

The quantum Zeno effect versus exponential decay alternative

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Abstract

In this talk I will recall the concept of continuous monitoring of a quantum system and then discuss the related QUANTUM ZENO and EXPONENTIAL DECAY scenarios in quantum measurements. Applying a variant of the Gnedenko–Kolmogorov limit theorem, we show that for typical states of the system continuous monitoring of massive particles yields complementarity of the quantum Zeno and anti-Zeno effects, while for systems of massless particles, the quantum Zeno and exponential decay scenarios are complementary instead. It turns out that for the latter systems on a quantum metric graph, the corresponding decay rate is quite sensitive to the presence of Aharonov–Bohm field (provided that the Euler characteristics of the graph is zero). Based on the dilation theory for dissipative operators, in the framework of continuous monitoring paradigm we provide rigorous foundations for the *exclusive* and *interference* measurement alternatives in quantum measurements theory. In this setting, I also hope to explain the celebrated “two slit experiment” in a way that is accessible for mathematicians.

The talk is based on a recent work with Eduard Tsekanovskii.