

A Priori Conjectural Knowledge in Physics: The Comprehensibility of the Universe

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Abstract

In this paper I argue for a priori conjectural scientific knowledge about the world. Physics persistently only accepts unified theories, even though endlessly many empirically more successful disunified rivals are always available. This persistent preference for unified theories, against empirical considerations, means that physics makes a substantial, persistent metaphysical assumption, to the effect that the universe has a (more or less) unified dynamic structure. In order to clarify what this assumption amounts to, I solve the problem of what it means to say of a theory that it is unified. There are, I argue, eight different kinds of unity important in theoretical physics, all varieties of one basic idea. This provides us with a precise way of partially ordering physical theories with respect to their degree of unity. It also leads to a hierarchical view of physics, according to which physics makes a number of increasingly insubstantial metaphysical assumptions concerning the comprehensibility and knowability of the universe. Two of these are identified as constituting a priori conjectures. I conclude by arguing that the view developed in the paper resolves the traditional clash between empiricism and rationalism in the philosophy of science, and has important implications for science, and for academic inquiry more generally.

Keywords: A priori, a priori knowledge, physics, scientific method, metaphysics, empiricism, rationalism, unification, physicalism, simplicity, explanation, symmetry, degrees of theoretical unity, theories of everything, comprehensibility, natural philosophy, theory change, scientific progress, aims of science, Hume, Kant, Einstein, Duhem, Popper, Kuhn, Lakatos.

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