First steps towards a multi-species atom interferometer for inertial measurements

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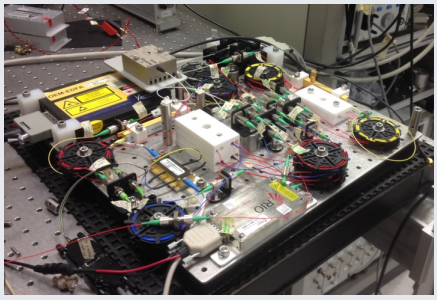
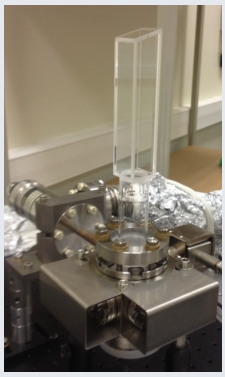
Cold atom interferometry has allowed in the last decades the development of extremely sensitive and accurate inertial sensors for measuring the gravity acceleration, Earth's gravity gradient or rotations. They appear very promising for a wide range of applications such as inertial navigation, geodesy, natural resource exploration, or fundamental physics. Up to now, cold atom interferometers involve the manipulation of a single atomic species. Our project at ONERA, aiming to handle three atomic species (^{87}Rb, ^{85}Rb and ^{133}Cs) simultaneously in the same instrument, would allow to take a big step in the field of cold atomic inertial sensors. A strong point of using different atomic species in the same instrument, compared to a single species experiment, is the ability to increase the number of complementary measurements without disturbance that could arise from spontaneous emission, the lasers manipulating one species having no influence on the other species.

We are currently finalizing the experimental apparatus. An innovative fibered laser system allowing the manipulation of the three atomic species has been developped and has allowed as a first step the cooling and trapping of cesium atoms. In the short term, the next step will be to cool and trap simultaneously the three atomic species at the same position. Note that this laser setup will be also useful for other experiments at LAC such as ionization of laser cooling of a cesium beam.



Fibered laser system



Vacuum cell of the multi-species interferometer

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