Relativistic effects on space-based quantum technologies

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Experiments in quantum technologies are rapidly progressing from table-top to space-based setups. There are plans to use satellites to distribute entanglement for quantum cryptography and teleportation (e.g., the Space-QUEST project) and to install quantum clocks in space (e.g., the Space Optical Clock project). However,

at these scales relativistic effects become observable. For instance, the Global Positioning System, a system of satellites used for time dissemination and navigation, requires relativistic corrections to determine time and positions accurately. Experiments are reaching relativistic regimes, yet the effects of gravity and motion on quantum technologies are largely unknown.

In this talk I will show that gravity and motion affect entanglement and therefore, quantum teleportation require corrections which depend on the state of motion of the observers. Earth-based and space-based proposals to test these effects will be presented. Finally, I will discuss how relativistic effects can be exploited to improve the precision measurements of quantities relevant in relativistic quantum theory such as accelerations and gravitational field strengths.