

When champions meet: Rethinking the Bohr--Einstein debate

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Abstract

Einstein's philosophy of physics (as clarified by Fine, Howard, and Held) was predicated on his Trennungsprinzip, a combination of separability and locality, without which he believed objectification, and thereby "physical thought" and "physical laws", to be impossible. Bohr's philosophy (as elucidated by Hooker, Scheibe, Folse, Howard, Held, and others), on the other hand, was grounded in a seemingly different doctrine about the possibility of objective knowledge, namely the necessity of classical concepts.

In fact, it follows from Raggio's Theorem in algebraic quantum theory that - within an appropriate class of physical theories - suitable mathematical translations of the doctrines of Bohr and Einstein are equivalent. Thus - upon our specific formalization - quantum mechanics accommodates Einstein's Trennungsprinzip if and only if it is interpreted a la Bohr through classical physics.

Unfortunately, the protagonists themselves failed to discuss their differences in this constructive way, since their debate was dominated by Einstein's ingenious but ultimately flawed attempts to establish the "incompleteness" of quantum mechanics.

This aspect of their debate may still be understood and appreciated, however, as reflecting a much deeper and insurmountable disagreement between Bohr and Einstein about the knowability of Nature. Using the theological controversy on the knowability of God as an analogy, we can say that Einstein was a Spinozist, whereas Bohr could be said to be on the side of Maimonides. Thus Einstein's off-the-cuff characterization of Bohr as a 'Talmudic philosopher' was spot-on.

Keywords: Bohr-Einstein debate, EPR, objectification, completeness of quantum mechanics, Raggio's Theorem

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