Characterization of Cooling and Launch Dynamics of Cold ^{133}Cs Atoms for Quantum Gravimetry

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We present a characterization of the cooling and launch dynamics of cold ^{133}Cs atoms in a magneto-optical trap (MOT), aimed at optimizing their use as a source for quantum gravimetry. Cold atom interferometers enable high-precision measurements of gravitational acceleration [1, 2].

The temporal response of the MOT magnetic field is investigated through induced voltage measurements in a probe coil, revealing a damped oscillatory transient consistent with an effective RLC circuit arising from inductive coupling and parasitic capacitances. The extracted time constants show a strong asymmetry between loading and fast discharge processes.

The loading and decay dynamics of the atomic cloud are characterized via fluorescence measurements, following a rate equation model. From exponential fits, we extract steady-state atom numbers and characteristic lifetimes.

Additionally, the temperature of the atomic cloud is determined using time-of-flight expansion, allowing extraction of the thermal velocity distribution.

Finally, we explore the role of dynamic cooling sequences and frequency detuning during the launch stage, connected to non-adiabatic effects such as cloud segmentation [3].

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