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Quantum phenomena modelled by interactions between many classical worlds HOWARD WISEMAN, MICHAEL HALL, Centre for Quantum Dynamics, Griffith University, DIRK-ANDRE DECKERT, Ludwig-Maximilians-Universität München — [Ref: Phys. Rev. X 4 041013 (2014).] We investigate how quantum theory can be understood as the continuum limit of a mechanical theory, in which there is a huge, but countable, number of classical "worlds," and quantum effects arise solely from a universal interaction between these worlds, without reference to any wave function. Here a "world" means an entire universe with well-defined properties, determined by the classical configuration of its particles and fields. In our approach each world evolves deterministically; probabilities arise due to ignorance as to which world a given observer occupies; and we argue that in the limit of infinitely many worlds the wave function can be recovered (as a secondary object) from the motion of these worlds. We introduce a simple model of such a "many interacting worlds" approach and show that it can reproduce some generic quantum phenomena–such as Ehrenfest's theorem, wavepacket spreading, barrier tunneling and zero point energy–as a direct consequence of mutual repulsion between worlds. Finally, we perform numerical simulations using our approach. We demonstrate, first, that it can be used to calculate quantum ground states, and second, that it is capable of reproducing, at least qualitatively, the double-slit interference phenomenon.

Howard Wiseman
Griffith University

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