MIGA, ELGAR and Gravitational Wave Detection at low frequency with Atom Interferometry

A. Bertoldi for the MIGA collaboration
andrea.bertoldi@institutoptique.fr, LP2N, Institut d'Optique – Talence, France

The recent detection of Gravitational Waves (GWs) by LIGO and VIRGO opened a new observation window on the Universe and started the era of Gravitational Astronomy. Atom interferometry has been proposed to extend the detection bandwidth of GW detectors in the infrasound band (10 mHz - 10 Hz) [1,2], where actual ground-based detectors are limited by low frequency gravity noise. Adopting as probes arrays of atomic ensembles in free fall and tracking their motion on geodesics with atom interferometry allows the suppression of Newtonian Noise [3], enables low frequency sensitivity, and opens the way toward the realization of low frequency GW detectors on Earth.

I will report on: 1. the "Matter wave - laser based Interferometer Gravitation Antenna" (MIGA) project [4], which builds an atom interferometry based 200 m demonstrator for GW detection in the underground environment of LSBB (Rustrel, France); 2. the "European Laboratory for Gravitation and Atom-interferometric Research" (ELGAR) collaboration, which proposes to design an enhanced sensitivity infrastructure to study space-time and gravitation.

[1] S Dimopoulos et al, Phys Lett B 678, 37 (2009)
[2] P W Graham et al, Phys. Rev. Lett. 110, 171102 (2013)
[3] W Chaibi et al, Phys Rev D 93 (2), 021101 (2009)
[4] B Canuel et al, Sci. Rep. 8, 14064 (2018)