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The MIGA large scale Atom Interferometer

We are building a large-scale gravity antenna, MIGA [1], demonstrator for low frequency Gravitational Waves (GW) detection based on atom interferometry. This new infrastructure will be embedded into the LSBB underground laboratory, ideally located away from major anthropogenic disturbances and benefitting from very low background noise. MIGA will provide precise measurements of the local gravity sensed by a network of three free-falling atom test masses distant up to 150 m. Each atom test mass of the network will be manipulated by cavity enhanced Bragg pulses to create an atom interferometer.
Fluctuation of the earth gravity field is expected to be a major source of noise for future infrasound GW detectors. In these experiments, mass density variations caused by local seismic or atmospheric perturbations determine spurious displacements of the free-falling test masses called Gravity Gradient Noise (GGN), that mimics GW effects. This noise source is expected to become dominant in the infrasound domain and must be tackled for the future realization of observatories exploring GWs at low frequency. Using a network of test masses, it becomes possible to exploit the GGN spatial correlation properties and provide a GW measurement with a strong GGN filtering [2].
The MIGA project is carried out by a consortium that gathers 17 expert French laboratories and companies in atomic physics, metrology, optics, geosciences and gravitational physics. This poster will present the main objectives of the project, the status of the construction of the instrument and the motivation for the applications of MIGA in GW physics.

References

[1] Benjamin Canuel et al., Exploring gravity with the MIGA large scale atom interferometer, Sci. Rep. 8 14064 (2018).
[2] Walid Chaibi et al., Low frequency gravitational wave detection with ground-based atom interferometer arrays, Phys. Rev. D 93, 021101 (2016).

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