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More Variations on Aharonov-Bohm, Peter A. Sturock, Timothy R. Groves, Alexander Ershkovich, C. Alden Mead, Herman Batelaan and Akira Tonomura: Batelaan and Tonomura Reply

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The Hamilton–Jacobi equation may be an example of a theoretical vehicle by which to explore generalizations such as relativistic effects, separation of variables, multiple particle effects, or the classical limit of the de Broglie–Bohm theory.

C. Alden Mead recollects interesting statements made by Bohm. We agree fully with Bohm’s statement that “it would be much more revolutionary for this effect to be wrong than for it to be right.” Attempts to disprove the AB effect should be seen for what they are, outright attempts at finding limits to the validity of quantum mechanics itself. And although quantum mechanics is unfinished with respect to, say, decoherence theory and quantum gravity, the AB effect appears to be well within its validity range.

We do not share Bohm’s astonishment that, as Mead relates, “certain physicists refused to accept the AB effect and even went to great lengths to try to disprove it.” Rather, to risk overusing a platitude, extraordinary phenomena should be exposed to extraordinary scrutiny. Failed attempts to disprove an idea often provide insight into its fundamental character. In that context, we reiterate the main message of our article. Many facets of the AB effect—for example, the electric version, the dispersionless nature, relativistic momentum conservation, the relation to the Mott–Schwinger effect, and the AB effects for other than electromagnetic gauge-invariant theories—need exploration. We predict a bright future for the AB effect, with many surprises to come.

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