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Study of the Aharonov-Bohm effect: a derivation of one particle quantum mechanics from quantum field theory BENLIANG LI, Nanyang technological university, DANIEL HEWAK, University of Southampton, QIJIE WANG, Nanyang technological university — In this article, we start with the discussions on the Aharonov-Bohm effect then raise a plausible interpretation within the quantum electrodynamics (QED) framework. We provide a quantum treatment of the source of the electromagnetic potential and argue that the underlying mechanism in AB effect can be viewed as interactions between electrons described by QED theory where the interactions are mediated by virtual photons. On further analysis, we show that the framework of one particle quantum mechanics (OPQM) can be given, in general, as a mathematically approximated model which is reformulated from QED theory while the Aharonov-Bohm effect scheme provides a platform for our derivations. In addition, the classical Maxwell equations are derived from QED scattering process while both classical electromagnetic fields and potentials serve as mathematical tools that are constructed to approximate the interactions among elementary particles described by QED physics, i.e., neither classical fields nor potentials represent any real entities of nature.

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