IAG Scientific Assembly 2025:
Geodesy for a changing environment

Symposium G10: Modern Concepts and Quantum Technology for Geodesy

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Emerging developments in quantum physics enable novel applications and measurement concepts in geodesy and gravitational field observation. In this symposium, we discuss new types of sensors and gravity mission concepts that are based on those advanced techniques. We will address the measurement of terrestrial gravity anomalies by means of observing free-falling atoms (quantum gravimetry) which may gradually replace the falling corner cubes. Atom interferometry allows nearly continuous measurements and offers the access to gradients. It is also supposed for future measurements in space, where different scenarios are recently studied.

According to Einstein's theory of general relativity, frequency comparisons of highly precise optical clocks connected by optical links give a direct access to differences of the gravity potential (relativistic geodesy) which allows gravity field recovery and height determination on long baselines. In future, precise optical clocks can be applied for defining and realizing an international height system in a new way. Networks of optical clocks, including clocks on satellites and the Moon, can also be used to monitor mass variations in a complementary way to established methods.

In addition, laser interferometry between test masses in space with nanometer accuracy belongs to these novel concepts. This technique has been successfully realized as a demonstrator in the GRACE-FO mission and will now be the main tracking system in the upcoming MAGIC constellation of NASA and ESA. In the future even more refined concepts (tracking swarms of satellites, space gradiometry) will be realized.

All these above-mentioned techniques will open a door to a vast bundle of applications such as fast local gravimetric surveys, the gravimetric observation of the Earth-Moon system with high spatial-temporal resolution. Terrestrial mass variations can be monitored at various scales providing unique information on the climate change processes.

We invite presentations illustrating the principles and state of the art of those novel techniques and the application of the new methods for terrestrial and satellite geodesy, navigation and fundamental physics. We also welcome papers covering theoretical foundations and description of the new methods as well as revised modeling schemes.