

Are All Particles Real?

Goldstein, Sheldon and Taylor, James and Tumulka, Roderich and Zanghi, Nino (2004) Are All Particles Real?.

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Abstract

In Bohmian mechanics elementary particles exist objectively, as point particles moving according to a law determined by a wavefunction. In this context, questions as to whether the particles of a certain species are real--questions such as, Do photons exist? Electrons? Or just the quarks?---have a clear meaning. We explain that, whatever the answer, there is a corresponding Bohm-type theory, and no experiment can ever decide between these theories. Another question that has a clear meaning is whether particles are intrinsically distinguishable, i.e., whether particle world lines have labels indicating the species. We discuss the intriguing possibility that the answer is no, and particles are points---just points.

Keywords: Bohmian mechanics, ontology, empirical equivalence, fundamental limitations of science, particle trajectories in quantum physics

Subjects: [Specific Sciences: Physics: Quantum Mechanics](#)

ID Code: 1728

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Deposited On: 25 April 2004