

Postdoc position in atom interferometry and test of fundamental physics at the SYRTE laboratory

Starting date: July 1st, 2017 - Duration: 1 year (renewable). Location: Paris, France.

Cold atom interferometers have reached sensitivity and accuracy levels competing with or outperforming inertial sensors based on different technologies. Our project aims at exploiting a state of the art atom interferometer for a test of a fundamental symmetry of Physics, the Lorentz symmetry.

Context. The quest for a unified theory of the gravitational interaction (described within the theory of General Relativity) and the strong and electro-weak interactions (described by quantum field theory) has been the focus of intense theoretical efforts for more than 50 years. Unification theories (e.g. string theory) often resort to extra dimensions which result in violations of the fundamental laws of physics, in particular the Einstein Equivalence Principle. One aspect of such violation is that of the Lorentz symmetry, i.e. a breaking of the invariance of the fundamental laws of physics under rotations or boosts.

Many experimental tests of Lorentz symmetry have been performed with vastly different types of system ranging from pulsar observations, planetary orbital dynamics, torsion balances, optical or microwave cavities, or atomic physics experiments. Up to now, these tests have yet shown no violation of Lorentz symmetry. The goal of our project is to improve the sensitivity of the tests of Lorentz symmetry involving the coupling between matter and gravity, an area which has been hardly explored experimentally. The test will be performed using a state of the art cold atom accelerometer of the SYRTE laboratory. We will perform the first test of Lorentz invariance with a horizontal atom accelerometer featuring a stability of $10^{-11} m \cdot s^{-2}$, in order to achieve a potential improvement of three orders of magnitude compared to previous results.

Description of the work. The work will be conducted on the cold atom gyroscope-accelerometer experiment of the SYRTE laboratory, within the team “Atom interferometry and inertial sensors”. The experiment was built 8 years ago and has been constantly improved since then. The postdoc will supervise a PhD student and the operation of the experiment in order to perform the Lorentz invariance test. The work will be mainly of experimental nature, followed by data analysis and collaboration with our theory partners.

Application. We are looking for outstanding candidates, preferably with experience in atomic physics, cold atoms, or atom interferometry. The applicant should be used to experimental team work, with analytical and interdisciplinary thinking. The position is based on a full-time employment at the SYRTE laboratory. The interested candidate should address a CV and a motivation letter to Remi Geiger (email: remi.geiger@obspm.fr).