Energy and Momentum Conservation in Bohm's Model for Quantum Mechanics

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Abstract

Bohm's model for quantum mechanics is examined and a well-known drawback of the model is considered, namely the fact that the model does not conserve energy and momentum. It is shown that the Lagrangian formalism and the use of energy-momentum tensors provide a way of addressing this non-conservation aspect once the model is considered from the point of view of an interacting particle-field system. The full mathematical formulation that is then presented demonstrates that conservation can be reintroduced without disrupting the present agreement of Bohm's model with experiment.

Acknowledgement

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Dr Sheldon Goldstein:

"This thesis is a very nice piece of work. It is written with exceptional clarity and facility of expression, and marks a significant contribution to the field."

Dr David Miller:

"The problem with Bohmian mechanics addressed by the thesis concerns energy and momentum conservation and is therefore fundamental. It is timely and important that the problem be addressed. The work in the thesis provides a solution to the problem and therefore makes a significant and original contribution to the discipline."

Dr Craig Callender:

"I recommend that the degree be awarded. Any errors I found were unimportant ones. My overall impression is that this dissertation is a very fine work in foundations of physics."

This is to certify that the work embodied in this thesis is original and has not been submitted for a higher degree at any other institution.

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Please Note:

The symbol for the quantity "h bar" (= Planck's constant divided by 2π) appears as ħ in the printing of this thesis (i.e., as a letter h with a small gap in its vertical stroke).