

# On the Reality of Gauge Potentials

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## Abstract

Classically, a gauge potential was merely a convenient device for generating a corresponding gauge field. Quantum-mechanically, a gauge potential lays claim to independent status as a further feature of the physical situation. But whether this is a local or a global feature is not made any clearer by the variety of mathematical structures used to represent it. I argue that in the theory of electromagnetism (or a non-Abelian generalization) that describes quantum particles subject to a classical interaction, the gauge potential is best understood as a feature of the physical situation whose global character is most naturally represented by the holonomies of closed curves in space-time.

**Keywords:** gauge potentials, gauge theories, quantum mechanics, electromagnetism, Aharonov-Bohm

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