

"On the Time Reversal Invariance of Classical Electromagnetic Theory"

Malament, David (2003) "On the Time Reversal Invariance of Classical Electromagnetic Theory".

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Abstract

David Albert claims that classical electromagnetic theory is not time reversal invariant. He acknowledges that all physics books say that it is, but claims they are "simply wrong" because they rely on an incorrect account of how the time reversal operator acts on magnetic fields. On that account, electric fields are left intact by the operator, but magnetic fields are inverted. Albert sees no reason for the asymmetric treatment, and insists that neither field should be inverted. I argue, to the contrary, that the inversion of magnetic fields makes good sense and is, in fact, forced by elementary geometric considerations. I also suggest a way of thinking about the time reversal invariance of classical electromagnetic theory -- one that makes use of the invariant (four-dimensional) formulation of the theory -- that makes no reference to magnetic fields at all. It is my hope that it will be of interest in its own right, Albert aside. It has the advantage that it allows for arbitrary curvature in the background spacetime structure, and is therefore suitable for the framework of general relativity. (The only assumption one needs is temporal orientability.)

Keywords: time reversal invariance; electromagnetic theory; relativity theory; David Albert

Subjects: [Specific Sciences: Physics: Classical Physics](#)
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ID Code: 1406

Deposited By: [Malament, David B.](#)

Deposited On: 23 September 2003

Additional Information: The paper is forthcoming in *Studies in the History and Philosophy of Modern Physics*.

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