Processing quantum information with relativistic motion of atoms

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We show that particle detectors, such as 2-level atoms, in non-inertial motion (or in gravitational fields) could be used to build quantum gates for the processing of quantum information.

Concretely, we show that through suitably chosen non-inertial trajectories of the detectors the interaction Hamiltonian's time dependence can be modulated to yield arbitrary rotations in the Bloch sphere due to relativistic quantum effects.