Review of: "Quantum mechanics and symplectic topology"

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This article considers a formulation of non-relativistic quantum mechanics based on symplectic topology on a complex-valued phase space. Due to the limited distinguishability of quantum states, the geometry of the phase space is not given by points. Rather, states are defined by a set of n = d N symplectic capacities, with d being the spatial dimensions and N the number of particles. All these symplectic capacities have to stay above the Gromov width c_G = h/2. Within this construction, the author proceeds to build the notion of overlap between states and the fidelity of such based on the Born rule. The conservation of such fidelity in time leads to the Schrödinger equation for the overlap between states. Finally, a discussion on how this formalism specially suits the ensemble interpretation of quantum mechanics is given.

I find that the article tries to collect several ideas without clearly stating which of them are truly novel and to which extend. Also, the paper aims to provide a formulation of quantum mechanics, but does not have the structure of a mathematically clear and unambiguous construction, with its corresponding definitions, axioms, and so on. It manages to obtain the unitary evolution out of the conservation of probability and the Born rule in a way that is just a somehow trivial translation of a known derivation to the formalism in the paper. But it does not provide an operational meaning to the probabilities, the preparation of a state or its measurement, so it does not really deepen into the physical meaning of these concepts, and hence does not add anything new at the interpretational level.

In summary, I'm not sure whether the article adds some ingredient to the formulation that is genuinely new, but the overall construction is, in my opinion, not consistently and completely enough formulated to be considered a novel formulation on its own. So my feeling is that, somehow, the article seems to lie in the middle of nowhere. Maybe it can be considered a first attempt to provide a mathematical formulation that specially suits the ensemble interpretation of quantum mechanics.

I feel also that there are several inaccuracies in certain statements of the text, which for reasons of time I cannot number in full. Let me mention, just as an example, the statement on page 6, first column, line 10: “The members of the [classical] ensemble are thus identical copies of each other.” This statement is strictly not true for a general classical ensemble. Out of the context, I think one can deduce what the author wants to mean, though. So I would recommend the author to revise and polish these kind of inaccuracies. Also a minor revision of English is in order, specially for the third person singular conjugation of verbs.

I shall finally mention some statement that is, I think, actually wrong beyond any context, although fortunately it is not further used in the article. On page 3, just above the figure, it is stated: “The total area overlap […] is given by the linear sum of the contributions [for each component]”. I think this is not the case for entangled states.