Contribution ID: **275** Type: **Poster Presentation**

Quantum state inference from coarse-grained descriptions: analysis and an application to quantum thermodynamics

Thursday, 6 July 2023 16:22 (1 minute)

Whether considering our everyday perception of the surrounding environment or a sophisticated experimental setup, a characterization of a physical system is given in terms of measurement results of its observable properties. Thus, given that this characterization is not unique, it is necessary to consider which features are being observed as well as how they are being observed. In this context, the aim of state inference is to assign to the system a description that abides by the know data. In this work, we discuss two ways of assigning a description to a quantum system assuming that we have a coarse-grained access to its properties. Specifically, we compare the maximum entropy principle method, with the Bayesian-inspired average assignment map method [Correia et al., Phys. Rev. A 103, 052210 (2021)]. Despite the fact that the assigned descriptions by both methods respect the measured constraints, and that they share the same conceptual foundations, the descriptions differ in scenarios that go beyond the traditional open quantum system-environment structure. The average assignment map is thus shown to be a more sensible choice for the ever more prevalent scenario of complex quantum systems. We discuss the physics behind such a difference, and further exploit it in a quantum thermodynamics process.

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No

Level for award;(Hons, MSc, PhD, N/A)?

N/A

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Session Classification: Poster Session 2

Track Classification: Track G - Theoretical and Computational Physics