

A versus B! Topological nonseparability and the Aharonov-Bohm effect

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Abstract

Since its discovery in 1959 the Aharonov-Bohm effect has continuously been the cause for controversial discussions of various topics in modern physics, e.g. the reality of gauge potentials, topological effects and nonlocalities.

In the present paper we juxtapose the two rival interpretations of the Aharonov-Bohm effect. We show that the conception of nonlocality encountered in the Aharonov-Bohm effect is closely related to the nonseparability which is common in quantum mechanics albeit distinct from it due to its topological nature. We propose a third alternative interpretation based on the loop space of holonomies which serves to solve some of the problems and we trace back the topological nonlocality and thereby the Aharonov-Bohm effect to their quantum mechanical origin. All three discussed interpretations are, of course, empirically equivalent. In fact, they present us with an instructive case study for the thesis of theory underdetermination by empirical data.

Keywords: gauge theory, topology, holonomies, nonlocality, underdetermination

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