MINI CURSO

Organizer***: Pablo Barbelis Blonstein***

RELATIVISTIC QUANTUM INFORMATION

Dra. Ivette Fuentes
University of Nottingham

Resumen

Cutting-edge experiments in quantum communications are reaching regimes where relativistic effects can no longer be neglected. For example, there are advanced plans to use satellites to implement teleportation and quantum cryptographic protocols. Relativistic effects can be expected at these regimes: the Global Positioning System (GPS), which is a system of satellites that is used for time dissemination and navigation, requires relativistic corrections to determine time and positions accurately. Therefore, it is timely to understand what are the effects of gravity and motion on entanglement and other quantum properties exploited in quantum information. In these lectures I will introduces the basic techniques employed to quantify entanglement in relativistic quantum field theory. With these tools, I will show that entanglement can be created or degraded by gravity and non-uniform motion. I will discuss how relativistic effects can degrade the efficiency of quantum communication protocols between moving observers.

However, the effects can also be exploited in quantum information. For example, I will show that the relativistic motion of a quantum system can be used to perform quantum gates. These results, which will inform future space-based experiments, can be demonstrated in table-top experiments using superconducting circuits and Bose-Einstein condensates.

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