Posudek na doktorskou práci

Název: Chaotic dynamics of purification protocols

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Chaotic dynamics is a fascinating branch of physics with numerous overlaps with other sciences. While being of fundamental importance it has practical implications. The blend between (classical) chaos theory and quantum mechanics is not as old as chaos theory itself but it gains on importance. On a first look chaos cannot be present in quantum dynamic as it contradicts its basic laws. However, this can be overcome in several ways. One of them is to consider quantum versions of classically chaotic systems, the other is to consider quantum protocols with no direct classical analogue. The present thesis deals with purification protocols falling into the second category.

Purification or distillation protocols represent a primitive of quantum information and communication. Its aim is to increase the purity of a sub ensemble of states (single or multipartite) at the expense of a larger set of states. This can be accomplished in several ways and the involved protocols have different properties. As the involved dynamics is nonlinear in the quantum state involved it can, in principle, exhibit chaotic dynamics. In connection with this the natural question come up whether another effect – phase transition – can appear. The present thesis elaborates on this particular point and the proof of the presence of a phase transition and its properties can be considered the strongest scientific result. In my opinion the result is highly interesting with strong potential to be extended further (beyond the scope of the thesis).

The authors wrote an extensive study on the topic of purification protocols. He worked independently and obtained a number of interesting results. The results are of importance to the quantum information community. I fully support to award the title PhD to the candidate based on the submitted thesis.

V Praze, 31. 3. 2023

prof. Ing. Igor JEX, DrSc.