

AGPhil 1: Quantum and Classical Gravity 1

Time: Monday 9:30–11:15

Location: PTB SR AvHB

Invited Talk AGPhil 1.1 Mon 9:30 PTB SR AvHB
The Dark Energy Crisis as a Problem of Underdetermination of Pursuit-worthiness — ●PATRICK DUERR — von Weizsäcker Institut für Grundlagenforschung in den Wissenschaften, Eberhard Karls Universität Tübingen, Germany

We ought not to conceive of the Dark Energy problem as a crisis in the traditional–Kuhn-inspired–way. Instead of a frenzy of motley explored ideas, triggered by an empirical or theoretical anomaly that defies the prevalent cosmological framework, the Λ CDM model, the Dark Energy crisis consists in a proliferation of approaches to account for the pertinent phenomena—in the hopes of hitting on a conclusive empirical anomaly. The main hypothesis, defended in this talk, is that the Dark Energy crisis is best construed in terms of underdetermination of pursuit-worthiness (rather than the more familiar plight of evidential underdetermination). What renders the Dark Energy crisis so perplexing is that none of them stands out as uncontroversially preferred in terms of their promise—the rational justification for their pursuit, i.e. the reasons to work on them. I substantiate this claim by applying a Peircean economic model of pursuit-worthiness to the main Dark Energy proposals. I conclude with counselling two complementary research strategies, implemented already in the cosmology community. The first, reminiscent of Feyerabendian “anarchism”, encourages bold heterodox ideas, with the goal of enhancing the testability of the present paradigm through theory pluralism. Secondly, reminiscent of Wheeler’s “daring conservatism”, we should explore the implications of the Λ CDM model, and seek to devise more and stricter tests.

AGPhil 1.2 Mon 10:15 PTB SR AvHB
Dark Matter or Modified Gravity? A pragmatic choice between two working hypotheses — ●ANTONIS ANTONIOU — Institut für Philosophie, Rheinischen Friedrich-Wilhelms-Universität Bonn

The debate between dark matter and modified gravity scenarios in response to the cosmological anomalies observed in the 1970s and 1980s is often framed in the philosophy of physics as a clash between two competing theories or models: the standard cosmological model with general relativity (Λ CDM) and Milgrom’s Modified Newtonian dynamics (MOND) (cf. Massimi 2018; Jacquart 2021; Martens and King 2023; Duerr and Wolf 2023). This discussion questions the fairness

of directly comparing Λ CDM and MOND due to their different theoretical statuses. A more nuanced understanding of the philosophical question regarding the preference between the two possible lines of explanation for the observed cosmological anomalies emerges by framing the debate as a pragmatic choice between two working hypotheses: (1) introducing a non-baryonic form of matter to the mass-energy budget of the universe and (2) modifying gravitational dynamics. A historical analysis of the scientific situation in the 1980s suggests that, although no conclusive evidence supports the former hypothesis, the pragmatic advantages of adopting a dark matter scenario far outweigh the pursuit of a modified theory of gravity with a different phenomenology on the galactic scale.

AGPhil 1.3 Mon 10:45 PTB SR AvHB
Functional unity in quantum gravity — ALEX SEUTHE¹ and ●LUIGI LAINO² — ¹TU Dortmund University, Dortmund, Germany — ²University of Naples Federico II, Naples, Italy

The unification of General Relativity (GR) and Quantum Mechanics (QM) is a significant open question in physics. This issue, tackled by approaches such as Loop Quantum Gravity (LQG), challenges our conventional interpretation of space and time (and spacetime).

LQG is in tension with Kant’s philosophy of pure reason, where space and time are pure intuitions. We think that Cassirer’s neo-Kantian revision of Kant’s Aesthetics may be of service for framing questions arising here. Hence, our paper will:

1) Illustrate how later neo-Kantian interpretations of Kantian Aesthetics prevent a collapse of a revised Kantian philosophy in light of new developments in physics, particularly by leveraging the idea of “functionalism” (also upheld by Rovelli and relational QM).

2) Demonstrate how, through Cassirer’s advanced philosophy of symbolic forms, unity can be perceived as a functional concept. We will also utilise his books *Zur Einsteinschen Relativitätstheorie* (1921) on GR and *Determinismus und Indeterminismus in der modernen Physik* (1937) on QM, focusing on Cassirer’s systematic method and his approach to establishing functional unity as the focal point in the epistemology of physics.

In 2024, as we celebrate the 300th anniversary of Immanuel Kant and the 150th of Ernst Cassirer, it is an opportune moment to critically revisit their philosophical insights.