Development of a multi species cold atom interferometer

Clément Diboune[1], Alexis Bonnin[1], Nassim Zahzam[1], Yannick Bidel[1], Alexandre Bresson[1], Malo Cadoret[1,2]

[1]ONERA, DMPH, BP 80100, 91123 Palaiseau, France

[2]Conservatoire National des Arts et Métiers (CNAM), 75003 Paris, France

Atom interferometry is now proven to be a very efficient technique to achieve highly sensitive and absolute inertial sensors. As a matter of fact gyroscopes or gravimeters based on this technique by using cold atoms have already been developed and give now very promising performance.

Our work concerns particularly the development of a multi species atom interferometer addressing mainly the topics of onboard applications such as navigation or geophysics, but also fundamental physics. At ONERA a double species – ^{87}Rb / ^{85}Rb – cold atom interferometer has already been developed and allowed the first atomic test of the weak equivalence principle with simultaneous measurements. We have also pointed out the interest of using more than one atomic species in the instrument through the development of original concepts to improve inertial measurements. We are currently working on the implementation of a third atomic species – ^{133}Cs – to go further into these concepts and get rid of the dead times measurements inherent to the use of a single species atomic interferometer. It could also be of interest for the equivalence principle test by comparing the free fall between cesium and rubidium.

The first step towards the triple species – ^{87}Rb / ^{85}Rb / ^{133}Cs – cold atom interferometer is the development of the laser needed for the cesium's cooling and manipulation**.** We are currently building a fibered laser system using an original approach potentially well suited for onboard applications.

We will present the ongoing progress concerning the laser development and also the different concepts of use of the multi species atom interferometer.