

Abstract

Ultra cold atoms in space offer several unique opportunities to test fundamental physics, for example, tests of the equivalence principle. Evaporative cooling in optical traps is a widely used method for preparing such ultra-cold atoms and generating Bose-Einstein condensates (BECs). However, this approach often requires a significant power budget for trapping and cooling, making it less suitable for energy-constrained, space-based setups where magnetic chip traps are typically preferred. All-optical traps offer distinct advantages over chip traps, notably the freedom to manipulate the magnetic field and an enhanced symmetry of the trap. To leverage these benefits while addressing limited power budgets, we are investigating the use of a resonantly enhanced 1064 nm optical dipole trap for ^{87}Rb. As an initial step, we are developing a bow-tie cavity for evaporative cooling to achieve Bose-Einstein condensation, which will serve as a matter-wave source for interferometry in free-fall experiments at the Gravitower Bremen facility. This work presents our experimental design, current progress, and preliminary tests of the resonator. This work is supported by the German Space Agency (DLR) with funds provided by the Federal Ministry for Economic Affairs and Climate Action under grant number DLR 50 WM 2267.