Contribution ID: **54** Type: **Oral contribution**

Low-Energy Test of Quantum Gravity via Angular Momentum Entanglement

Wednesday 9 July 2025 10:00 (20 minutes)

Currently envisaged tests for probing the quantum nature of the gravitational interaction in the low-energy regime typically focus either on the quantized center-of-mass degrees of freedom of two spherically-symmetric test masses or on the rotational degrees of freedom of non-symmetric masses under a gravitational interaction in the Newtonian limit. In this talk, I am going to present a novel proposal based on the interaction between the angular momenta of spherically-symmetric test masses considering the general relativistic correction related to frame-dragging that leads to an effective dipolar interaction between the angular momenta. In this approach, the mass of the probes is not directly relevant; instead, their angular momentum plays the central role. It is possible to demonstrate that, while the optimal entangling rate is achieved with a maximally delocalized initial state, significant quantum correlations can still arise between two rotating systems even when each is initialized in an eigenstate of rotation. Additionally, the robustness of the generated entanglement against typical sources of noise is explored while emphasizing that the combination of angular momentum and spherically-symmetric test-masses mitigates the impact of many common noise sources.

Working Group

WG3 - Low-energy gravitational effects in quantum systems

Author: PETRUZZIELLO, Luciano (Universität Ulm)

Presenter: PETRUZZIELLO, Luciano (Universität Ulm)

Session Classification: WG3 Low-energy Gravitational Effects in Quantum Systems 2