Are Bohmian Corpuscles Idle Wheels?

Wayne C. Myrvold
Department of Philosophy
The University of Western Ontario

21st Century Directions in De Broglie-Bohm Theory and Beyond
September 1, 2010

Bohm's interpretation cannot be refuted by experiment, and this is true of all the counter-proposals in the first group. From the fundamentally positivistic (it would perhaps be better to say purely physical) standpoint, we are thus concerned not with counter-proposals to the Copenhagen interpretation, but with its exact repetition in a different language.

Bohm's interpretation cannot be refuted by experiment, and this is true of all the counter-proposals in the first group. From the fundamentally positivistic (it would perhaps be better to say purely physical) standpoint, we are thus concerned not with counter-proposals to the Copenhagen interpretation, but with its exact repetition in a different language.

W, Heisenberg (1955)

the 'unoccupied grooves' must be physically real. Moreover they obey the same laws of physics as the 'occupied groove' that is supposed to be 'the' universe. But that is just another way of saying that they are universes too. ... In short, pilot-wave theories are parallel-universes theories in a state of chronic denial. This is no coincidence. Pilot-wave theories assume that the quantum formalism describes reality. The multiplicity of reality is a direct consequence of any such theory.

the 'unoccupied grooves' must be physically real. Moreover they obey the same laws of physics as the 'occupied groove' that is supposed to be 'the' universe. But that is just another way of saying that they are universes too. ... In short, pilot-wave theories are parallel-universes theories in a state of chronic denial. This is no coincidence. Pilot-wave theories assume that the quantum formalism describes reality. The multiplicity of reality is a direct consequence of any such theory.

D. Deutsch (1996)

the corpuscle's role is minimal indeed: it is in danger of being relegated to the role of a mere epiphenomenal "pointer", irrelevantly picking out one of the many branches defined by decoherence, while the real storydynamically and ontologicallyis being told by the unfolding evolution of those branches. The "empty wavepackets" in the configuration space which the corpuscles do not point at are none the worse for its absence: they still contain cells, dust motes, cats, people, wars and the like.

H. Brown and D. Wallace (2005)

[The Bohmian approach] leaves in the formalism the structure of all parallel worlds, but claims that they are not related to our experience. But in these empty worlds the wave in the shape of Lev Vaidman might also write a paper in the empty wave copy of the Foundations of Physics Journal, so how [do] You, the reader, know that this is not such an empty wave world?

[The Bohmian approach] leaves in the formalism the structure of all parallel worlds, but claims that they are not related to our experience. But in these empty worlds the wave in the shape of Lev Vaidman might also write a paper in the empty wave copy of the Foundations of Physics Journal, so how [do] You, the reader, know that this is not such an empty wave world?

L. Vaidman (2005)

Mathematical formalism, Physical theory

- Mathematical formalism alone does not a physical theory make; some specification is required of how physical objects (which surely include, but need not be restricted to, familiar things such as tables and chairs) are represented in the theory.
- We should be prepared for this to take very different forms in different theories.
- Macroscopic objects may be *multiply realizable*.

Mathematical formalism, Physical theory

- Mathematical formalism alone does not a physical theory make; some specification is required of how physical objects (which surely include, but need not be restricted to, familiar things such as tables and chairs) are represented in the theory.
- We should be prepared for this to take very different forms in different theories.
- Macroscopic objects may be *multiply realizable*.

Mathematical formalism, Physical theory

- Mathematical formalism alone does not a physical theory make; some specification is required of how physical objects (which surely include, but need not be restricted to, familiar things such as tables and chairs) are represented in the theory.
- We should be prepared for this to take very different forms in different theories.
- Macroscopic objects may be *multiply realizable*.

Functionalism

- Contrast:
  - Anything that behaves like a tiger is a tiger.
  - Any structure in a physical theory that behaves like a tiger is a tiger.
- *Cf.* Classical mechanics: a many-worlds theory?

Functionalism

- Contrast:
  - Anything that behaves like a tiger is a tiger.
  - Any structure in a physical theory that behaves like a tiger is a tiger.
- *Cf.* Classical mechanics: a many-worlds theory?

Functionalism

- Contrast:
  - Anything that behaves like a tiger is a tiger.
  - Any structure in a physical theory that behaves like a tiger is a tiger.
- *Cf.* Classical mechanics: a many-worlds theory?

Functionalism

- Contrast:
  - Anything that behaves like a tiger is a tiger.
  - Any structure in a physical theory that behaves like a tiger is a tiger.
- *Cf.* Classical mechanics: a many-worlds theory?

What do Bohmian corpuscles do?

- Energy is naturally associated with a system's wave-function, not the Bohmian corpuscles.
- The work I have to do to alter the state of a system is a function of the change of wave-function and is independent of the corpuscle's position.
- When you push on something, it is the wave-function that pushes back.

What do Bohmian corpuscles do?

- Energy is naturally associated with a system's wave-function, not the Bohmian corpuscles.
- The work I have to do to alter the state of a system is a function of the change of wave-function and is independent of the corpuscle's position.
- When you push on something, it is the wave-function that pushes back.

What do Bohmian corpuscles do?

- Energy is naturally associated with a system's wave-function, not the Bohmian corpuscles.
- The work I have to do to alter the state of a system is a function of the change of wave-function and is independent of the corpuscle's position.
- When you push on something, it is the wave-function that pushes back.

What do Bohmian corpuscles do?

- Assumption: Experiences of conscious observers are determined by positions of Bohmian particles.
- An ineliminable assumption of the theory?

What do Bohmian corpuscles do?

- Assumption: Experiences of conscious observers are determined by positions of Bohmian particles.
- An ineliminable assumption of the theory?

A direction for new research?

- De Broglie introduced the waves to guide the particles.
- But interaction is mediated the waves; it starts to look as if the particles don't act at all.
- *Cf.* Classical EM: interaction between charges is mediated by fields, but charges are sources of fields.
- Could there be a version of Bohmian mechanics in which Bohmian particles act more like sources of wave fields?

A direction for new research?

- De Broglie introduced the waves to guide the particles.
- But interaction is mediated the waves; it starts to look as if the particles don't act at all.
- *Cf.* Classical EM: interaction between charges is mediated by fields, but charges are sources of fields.
- Could there be a version of Bohmian mechanics in which Bohmian particles act more like sources of wave fields?

A direction for new research?

- De Broglie introduced the waves to guide the particles.
- But interaction is mediated the waves; it starts to look as if the particles don't act at all.
- *Cf.* Classical EM: interaction between charges is mediated by fields, but charges are sources of fields.
- Could there be a version of Bohmian mechanics in which Bohmian particles act more like sources of wave fields?

A direction for new research?

- De Broglie introduced the waves to guide the particles.
- But interaction is mediated the waves; it starts to look as if the particles don't act at all.
- *Cf.* Classical EM: interaction between charges is mediated by fields, but charges are sources of fields.
- Could there be a version of Bohmian mechanics in which Bohmian particles act more like sources of wave fields?