AKPhil 6: Wissenschaftstheorie I

Zeit: Dienstag 16:45–17:45 Raum: KGI-HS 1015

AKPhil 6.1 Di 16:45 KGI-HS 1015

Why boundary conditions can be laws — •Wolfgang Pietsch — Wissenschaftstheorie, Universität Augsburg

Starting from the underdetermination thesis it is argued, that at least partly the distinction between physical laws and boundary conditions is determined by conventions. Both conceptual and historical evidence will be presented for this conclusion. Conceptually, an analogy will be drawn to Quine's well-known argument concerning the analytic-synthetic distinction. Analytic share with law-like statements the property that, independently of the circumstances, they always hold. In contrast, synthetic statements just like boundary conditions must be deduced from the specific empirical situation. Thus, many of Quine's conclusions derived for the analytic-synthetic distinction apply for the distinction between laws and boundary conditions as well: In particular, the status of a physical statement as law or as boundary condition is not fully determined by the empirical data but also requires well-adapted conventions. With a paradigm shift, statements may switch their status from physical law to boundary condition and vice versa. One historic example concerns the numerical value of the radii of the planets. According to Kepler's astronomy these are determined by law, for Newton they are contingent facts. Where else is the distinction of importance? For instance, Boltzmann's explanation of macroscopic irreversibility presupposes, that an unambiguous line between (reversible) fundamental laws and (irreversible) boundary conditions can be drawn.

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Scale separation as a condition for quantitative modelling — •Rafaela Hillerbrand — Faculty Of Philosophy, University of Oxford, UK

In many applied contexts, it is not qualitative but quantitative forecast that is required. For example climate models shall predict not only the correct shape of the probability distribution of a possible change in mean temperature, but also the numerical values associated to its mean, its variance and so forth. This paper addresses the question on when the description of an empirical phenomenon allows for such a quantitative modelling. The distinction between working and non-working quantitative predictions does not coincide with the boundary between social and natural sciences. Even for the latter numerous examples exist for which quantitative models are still missing. A well known example within physics is hydrodynamic turbulence.

It is argued that the key issue in deriving quantitative forecasts is the separation of the relevant scales. It is shown that this holds both for purely phenomenological models as well as for models derived within a deeper theoretical framework. As an example for a working quantitative model the semi-classical description of the Laser is opposed to hydrodynamic turbulence, which up to now does not allow for quantitative modelling due to a lack of scale separation. Similarly scale separation distinguishes models within QED from QCD models.