

The Principle of Least Action as the Logical Empiricist's Shibboleth

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Abstract

The present paper investigates why Logical Empiricists remained silent about one of the most philosophy-laden matters of theoretical physics of the day, the Principle of Least Action (PLA). In the two decades around 1900, the PLA enjoyed a remarkable renaissance as a formal unification of mechanics, electrodynamics, thermodynamics, and relativity theory. Taking Ernst Mach's historico-critical stance, it could be liberated from much of its physico-theological dross. Variational calculus, the mathematical discipline on which the PLA was based, obtained a new rigorous basis. These three developments prompted Max Planck to consider the PLA as formal embodiment of his convergent realist methodology. Typically rejecting ontological reductionism, David Hilbert took the PLA as the key concept in his axiomatizations of physical theories. It served one of the main goals of the axiomatic method: 'deepening the foundations'. Although Moritz Schlick was a student of Planck's, and Hans Hahn and Philipp Frank enjoyed close ties to Göttingen, the PLA became a veritable Shibboleth to them. Rather than being worried by its historical connections with teleology and determinism, they erroneously identified Hilbert's axiomatic method tout court with Planck's metaphysical realism. Logical Empiricists' strict containment policy against metaphysics required so strict a separation between physics and mathematics to exclude even those features of the PLA and the axiomatic method not tainted with metaphysics.

Keywords: Principle of Least Action, calculus of variations, Hilbert's axiomatic method in physics, Mach-Planck controversy, Logical Empiricism, Moritz Schlick, Hans Hahn, Philipp Frank.

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