

Quantum optics experiments in space

It is an open issue whether quantum laws, originally established to describe nature at the microscopic level of atoms, are also valid in the macroscopic domain such as on distances accessible in space. Some proposals predict that quantum entanglement is limited to certain mass and length scales or altered under specific gravitational circumstances. Testing the quantum correlations over distances achievable with systems placed in the Earth orbit or even beyond would allow to verify both the validity of quantum physics and the preservation of entanglement over distances impossible to achieve on ground. Hence, these fundamental questions do have their impact for a future quantum network also using space-based systems. We proposed to the European Space Agency (ESA) to perform a ground-to-space quantum communication tests from the International Space Station (ISS) orbiting at a height of approximately 400 km as well as to mini-satellites. I will present the proposed experiments in space as well as the design of a space based quantum communication payload and the feasibility experiments performed on the Canary Islands over a 144 km link. Additionally I will present the ongoing R&D activities performed in a consortium consisting of partners from academia as well as from industry to implement space proved entangled photon sources ready for a quantum mission in space.