The Time Machine Factory [unspeakable, speakable] on Time Travel -TMF2024



Contribution ID: 108

Type: talk

Quantum clocks, reference frames and the relational flow of time

Wednesday 25 September 2024 10:00 (35 minutes)

In this talk I will use the Page-Wootters "timeless" framework for analyzing dynamics from the perspective of inertial and non-inertial quantum clocks. I will derive a new time-energy uncertainty relation indicating that the duration of an energy measurement carried out by an external system cannot be performed arbitrarily fast from the perspective of the internal clock [1]. In addition, when using the relativistic mass-energy equivalence to study an accelerating massive quantum particle with an internal clock I will show that the evolution from the perspective of that clock is non-Hermitian [2]. As a particular consequence, I will prove that the effective Hamiltonian of two gravitationally interacting particles is non-Hermitian from the perspective of the clock of either particle [2]. If time lets me, I will discuss some related results addressing dynamical nonlocality [3] and spatiotemporal quantum reference frames [4] in light of the relativistic independence principle [5]. References

[1] I.L. Paiva, A.C. Lobo, and E. Cohen, Quantum 6 (2022) 683.

[2] I.L. Paiva, A. Te'eni, B.Y. Peled, E. Cohen, and Y. Aharonov, Commun. Phys. 5 (2022) 298.

[3] I.L. Paiva, M. Nowakowski, and E. Cohen, Phys. Rev. A 105 (2022) 042207.

- [4] M. Suleymanov, I.L. Paiva, and E. Cohen, Phys. Rev. A 109 (2024) 032205.
- [5] A. Carmi, and E. Cohen, Sci. Adv. 5 (2019) eaav8370

Primary author: Prof. COHEN, Elihau (Faculty of Engineering and the Institute of Nanotechnology and Advanced Materials, Bar Ilan University, Ramat Gan 5290002, Israel)

Presenter: Prof. COHEN, Elihau (Faculty of Engineering and the Institute of Nanotechnology and Advanced Materials, Bar Ilan University, Ramat Gan 5290002, Israel)

Session Classification: Session V. Teleportation, entanglement and decoherence