Title:	Quantum Stern-Gerlach experiment and path entanglement of a Bose-Einstein condensate
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Abstract:	In this paper, a quantum Stern-Gerlach thought experiment is introduced where, in addition to the intrinsic angular momentum of an atom, the magnetic field is considered to be a quantum mechanical field. A free falling spin polarized Bose-Einstein condensate passes close to a flux qubit and interacts with the quantum superimposed magnetic field of the flux qubit. Such an interaction results a macroscopic quantum entanglement of the path of a Bose-Einstein condensate with the magnetic flux quantum state of the flux qubit. In this paper, three regimes of coupling between the flux qubit and a free falling Bose-Einstein condensate are discussed. This paper also explains how to produce a path entangled Bose-Einstein condensate where the condensate can be located at physically distinct locations simultaneously. This paper highlights new insights about the foundations of the quantum Stern-Gerlach experiment.
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