Cold Atom Sagnac Interferometer

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The very high sensitivity of matter-wave interferometry for detecting accelerations and rotations has made it to an ideal tool for applications in fundamental physics and metrology[1]. We report on the status of our dual atom interferometer for the precise determination of inertial forces. The aim is to investigate different interferometer pulse sequences, and measurements strategies like continuous or pulsed operation.

In this project we use the synchronous operation of two counterpropagating atom interferometers to discriminate between accelerations and rotations. The ensembles of 10μk cold ^{87}Rb atoms are launched with a velocity of about 4.4m/s from two double-mot sources on precisely controlled parabolas into the interferometer chamber. After the preparation of the atoms in the groundstate, a sequence of three atom-light interactions follows in the interferometry chamber forming the actual interferometer by coherently splitting, deflecting and recombining the atoms. These manipulations have been realized with optical Raman transitions. The detection is realized by measuring the fluorescence light in both output states in each interferometer. All this allows for a compact and transportable setup while still enabling sensitivities comparable to the best conventional sensors.

In the current low resolution mode, we optimize critical interferometer components such as atom preparation and detection and analyze systematic effects. Finally we will present the scheme to upgrade the experiment to the full sensitivity of $2*10^{-9}$ rad/s for $1*10^{8}$ atoms per shot at a velocity of 3m/s.

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[1] C. Jentsch, T. Müller, E.M. Rasel, and W. Ertmer, Gen. Rel. Grav. 36(10), 2197(2004)