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Gauge- and Galilei-invariant Geometric Phases

Bacciagaluppi, Guido (1997) *Gauge- and Galilei-invariant Geometric Phases*. [Preprint]



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Abstract

Neither geometric phases nor differences in geometric phases are generally invariant under time-dependent unitary transformations (unlike differences in total phases), in particular under local gauge transformations and Galilei transformations. (This was pointed out originally by Aharonov and Anandan, and in the case of Galilei transformations has recently been shown explicitly by Sjoqvist, Brown and Carlsen.) In this paper, I introduce a phase, related to the standard geometric phase, for which phase differences are both gauge- and Galilei-invariant, and, indeed, invariant under transformations to linearly accelerated coordinate systems. I discuss in what sense this phase can also be viewed as geometric, what its relation is to earlier proposals for making geometric phases invariant under gauge or Galilei transformations, and what is its classical analogue. I finally apply this invariant phase to Berry's derivation of the Aharonov-Bohm effect.

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Item Type: Preprint
Keywords: geometric phases, gauge transformations, Galilei transformations, Aharonov-Bohm effect
Subjects: [Specific Sciences](#) > [Physics](#) > [Quantum Mechanics](#)
Depositing User: [Guido Bacciagaluppi](#)
Date Deposited: 27 Feb 2005
Last Modified: 07 Oct 2010 11:13
Item ID: 2211
URI: <http://philsci-archive.pitt.edu/id/eprint/2211>

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