Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Competition between spin echo and spin self-rephasing in a trapped atom interferometer XAVIER ALAUZE, ALEXIS BONNIN, FRANCK PEREIRA DOS SANTOS, SYRTE - Observatoire de Paris, CYRILLE SOLARO, Aarhus University, JEAN-NOEL FUCHS, Laboratoire de Physique Theorique de la Matiere Condensee - UPMC, FREDERIC COMBES, FREDERIC PICHON, Laboratoire de Physique des Solides - Universite Paris-Sud — The FORCA-G project aims to develop a quantum sensor to probe short range forces. We realize a trapped atom interferometer of ^{87}Rb in a vertical optical lattice in which stimulated Raman transitions induce coherent coupling between adjacent lattice sites. We thus measure the Bloch frequency with a state-of-the-art relative sensitivity of 1.8 10^{-6} at 1s. Optical evaporative cooling allows us to increase the density and thus the number of atoms per well. We studied in a recent work the impact of atomic interactions at densities of a few 10^{12} atoms/cm^3. We observe, in the dipolar trap, an unexpected behaviour of the contrast, when applying a π-pulse to symmetrize the interferometer. These results are interpreted as a competition between the spin-echo technique and a spin self-rephasing (SSR) mechanism based on identical spin rotation effect (ISRE) . Originating from particle indistinguishability, SSR is a remarkable mechanism that can enhance the clock's coherence up to several tens of seconds. This illustrates the important role of atomic interactions, in quantum sensors based on trapped ultracold atomic ensembles. They can lead to complex and non-intuitive dynamics of the system, either detrimental or favorable depending on the interferometer configuration.

Xavier Alauze
SYRTE - Observatoire de Paris

Date submitted: 28 Jan 2017 Electronic form version 1.4