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Transportable absolute Quantum Gravimeter based on Bose-Einstein condensates

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The transportable absolute Quantum Gravimeter QG-1 is designed to perform long-term stable gravity measurements in field with systematic uncertainty superseding current absolute gravimeters. A gravity measurement will be carried out based on atom interferometry with Bose-Einstein condensates (BEC) created on an atom chip[1]. Current generation atom gravimeters are starting to be used as inertial sensors in geodetic measurement campaigns competing with state-of-the-art classical sensors. These gravimeters rely on atom interferometry with laser cooled atoms. However, they are limited in uncertainty due to the residual expansion rate of the atomic ensemble and its interplay with wave front aberrations of the light beam for coherent manipulation of the atoms[2]. To overcome this limitation, QG-1 uses magnetically lensed BECs implying signifcantly reduced expansion rates for interferometry, mitigating the main uncertainty in current atomic gravimeters[3]. Thanks to the atom-chip technology providing a high BEC flux, our simplified telecom fiber based laser and compact electronic, this device is designed to be transportable for geodetical studies in field. In this talk we will discuss the principle of operation, the current progress and the perspectives to overcome the limitation of state-of-the-art atom gravimeters.

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[1] Abend et al, 2016, doi:10.1103/PhysRevLett.117.203003
[2] Schkolnik et al, 2015, doi:10.1007/s00340-015-6138-5
[3] Rudolph et al, 2015, doi:10.1007/s00340-015-6138-5