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Quantum Technology Application in Space

Spacecraft provide a fascinating insight into the world outside our own planet. But satellites are not only used as carriers of astronomical telescopes, camera systems, or sensors. They are even used as platforms for carrying out many experiments for fundamental research and serve as test masses for the ultra-precise observation of gravitational fields which has to be determined by measuring time, distances and accelerations, and by comparing the results in different inertial frames. During the last 15 years quantum optics and quantum engineering seemed and seems to become a powerful tool for inertial sensing in space. Space provides the possibility of carrying out quantum experiments over very large distances, along spacecraft orbits with highly varying velocities, and under weightlessness conditions resulting in long interrogation times. On the other side, this technology whose development has been mainly driven by scientific needs is meanwhile used for earth observation, satellite navigation, satellite communication, and satellite geodesy. More and more, quantum sensors (not only atomic clocks) will be used onboard spacecraft utilized for daily services.

As a result of fundamental research (quantum optics and gravitational physics), quantum technology are directly applied to the future GNNS-fleets and constellations, vice versa the increasing precision of GNNS-systems can be used for fundamental physics experiments as well.

The talk will focus on present and future application fields f quantum sensors and quantum technology in space and will give an overview of recent and past experiments in space.