Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **270** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

General Formalism of the Quantum Equivalence Principle

Tuesday 10 June 2025 15:15 (15 minutes)

A consistent theory of quantum gravity will require a fully quantum formulation of the classical equivalence principle. Such a formulation has been recently proposed in terms of the equality of the rest, inertial and gravitational mass operators, and for non-relativistic particles in a weak gravitational field. In this work, we propose a generalization to a fully relativistic formalism of the quantum equivalence principle, valid for all background space-times, as well as for massive bosons and fermions. The principle is trivially satisfied for massless particles. We show that if the equivalence principle is broken at the quantum level, it implies the modification of the standard Lorentz transformations in flat space-time and a corresponding modification of the metric in curved space-time by the different mass ratios. In other words, the observed geometry would effectively depend on the properties of the test particle. Testable predictions of potential violations of the quantum equivalence principle are proposed.

Keyword-1

Quantum Gravity

Keyword-2

Equivalence Principle

Keyword-3

Authors: Dr LAMBIASE, Gaetano (University of Salerno); FRIDMAN, Mitja; Dr DAS, Saurya (University of Lethbridge)

Presenter: FRIDMAN, Mitja

Session Classification: (DTP) T2-10 Classical gravity and general relativity | Gravité classique et relativité générale (DPT)

Track Classification: Technical Sessions / Sessions techniques: Theoretical Physics / Physique théorique (DTP-DPT)