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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.
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- [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

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