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Superconducting electro-mechanics to explore the effects of general relativity in massive superpositions

Wednesday 9 July 2025 15:00 (20 minutes)

The combination of time dilation in general relativity with the possibility in quantum mechanics for masses to exist in a quantum superposition of being in two places at the same time leads to a prediction of quantum uncertainty in the definition of local time, something incompatible with our understanding of quantum mechanics. With no theoretical solution to the fundamental conflict, experimental observations will play a crucial role in constraining possible theoretical attempts to bridge the gap between the two theories. Here, I will give an overview of our approach to experimentally testing the combination of quantum mechanics and general relativity. Key to this is the determination of the requirements on physical parameters to perform experiments where both theories potentially interplay. We use these requirements to compare different systems, focusing on mechanical oscillators which can be coupled to superconducting circuits. And finally, we discuss the opportunities and challenges in achieving this regime using superconducting qubits coupled to massive mechanical resonators.

Working Group

WG4 - Low-energy high-precision experiment

Author: STEELE, Gary (TU Delft)

Presenter: STEELE, Gary (TU Delft)

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