Contribution ID: **246** Type: **Talk**

Quantumness and memory effects in multi-time measurements

Wednesday 25 June 2025 14:55 (15 minutes)

More than a century after the birth of quantum theory, the question of which properties and phenomena are fundamentally quantum remains under active investigation. In this talk, I will discuss when and to what extent quantumness can be unambiguously associated with an open quantum system that is sequentially measured at different times. Central to our analysis are the quantum regression theorem, which defines the Markovianity of the multi-time statistics, and the Kolmogorov consistency conditions, which discriminate classical and non-classical statistics. We show that in the Markovian case the multi-time statistics cannot be accounted for by means of any classical process if and only if the dynamics generates coherences and subsequently turns them into populations [1]. On the other hand, such a direct connection between the dynamics of quantum coherences and non-classicality cannot be extended to general non-Markovian processes, where, instead, non-classicality is related to a global property of the system-environment correlations [2] that is fully captured by higher-order quantum maps, i.e., quantum combs [3]. **References** [1] A. Smirne, D. Egloff, M. G. Diaz, M. B. Plenio, and S. F. Huelga, Quantum Sci. Technol. 4, 01LT01 (2018) [2] S. Milz, D. Egloff, P. Taranto, T. Theurer, M. B. Plenio, A. Smirne, and S. F. Huelga, Phys. Rev. X 10, 041049 (2020) [3] G. Chiribella, G. M. D'Ariano, and P. Perinotti, Phys. Rev. Lett. 101, 060401 (2008).

Author: SMIRNE, Andrea (Istituto Nazionale di Fisica Nucleare)

Presenter: SMIRNE, Andrea (Istituto Nazionale di Fisica Nucleare)

Session Classification: Wednesday Parallel Session F