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Liouville mechanics with an epistemic restriction and Bohr's response to EPR TERRY RUDOLPH, Imperial College, STEPHEN BARTLETT, University of Sydney, ROBERT SPEKKENS, Perimeter Institute — We introduce a toy theory that reproduces a wide variety of qualitative features of quantum theory for degrees of freedom that are continuous. Specifically, we consider classical mechanics supplemented by a constraint on the amount of information an observer may have about the motional state (i.e. point in phase space) of a collection of classical particles – Liouville mechanics with an epistemic restriction (This may well be how Heisenberg initially understood the Uncertainty Principle). We develop the formalism of the theory by deriving the consequences of this "classical uncertainty principle" on state preparations, measurements, and dynamics. The result is a theory of hidden variables, although it is not a hidden variable model of quantum theory because of its locality and noncontextuality. Despite admitting a simple classical interpretation, the theory also exhibits the operational features of Bohr's notion of complementarity. Indeed, it includes all of the features of quantum mechanics to which Bohr appeals in his response to EPR. This theory demonstrates, therefore, that Bohr's arguments fail as a defense of the completeness of quantum mechanics.

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