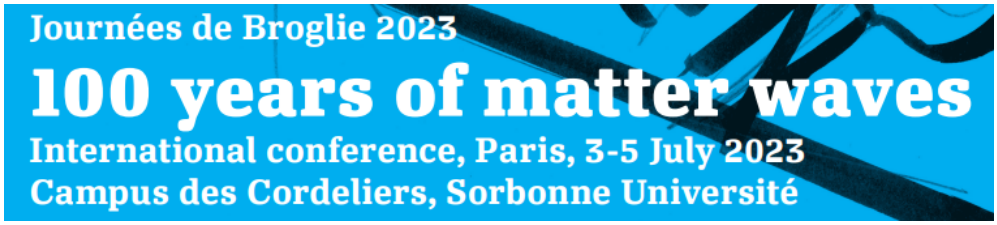

Atomic interferometry based inertial sensors

Arnaud Landragin, Quentin Beaufils, Remi Geiger, Carlos Garrido Alzar, Sébastien Merlet, Franck Pereira dos Santos and Leonid Sidorenkov

LNE-SYRTE, Observatoire de Paris, Université PSL, CNRS, Sorbonne Université,
61 avenue de l'Observatoire,75014 Paris, France

Abstract

Atomic interferometry is based on the principle of wave-matter duality, stated by Louis de Broglie. In practice, most atomic interferometers are based on the manipulation of atomic wave packets (separation and deflection) by light. Since the pioneering experiments of 1991, atomic interferometry has established itself as a unique tool for the precise measurement of fundamental constants and gravito-inertial effects. It covers multiple applications in metrology, inertial navigation, geophysics, fundamental physics tests, and has been proposed for the detection of gravitational waves. Indeed, atomic interferometry combines both a high intrinsic sensitivity and a high accuracy thanks to the high level of control of the atom-laser interaction.
In particular, interferometers with free-falling atoms have shown state-of-the-art performances as gravimeters and gyroscopes, and very promising performances as gradiometers. Important efforts are being made to improve their accuracy and sensitivity by using more coherent atomic sources and more complex atomic manipulation on the one hand, and to make them more robust to parasitic vibrations and to extend their fields of application on the other hand. Behind these developments, trapped or guided interferometers are more prospective and open to new applications such as local force measurements. In particular, they could benefit from quantum engineering protocols to improve the sensitivity below the quantum standard detection limit.