Review of: "Quantum mechanics and symplectic topology"

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Potential competing interests: No potential competing interests to declare.

The motivating claim in the paper `that the indeterminacy relation, despite its fundamental significance for the characteristic behaviour of quantum systems, do[es] not play a foundational role in the various mathematical formulations of non-relativistic quantum mechanics' can be seen from the foregoing [omitted] to not be entirely true. On the one hand the indeterminacy relation cannot be regarded as of universal significance: because it does not apply to a pair of observables/operators that are both bounded. For example: a pair of spin operators are such that the indeterminacy can be made zero for a suitable choice of state. The indeterminacy relations do not have the fixed significance that Henriksson believes. On the other hand, the CCRs, from which the indeterminacy relations are derived, have --- essentially since Weyl's work in 1927 --- shown the importance of symplectic groups and manifolds in quantum mechanics. In that sense Henriksson is swimming with the tide, while singing to the choir.

There is too little said to know just what manifold is intended to be symplectic, so my comment here is more in the way of a caution. Symplectic manifolds must be even dimensional, so the Euclidean space on which the position and momentum wave functions are defined cannot be a symplectic space. Yet it is things occurring in this Euclidean space that are observed. Thus one must be careful with the idea that the Gromov *non-squeezing theorem* applies in a straightforward way in Euclidean space rather than phase space.

This also relieves us of the mystery that Henriksson claims for the complex character of the phase space. Observations are made in Euclidean space, but the phase space is complex and the states are square roots of probabilities. What is surprising, if anything is, is that eigenvalues are real. I think Henriksson may be too influenced by a form of positivism that rests too much on observation --- but if so then one wonders how so much explanatory value has been invested in symplectic topology, which is unobservable by design?

Lastly, there is some unclearness on the nature of quantum probabilities. Probabilities are `a quantitative measure for the belief of the observer about the state of the system, rather than a description of the state of the system itself.' In philosophical language, the probabilities are Bayesian or subjective, as in the work of R. T. Cox, which Henriksson relies on. The problem is that this invites questions as to the state of the particular quantum system independent of subjective beliefs. The author espouses an ensemble interpretation which seeks to avoid this question. But often lurking in ensemble accounts are hidden variables --- and they have not fared well, to say the least!

But the reviewer certainly agrees that symplectic geometry has an interesting future in quantum theory