Abstract
The past decades have seen dramatic progress in our ability to manipulate and coherently control the motion of atoms. This exquisite control offers the prospect of a new generation of force sensors [1] of unprecedented sensitivity and accuracy, from applications in navigation and geophysics, to tests of general relativity or studies of highly-entangled quantum states. The spectacular sensitivity of matter-wave interferometers can be used for very precise measurements. It is for example possible to measure the acceleration of gravity with an accuracy of 1 part per billion, the rotation of the Earth with an accuracy better than 1 millidegree per hour and detect minute changes in gravity caused by mass displacements. These devices are so precise that they are used today as reference for fundamental constants (mass, gravity), and are powerful candidates to test general relativity on ground, underground or in space.

The future of matter-wave inertial sensors goes far beyond lab-based inertial sensors. While these experiments are typically quite large, require a dedicated laboratory, and are designed to operate well only in environments where the temperature, humidity, acoustic noise is tightly constrained, many efforts have been put in designing compact, robust and mobile sensors. The development of this technology lead to a new generation of atomic sensors that have been operated in airplanes and rockets, that are commercially available and could be the next generation of navigation unit.

Biography
Philippe Bouyer is the deputy director of the Institut d'Optique in Bordeaux. He received his doctorate at Ecole Normale Supérieure in 1995 and was then a postdoctoral fellow at Stanford during which he worked on atom interferometer-based inertial sensor experiments. He joined CNRS and the Institut d’Optique Graduate School in 1996, where he worked on atom lasers and Anderson localization with cold atoms. He is the cofounder of MUQUANS, a company selling atomic
gravimeters and atomic clocks. His current interests are the study of quantum simulators with ultracold atoms and the development of atom interferometers for navigation and for testing general relativity in space or detecting gravity fields and gravitational waves underground. He is the recipient of the 2012 Louis D award of the French academy, APS fellow and OSA senior member.