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ENTANGLEMENT DYNAMICS OF PHOTON PAIRS AND QUANTUM MEMORIES IN THE GRAVITATIONAL FIELD OF THE EARTH AND ITS IMPACT ON SPACE-BASED QUANTUM COMMUNICATION

Abstract

The effect of entanglement dynamics due to gravity – the basis of a mechanism of universal decoherence – for photonic states and quantum memories is investigated in Mach-Zehnder and Hong-Ou-Mandel interferometry setups in the gravitational field of the Earth. It appears to be possible in principle to witness this effect with near-future quantum technology in Hong-Ou-Mandel interferometry. This would represent an experimental test of a quantum multi-particle effect induced by the general relativistic redshift. As a consequence, general relativistic effects on space-based quantum memories which are expected to be an important ingredient for global quantum communication networks, have been analyzed for the first time. The impact on space-based quantum communication will be discussed.