Towards detecting traces of quantum friction in the corrections of the accumulated geometric phase

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Spatially separated bodies in a relative motion through vacuum experience a tiny friction force known as quantum friction (QF). This force has so far eluded experimental detection due to its small magnitude and short range. Quantitative details revealing traces of the QF in the degradation of the quantum coherence of a particle are presented. Environmentally induced decoherence for a particle sliding over a dielectric sheet can be decomposed into contributions of different signatures: one solely induced by the electromagnetic vacuum in the presence of the dielectric and another induced by motion. As the geometric phase (GP) has been proved to be a fruitful venue of investigation to infer features of the quantum systems, herein it is proposed to use the accumulated GP acquired by a particle as a QF sensor. Furthermore, an innovative experiment designed to track traces of QF by measuring the velocity dependence of corrections to the GP and coherence is proposed. The experimentally viable scheme presented can spark renewed optimism for the detection of non-contact friction, with the hope that this non-equilibrium phenomenon can be readily measured soon.

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