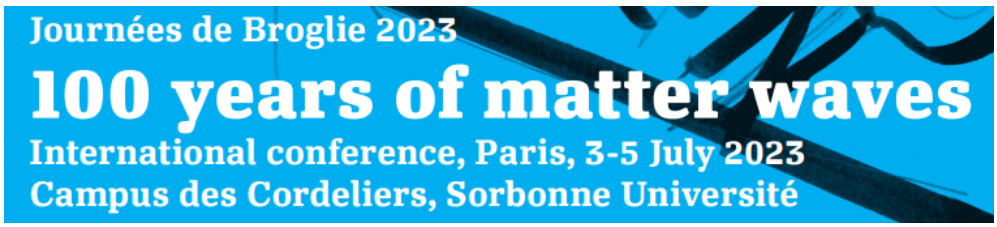

Quantum force and space-time topology in the Aharonov-Bohm effect

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Abstract

Zeilinger's dispersivity theorem predicts the absence of force, while Shelankov and Berry predict the presence of a force for Aharonov-Bohm effect. We investigated this conundrum both by experiment and theory [1]. An experiment is presented that supports Shelankov and Berry's prediction, while theory is presented to encompass both predictions thus resolving this confusing problem. Even if we feel that this issue is now resolved others remain. We will present a theoretical argument that questions the idea that one has to enclose a magnetic flux to observe the Aharonov-Bohm effect [2]. The idea is offered that spatial topology that is relevant for the Aharonov-Bohm effect is part of a space-time topology that may be used to escape the requirement that one has to enclose a magnetic flux, while still preserving gauge invariance.

[1] Maria Becker, Giulio Guzzinati, Armand Béché, Johan Verbeeck & Herman Batelaan, Asymmetry and non-dispersivity in the Aharonov-Bohm effect, Nature Communications 10, 1700 (2019).

[2] Pablo L. Saldanha, Aharonov-Bohm Effects and the Topology of Electromagnetic Fields in Spacetime. https://arxiv.org/abs/2302.14542