Arbeitsgruppe Philosophie der Physik (AGPhil)

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Übersicht der Hauptvorträge und Fachsitzungen

(HS 10)

Plenarvortrag der AGPhil

PV V	Di	9:45–10:30	Plenarsaal	**On the tension between mathematics and physics** — •Miklos Redei

Hauptvorträge

AGPhil 2.1	Mo	16:30–17:15	HS 10	**Fine-Tuning, Robustness, and Idealization** — •Casey McCoy
AGPhil 3.1	Di	11:00–11:45	HS 10	**What do we actually learn from simulated universes?** — •Stéphanie Ruphy
AGPhil 4.1	Di	14:00–14:45	HS 10	**Anthropic reasoning and finality** — •Richard Dawid
AGPhil 5.1	Mi	11:00–11:45	HS 10	**Is Model Building in Cosmology Special?** — •Claus Beisbart
AGPhil 6.1	Mi	14:00–14:45	HS 10	**The cosmological constant as a quantum gravity effect.** — •Fay Dowker
AGPhil 7.1	Mi	16:30–17:15	HS 10	**Time travelling in emergent spacetime** — •Christian Wüthrich
AGPhil 7.3	Mi	17:45–18:30	HS 10	**Q.E.D., QED** — •Chris Smeenk, Adam Koberinski

Hauptvorträge des fachübergreifenden Symposiums SYKM

Das vollständige Programm dieses Symposiums ist unter SYKM aufgeführt.

SYKM 1.1	Di	16:30–17:10	HS 4	**Conceptual problems with cosmological model-building from the point of view of General Relativity** — •George Ellis
SYKM 1.2	Di	17:10–17:50	HS 4	**Inhomogeneities in cosmology and the geometry of spacetime averaging** — •Mauro Carfora
SYKM 1.3	Di	17:50–18:30	HS 4	**Bayes, datasets, and priors in the hunt for dark energy** — •Michela Massimi

Fachsitzungen

AGPhil 1.1–1.4	Mo	14:00–16:00	HS 10	**Philosophy of Cosmology I**
AGPhil 2.1–2.3	Mo	16:30–18:15	HS 10	**Philosophy of Cosmology II**
AGPhil 3.1–3.3	Di	11:00–12:45	HS 10	**Philosophy of Cosmology III**
AGPhil 4.1–4.3	Di	14:00–15:45	HS 10	**Philosophy of Cosmology IV**
AGPhil 5.1–5.3	Mi	11:00–12:45	HS 10	**Philosophy of Cosmology V**
AGPhil 6.1–6.3	Mi	14:00–15:45	HS 10	**Philosophy of Cosmology VI**
AGPhil 7.1–7.3	Mi	16:30–18:30	HS 10	**Philosophy of Cosmology VII**
AGPhil 8	Mi	18:30–19:00	HS 10	**Mitgliederversammlung der AGPhil**
AGPhil 9.1–9.4	Do	11:00–13:00	HS 10	**Philosophy of Cosmology VIII**
AGPhil 10.1–10.1	Do	14:00–14:30	HS 10	**Philosophy of Cosmology IX**

Mitgliederversammlung Arbeitsgruppe Philosophie der Physik

Mittwoch 18:30–19:00 HS 10

- Bericht
- Planung 2019/20
- Verschiedenes

AGPhil 1: Philosophy of Cosmology I

Zeit: Montag 14:00–16:00 Raum: HS 10

AGPhil 1.1 Mo 14:00 HS 10

Virtuelle und Mögliche Welten in Physik und Philosophie — •Hans Jürgen Pirner — 69120 Heidelberg, Philosophenweg 19

Was sind virtuelle und mögliche Welten und was haben Entwicklungen der modernen Physik mit ihnen zu tun? Der Vortrag entwickelt das wissenschaftliche Weltbild im Vergleich mit möglichen Welten und gelangt so zu einem besseren Verständnis unserer einzigen wirklichen Welt. Dazu beschreibe ich Beispiele aus der klassischen Physik, der Quantenmechanik und Kosmologie. Soll man Paralleluniversen oder das Multiversum einführen? Der Begriff der möglichen Welten in der Philosophie wird diskutiert und mit Zukunftsvisionen in der Science Fiction Literatur verglichen. Erkenntnisse über virtuelle oder hybride Welten eröffnen neue Perspektiven.

AGPhil 1.2 Mo 14:30 HS 10

Das Problem der Gravitation aus Sicht der Information ? — •Rudolf Germer — ITPeV — TU-Berlin

Aus fundamentalen Zusammenhängen versteht man, daß die Lichtgeschwindigkeit eine Grenze beim Verbreiten von Information mit elektromagnetischen Wellen bietet. Warum Gravitationswellen diese gleiche Geschwindigkeit aufweisen, ist unbekannt. Mit kleinsten Informationseinheiten, die Beziehungen zwischen Objekten und Ereignissen darstellen, kann man sowohl elektromagnetische wie mechanische Probleme einfach erfassen. Der elektromagnetische Quader gestattet zunächst, etwa ein Dutzend Naturkonstanten auf vier elementare Größen zurückzuführen. Entnimmt man dieser Struktur die räumliche Komponente, so lassen sich mechanische Analogien beschreiben. Die Masse taucht dabei als Beziehung mit ihrer Trägheit auf. Vergleicht man das Coulombgesetz mit dem Gravitationsgesetz, so ist die *schwere Masse* anscheinend äquivalent zum Objekt der Ladung. Beim Versuch, die Struktur des elektromagnetischen Quaders erneut anzuwenden, landet man bei der Planckmasse oder sehr großen Faktoren im Vergleich zur Feinstrukturkonstante. Dies zeigt vielleicht einen neuen Blickwinkel, um weiter über Gravitation nachzudenken. germer@physik.tu-berlin.de

AGPhil 1.3 Mo 15:00 HS 10

Die Gedanken sind frei. Philosophy of Cosmology — •Helmut Hille — Fritz-Haber-Straße 34, 74081 Heilbronn

Von Anaximander aus Milet (ca. 611 - 545) wurde als einer der ältesten Sätze der antiken Philosophie überliefert: "Der Ursprung der seienden Dinge ist das Unbegrenzte. Denn aus diesem entstehe alles und zu diesem vergehe alles. Weshalb auch unbeschränkt viele Welten produziert werden." Ohne heutige Kenntnisse in Physik und Kosmologie konnte Anaximander rein durch Vernunftüberlegungen diese Aussage treffen, die m.E. immer Bestand haben wird, solange wir der Vernunft und nicht dem Wunschdenken oder dem Zeitgeist folgen. Dazu gilt es, als Erstes zwischen Universum und Kosmos zu unterscheiden. Ein Kosmos ist ein geordnetes Ganzes, das aus einem gemeinsamen Ereignis hervorgegangen ist, das wir Big Bang oder auf Deutsch Urknall nennen. Das Universum ist das räumlich und zeitlich Unbegrenzte, in dem es unzählige Kosmen oder andere Konfigurationen gibt, wodurch bereits die Frage nach der Herkunft des von uns bewohnten Kosmos beantwortet ist. Ein Kosmos geht aus einer zusammenströmenden Materie oder Antimaterie hervor, die bei großer Menge und Dichte einen Big Bang verursacht, der alle Formatierungen löscht. Aus der verbleibenden strahlenden Energie ging anschließend und später durch Supernovae die Materie hervor, die wir kennen. Folgen wir weiterhin dem Satz von der Erhaltung der Energie, ergeben sich die Gegenstände der Kosmologie fast von selbst.

AGPhil 1.4 Mo 15:30 HS 10

Die philosophische Basis des Begriffes des Universums und seine Bedeutung für die Praxis der Physik — •Veronika Klauser — Humboldt-Universität zu Berlin

Was ist das Universum und mit welchen Mitteln lässt es sich erforschen? Auf den ersten Blick scheinen solche Fragen dem Bereich der Physik anzugehören. An dem Punkt jedoch, wo das Ganze (das Universum), und zwar im wörtlichen Sinne, ins Spiel kommt, tritt die Philosophie in ihrer Stärke auf, denn für das Erschließen der Idee des Universums sind die aufgrund einer präzisen Systematik gewonnenen (Meta)Begriffe von entscheidender Bedeutung. Egal, welche Rekonstruktionsverfahren dabei zu Grunde gelegt werden, mündet das Konzipieren des Begriffes des Universums immer in der Antinomie: in zwei einander ausschließenden Behauptungen bezüglich desselben Erkenntnisgegenstandes. Aus diesem Problem gibt es zwei Auswege: Das Ende des Wissens zu proklamieren (Kant) oder eine Grenze in Ansehung des Wissens selbst in das Erkenntnismodel zu integrieren (Hegel). Der bevorzugte Weg bestimmt, und zwar notwendig, die Rahmen, in welchen die empirisch gewonnenen Daten geordnet werden, was Auswirkungen auf die Endergebnisse hat. Im ersten Teil des Vortrages wird der besondere Status des Begriffes des Universums in Bezug auf die Klassische Deutsche Philosophie geschildert, im zweiten wird auf die Umgangsmöglichkeiten mit der antinomischen Natur dieses Begriffes (Kant, Hegel) eingegangen, schließlich wird danach gefragt, wie die Aufforderungen der Moderne für den erworbenen Begriff des Universums aussehen.

AGPhil 2: Philosophy of Cosmology II

Zeit: Montag 16:30–18:15 Raum: HS 10

Hauptvortrag AGPhil 2.1 Mo 16:30 HS 10

Fine-Tuning, Robustness, and Idealization — •Casey McCoy — Stockholm University, Stockholm, Sweden

Concerns over fine-tuning have motivated important developments in theoretical physics. Inflationary cosmology is one important example. In this context, fine-tuning has most often been characterized in terms of likelihood: fine-tuned conditions are said to be "improbable". Yet an interpretation of fine-tuning in such terms is untenable, since probability attributions in this context are unjustified. I propose a novel interpretation of fine-tuning which is based on an appreciation of the roles of robustness and idealization in our physical models, using the flatness and horizon problems as particular examples.

AGPhil 2.2 Mo 17:15 HS 10

Black hole "singularity": breakdown of general relativity theory? — •Kiril Maltsev — St Catherine's College, Manor Road, OX1 3UJ Oxford, UK

The existence of singular space-time solutions in general relativity can be interpreted in one of the two ways: either as a

1. theory deficiency, or 2. as opening up a new horizon of understanding the physical world.

We will argue that black hole thermodynamics supports the view that GR indeed breaks down when it comes to description of a black hole phenomenon. We will stress the difference between coordinate singularity and physical singularity, when discussing the Schwarzschild metric. Subsequently, we will outline that certain singular structures in GR are not a feature characteristic of particularly chosen coordinates but, according to Penrose-Hawking singularity theorems, an inevitable feature of GR, if specific energy and causality conditions are satisfied. The arguments in favour of theory breakdown will center on comparison of black hole mechanics with the 0th, 1st and 2nd law of thermodynamics, and the quest for a microscopic account of Bekenstein entropy. We will also comment on what the lack of a precise singularity definition, the concept of white hole, the wormhole construction in Kruskal-Szekeres coordinates, and neutron star physics reveal. Finally, we will give an outlook on LQG and M-theory, which proceed to describe a black hole without presuming a singularity. (200 words)

AGPhil 2.3 Mo 17:45 HS 10

A Bi-Directional Big Bang / Big Crunch Universe within a Two-State-Vector Quantum Mechanics? — •Fritz Wilhelm Bopp — Department Physik, Universität Siegen

A two-boundary quantum mechanics incorporating a big bang / big crunch universe is carefully considered.

After a persuasive motivation of the two-boundary concept we address the central question how the proposed a-causal quantum universe can be consistent with what is known about the seemingly causal macroscopia.

In a scenario where the universe is macroscopically identical in the expanding and contracting quantum epoch the border state of maximum extend is dynamically determined. The Born rule and the definite "Einstein Würfel" decisions are then direct consequences of this process.

The absence of coexisting macroscopic states is specific to the present thin universe. This might not be the case in the heavily interacting early universe. At the end of this period many coexisting macroscopic states would have to contribute and would have to be averaged over possibly explaining the homogeneity usually attributed inflation.

As the expanding and contracting epoch are quite similar but not completely identical a tiny CPT violation would not be unnatural in such a scenario.

AGPhil 3: Philosophy of Cosmology III

Zeit: Dienstag 11:00–12:45 Raum: HS 10

Hauptvortrag AGPhil 3.1 Di 11:00 HS 10

What do we actually learn from simulated universes? — •Stéphanie Ruphy — Université de Lyon, France

Computer simulations are everywhere in science today, playing a central epistemic role, especially in the studies of physical objects or processes for which data are very sparse or inexistent. But what can we actually learn about real-world systems from their simulated counterparts? Focusing on cosmological simulations, I will offer a requalification of the type of knowledge produced by simulation enterprises, emphasizing its modal character: simulations do produce useful knowledge about our world, but by telling us what could be or could have been the case, rather than by telling us what is or was actually the case. I will also discuss in this talk to what extent the building of increasingly detailed simulations of real-world phenomena shapes the very aims of science.

AGPhil 3.2 Di 11:45 HS 10

Some Issues and Non-Issues in Concordance Cosmology — •Marc Holman — University of Western Ontario

The so-called "flatness problem" is widely taken to be a major outstanding problem of modern cosmology and as such forms one of the prime motivations behind inflationary models. Upon distinguishing three different versions of this putative problem, I show that the observational fact that the large-scale Universe is so nearly flat is ultimately no more puzzling than similar "anthropic coincidences", such as the specific (orders of magnitude of the) values of the gravitational and electromagnetic coupling constants. In particular, there is no fine-tuning problem in connection to flatness of the kind usually argued for. Furthermore, the arguments regarding flatness and particle horizons typically found in cosmological discourses in fact address a mere single issue underlying the standard FLRW cosmologies, namely the *extreme* improbability of these models with respect to any "reasonable measure" on the "space of all spacetimes". In other words, there is arguably a serious cosmological fine-tuning problem, but it pertains to *generic* FLRW geometries. By their very nature, dynamical mechanisms such as inflation are inapt for addressing this latter problem.

AGPhil 3.3 Di 12:15 HS 10

Interventionism Meets Cosmology — •Phil Dowe[1] and Dayal Wickramasinghe[2] for the Dowe and Wickramasinghe-Collaboration — [1]School of Philosophy, Australian National University, Canberra, Australia — [2]Mathematical Sciences Institute, Australian National University, Canberra, Australia

Interventionism as an account of causal explanation and causal inference (Woodward 2003, Pearl 2000) is widely held to have been successful when applied to the special sciences. But it is also widely held that Interventionism doesn't apply on the cosmological scale because, among other reasons, at that scale no sense can be made of the idea of an intervention. We show that there is ample reason to think cosmology utilises causal inferences and furnishes causal explanations, and that attempts to extend the idea of an intervention at the cosmic scale are in some ways better placed to capture cosmic causal explanation than the main rival, Lewis' closest world semantics. To argue for this we consider the inflationary explanation of the expansion rates of the universe and the current acceleration, and the inflationary solution of Guth (1981) to the smoothness problem (horizon problem). In addition we illustrate how causal reasoning might clarify alleged epistemic limitations induced by cosmological horizons (particle and event horizons).

AGPhil 4: Philosophy of Cosmology IV

Zeit: Dienstag 14:00–15:45 Raum: HS 10

Hauptvortrag AGPhil 4.1 Di 14:00 HS 10

Anthropic reasoning and finality — •Richard Dawid — Stockholm University, Stockholm, Sweden

The talk points at a general conceptual shift in scientific reasoning that is required for endorsing anthropic arguments in cosmology. In the 20th century, empirically successful physical theories were taken to have stable explanatory value despite the fact that those theories were expected to be superseded by successor theories later on. This understanding was based on the expectation that the known theory would survive as an effective theory of its more fundamental successor. The effective theory's explanation of a phenomenon remained valid as an effective representation of the corresponding explanation at the level of the fundamental successor theory. The described argument would not be available to anthropic reasoning, however, if the multiverse theory on which it is based were at some stage superseded by a successor theory that lacked the multiverse structure. In that case, the explanatory value of anthropic reasoning would collapse entirely. Therefore, unlike other scientific explanations, anthropic explanations depend on implicit finality assumptions to establish their relevance. The talk will discuss implications of this shift.

AGPhil 4.2 Di 14:45 HS 10

The naturalness principle and its justification — •Miguel Ángel Carretero Sahuquillo — Bergische Universität Wuppertal

The naturalness principle has had a major role in particle physics during the last decades, in particular in model building. Nowadays, one can find a wide range of different definitions. Some of them seem mutually exclusive, but traditionally its notion has been linked to the fine-tuning problem. In order to palliate it as appears in the Higgs sector of the standard model, new physics should have appeared in the last LHC run. Thus, the persistence of fine-tuning has originated numerous works exploring both, the limits and the different conceptual definitions of naturalness. However, little work has been done re-examining precisely one of the main pillars naturalness advocates: its historical successes.

In this talk I will delineate the two kind of examples used in literature for justifying naturalness based on past instances, namely reconstructions and successes. As the sole success example, the charm quark episode will be reviewed. Exploring the motivations given for its prediction and the later computed mass will allow us to determine whether the charm quark is indeed a good example of a naturalness success, able to trigger further model building based on naturalness. The main conclusion will be a negative answer, which will driven us to claim that the charm quark case should count as a naturalness reconstruction, whose justificatory power is reduced with respect to an actual success.

AGPhil 4.3 Di 15:15 HS 10

Universe - Multiverse. The fine tuning of the constants of Nature — •Thomas Naumann — Deutsches Elektronen-Synchrotron DESY, 15738 Zeuthen, Germany

Einstein once said: "What really interests me is whether God could have created the world any differently." Our existence depends on a variety of constants which appear to be extremely fine-tuned to allow for the existence of Life. These include the number of spatial dimensions, the strengths of the forces, the masses of the particles, the composition of the Universe and others.
Starting from Leibniz' question whether we live in the "Best of all Worlds" we ask which parts of the laws of physics are fine-tuned and whether the hypothesis of a multiverse can explain the fine-tuning of so many fundamental quantities.
We discuss the role of hypotheses and Popper's criterion of falsification in physics as well as critique of the anthropic principle.

AGPhil 5: Philosophy of Cosmology V

Zeit: Mittwoch 11:00–12:45 Raum: HS 10

Hauptvortrag AGPhil 5.1 Mi 11:00 HS 10

Is Model Building in Cosmology Special? — •Claus Beisbart — Institute of Philosophy, University of Bern

Cosmology is a very special endeavor. As has often been argued, it differs from other sciences because it faces some peculiar epistemological challenges: It is in some sense concerned with everything there is; its object, the Universe, is unique; and the latter can only be observed from a particular perspective. Now modelling can deal with such challenges; for instance, models can abstract away from various aspects and thus help to constitute the object of cosmology; and it is common that a model has a unique system as its target. However, it may well be that the special character of cosmology and its epistemological challenges reappear at the level of modeling. The aim of this talk is thus to answer the question of whether modeling in cosmology is beset by special problems. I start with listing the most severe challenges that have been claimed for cosmology. I then discuss how the research strategy of modeling can in principle overcome some of the challenges. After a short proposal to systematize model building in present-day cosmology, I explore in which sense the practice of modeling in cosmology is special. I argue that some challenges to cosmology reappear in the guise of underdetermination problems, but I also show that such problems are not uncommon in other applications of modeling. I further argue that most difficulties and anomalies in present-day modeling in cosmology, e.g. the core-cusp problem or problems that arise due to the interrelationships between processes at several scales, are contingent in that they do not derive from the special character of cosmology.

AGPhil 5.2 Mi 11:45 HS 10

Exploring the Epistemological and Metaphysical Commitments of DM and MG — •Zhen Liang — DePaul University, Chicago, IL, USA

Due to the discrepancy between astronomical observations and current theories of gravity, two modifications of general relativity and Newtonian gravity have been proposed: (1) Dark Matter (DM) is posited to compensate for the missing mass that is indicated by the Einstein field equations; (2) a class of theories under the common name Modified Gravity (MG) is alternatively proposed to avoid the invocation of dark matter (which, of course, has yet to be observed). In this paper, I investigate both theories from a philosophical perspective. Pragmatically speaking, both DM and MG seem to *work*: both theories are capable of producing predictions in conformity with cosmological observations. Nevertheless, if we investigate the structure of both theories, a series of hidden metaphysical, ontological, and epistemological commitments undergirding DM and MG are brought to the fore*commitments that expose important philosophical and scientific implications that may impact the future of both theory-building and experimentation.

AGPhil 5.3 Mi 12:15 HS 10

The constructivist's programme and the problem of pregeometry — •Kian Salimkhani[1] and Niels Linnemann[2] — [1]University of Bonn — [2]University of Geneva

Prominently, Norton (2008) argues against constructivism about spacetime theories, the doctrine that spatiotemporal structure in the dynamics only has derivative status tout court. Particularly, he accuses Brown's dynamical approach to special relativity of being merely halfway constructivist: setting up relativistic fields as presupposed in the dynamical approach to special relativity already requires spatiotemporal background structure, referred to as pregeometry. In response, Menon (2018) recently tried to defend a full constructivist understanding of the dynamical approach in which the dynamical fields are rendered in terms of putatively non-spatiotemporal algebraic structure. But also Stevens (2018) can be read to aim at a full constructivist story based on a non-spatiotemporal ordering structure at its bottom. In this paper, we investigate to what extent a constructivist aiming at reconstructing spacetime from fields and their dynamical laws is able to do without any presupposed spatiotemporal structure. First, we present a reformulation of the challenge for the constructivist. We then argue that previous attempts to address the challenge are either tied to a certain account of natural laws or ill-directed. Finally, we offer a solution based on Stevens' proposal and reevaluate the problem of pregeometry in light of it.

AGPhil 6: Philosophy of Cosmology VI

Zeit: Mittwoch 14:00–15:45 Raum: HS 10

Hauptvortrag AGPhil 6.1 Mi 14:00 HS 10

The cosmological constant as a quantum gravity effect. — •Fay Dowker — Imperial College, London, UK

By treating the whole universe as a quantum system, and using features of the causal set approach to quantum gravity, Sorkin predicted the magnitude of the cosmological "constant", Lambda, today should be of the order of the ambient matter density today. This prediction was verified in the late 1990s and is the only prediction from quantum gravity that has been verified. I will review Sorkin's argument which uses the path integral or sum-over-histories approach as the fundamental framework for quantum theory. I will review the state of play on models based on Sorkin's original heuristic argument and their phenomenology, for example fits to the CMB and other data sets.

AGPhil 6.2 Mi 14:45 HS 10

Time's Arrow in a Quantum Universe: On the Nature of the Initial Quantum State — •Eddy Keming Chen — Rutgers University, New Brunswick, NJ, USA

In a quantum universe with an arrow of time, we postulate a low-entropy boundary condition (the Past Hypothesis) to account for the temporal asymmetry. In this talk, I show that we can use the Past Hypothesis to determine a natural initial quantum state of the universe. First, I introduce the idea that the quantum state of the universe can be impure. This stands in sharp contrast to the standard view, according to which the quantum state of the universe is pure. Second, I suggest that the Past Hypothesis is sufficient to determine a natural density matrix, which is simple and unique. This is achieved by what I call the Initial Projection Hypothesis: the initial density matrix of the universe is the (normalized) projection onto the Past Hypothesis subspace (in the Hilbert space). Third, because the initial quantum state is unique and simple, we no longer need to postulate fundamental statistical-mechanical probabilities to rule out anti-entropic quantum states (because there is only one possible initial state), and moreover we can interpret the quantum state to have the same status as laws of nature (because it is simple enough to be nomological). Hence, it offers a simple and unified answer to several open questions in philosophy of

cosmology, including a natural choice for the universal quantum state (cf: Hartle and Hawking 1984), the status of the quantum state (cf: Durr et al. 1997), and the reduction of statistical mechanical probabilities (cf: Albert 2000 and Wallace 2012).

AGPhil 6.3 Mi 15:15 HS 10

Geodesic Motion in General Relativity and in Weyl Geometry — •Dennis Lehmkuhl — Institut für Philosophie, Universität Bonn, Am Hof 1, 53113 Bonn

In 1918, Hermann Weyl and Albert Einstein exchanged almost two dozen letters. In the majority of them, they focus on comparing general relativity (GR) with Weyl's unified field theory. The latter is based on a generalisation of pseudo-Riemannian geometry that we now call Weyl geometry. One of the most interesting aspects of this correspondence is the discussion of the motion of test particles in GR as compared to Weyl's theory. I will first outline the different positions advocated by Weyl and Einstein and the arguments they name in their favour. In the 1920s, Einstein and Weyl then independently argued that the geodesic motion of test particles in GR could be derived rather than assumed. In 1975, Geroch and Jang provided a new type of proof for such a 'geodesic theorem'. I will argue that the Geroch-Jang theorem can be generalised to Weyl geometry if the latter is decoupled from the project of a unified field theory, and that it can then shed new light on the positions advocated by Einstein and Weyl in the 1910s and 1920s.

AGPhil 7: Philosophy of Cosmology VII

Zeit: Mittwoch 16:30–18:30 Raum: HS 10

Hauptvortrag AGPhil 7.1 Mi 16:30 HS 10

Time travelling in emergent spacetime — •Christian Wüthrich — University of Geneva, Switzerland

Most approaches to quantum gravity suggest that relativistic spacetime is not fundamental, but instead emerges from some non-spatiotemporal structure. This talk investigates the implications of this suggestion for the possibility of time travel in the sense of the existence of closed timelike curves in some relativistic spacetimes. In short, will quantum gravity reverse or strengthen general relativity's verdict that time travel is possible?

AGPhil 7.2 Mi 17:15 HS 10

Implications of the Modal Structure of Spacetime Events — •Samuel Fletcher — University of Minnesota, Minneapolis, USA

The points of spacetime are often described as events. Events, in turn, are often described as idealized, arbitrarily small and fast possible processes, or the possible parts of histories of particles. This is because not all point-events in a spacetime model represent actual parts of particle histories. However, this raises questions about the modal status of these point-events, for typically a spacetime model represents a merely possible way for spacetime and a material history of states of affairs to be. What does it mean to be a merely possible but not actual point-event of a merely possible but not actual spacetime? How can such mere possibilities play a role

I explore two explications of this status, one in terms of point particles and another in terms of fields. The former encounters certain difficulties explaining the possibility of point particles traversing certain types of closed timelike curves, while embracing a pure field ontology avoids the issues entirely. Thus, maintaining a pure field ontology clarifies and simplifies the modal structure of spacetime theory.

Hauptvortrag AGPhil 7.3 Mi 17:45 HS 10

Q.E.D., QED — •Chris Smeenk and Adam Koberinski — Western University, Canada

Quantum electrodynamics is often regarded as the most well-tested theory ever, due to incredibly high precisions tests such as the measurement of the anomalous magnetic moment of the electron. This talk proposes a different understanding the evidence in favor of QED. Regarding it as confirmed by a series of predictions does not adequately reflect the strength of the case in favor of QED, nor do they correctly capture the logic of theory testing. High precision tests of QED presuppose that the theory is correct in order to describe the experiments. This raises two concerns. The first regards whether this involves circular reasoning. The main issue has been whether any discrepancies that are uncovered with increasing precision can be accounted for with more detailed physical models. For example, low energy experiments with pure QED systems have, surprisingly, reached a level of precision such that other Standard Model interactions have to be taken into account. Studies of different systems have allowed for consistent independent determinations of the fine structure constant. Second, is this use of QED compatible with acknowledging that it is only an effective field theory? We will argue that the reasoning involved in treating these experiments only depends on QED providing an accurate description within a limited domain.

AGPhil 8: Mitgliederversammlung der AGPhil

Zeit: Mittwoch 18:30–19:00 Raum: HS 10

Mitgliederversammlung

AGPhil 9: Philosophy of Cosmology VIII

Zeit: Donnerstag 11:00–13:00 Raum: HS 10

AGPhil 9.1 Do 11:00 HS 10

#eco-techno-cosmo-logic develops an aesthetic-scientific experimental system based on the ongoing research at the Laboratori Nazionali del Gran Sasso — •Amelie Lössl[1], Jol Thomson[3], Diogo Da Cruz[1], Angela Neumair[1], and Elizabeth Mondragón[2] — [1]Akademie der Bildenden Künste, München, Deutschland — [2]Technische Universität München, München, Deutschland — [3]University of Westminster, London, Great Britain

The SFB42 is a research group built out of artists from the Munich Academy of Fine Arts and physicists of the TUM. Together they travelled to the LNGS, the largest underground research center in the world, where they collected important data for the project #eco_techno_cosmo_logic, which was initiated and developed by artist and researcher Jol Thomson. Based on the results of a subsequent workshop they were able to create some trans-objects by teaming up and working in interdisciplinary pairs. These objects are partial and material manifestations of this collaborative working process, where an intermingling of aesthetic and scientific methods and representations takes place. In our talk we will present and discuss the produced trans-objects. They are inspired by the concept of diffraction used by the feminist thinkers Donna Haraway and Karen Barad. Diffraction is a performative alternative to the analogy of our epistemologies as reflective, referring to a concept of physical optics, where it describes the interference pattern of diffracting light rays; which, in turn, enables knowledge production outside conventional patterns.

AGPhil 9.2 Do 11:30 HS 10

Probability Theory as a Physical Theory Gives Insight in Big Topics. Questions to Mathematicians. — •Louis Vervoort — University of Tyumen

There is something puzzling about probability theory: does it describe individual events (or systems), or rather ensembles of similar systems?

At any rate, probabilities are always measured on ensembles. In this sense probability theory, as a physical theory, is unique: other physical theories describe individual measurements and individual systems. Here it is argued that probability theory can be seen as a general theory of causality (or determinism), so dealing with the underlying causal connections between systems. This simple be it radical interpretation suggests new avenues of research for fundamental issues in physics and mathematics. For example, it suggests 1) a generalization of the Central Limit Theorem; and 2) a different approach to address the unification of quantum mechanics and relativity theory. Throughout the article precise questions to mathematicians are formulated to advance this research.

AGPhil 9.3 Do 12:00 HS 10

Extragalactic Realism — •Gauvain Leconte — IHPST, Paris, France

Ian Hacking's experimental argument for scientific realism about entities was designed to be applied only to laboratory sciences. Hacking thus defends, in a 1989 paper entitled "Extragalactic reality", an antirealist conception of astrophysics. I argue that this antirealism about astrophysics relies on a misconception of the methodology of present day astronomy and on an anthropocentric distinction between experimentation and observation.

First, I present Hacking's argument for antirealism about black holes and gravitational lenses and show that its shortcomings come from its anthropocentric character. I show that it if we use a non-anthropocentric concept of experimentation such as James Woodward's interventionist account of "natural experiments", then modern astronomy should be considered as an experimental science.

Then, I revisit the cases of gravitational lenses and black holes put forward by Hacking as arguments in favour of his antirealism about astrophysics. I maintain that recent developments such as the use of gravitational lenses to measure Hubble's parameter or the detection of gravitational waves prove that astronomers do perform interventions on astrophysical entities using gravitational lenses and black holes. Therefore, the proponents of the experimental argument for scientific realism should consider these extragalactic objects not as mere hypothetical or auxiliaries but real entities.

AGPhil 9.4 Do 12:30 HS 10

Constants of Nature - The Royal Road to Fundamental Physics — •Alexander Unzicker — Pestalozzi-Gymnasium München

Despite the deep mysteries surrounding their origin, there is little theoretical research about constants of nature. Rather, there appears to be considerable confusion about their role and importance.

The talk tries to clarify the concept in a straightforward manner and highlights the role of constants in history: scientific breakthroughs have usually been accompanied by an elimination of constants. It is argued that any complete theory of reality must do without any constants of nature - though in a different manner than most contemporary attempts.

AGPhil 10: Philosophy of Cosmology IX

Zeit: Donnerstag 14:00–14:30 Raum: HS 10

AGPhil 10.1 Do 14:00 HS 10

Experimentally proven; an argument used to justify mythological concepts and entities in theoretical physics. — •Osvaldo Domann — Stephanstr. 42, D- 85077 Manching

Established theoretical models were adapted over time introducing fictitious entities to explain new experimental data that didn't fit with the prevailing theory. Examples are gluons, gravitons, Higgs, dark matter, dark energy, time dilation, length contraction, etc. The result is a monumental patchwork without a strict internal logical structure and with paradoxes. A very often used argumentation to justify mythological entities is that they are experimentally proven, based on measurements which indirectly show consistency with the characteristics that were previously assigned to the mythological entities. The argument 'Experimentally Proven' avoids that new models build on well proven physical interaction laws are pursued by scientists, models which can explain the new experimental data without fictitious entities. Fictitious concepts or entities (time dilation) can be the result of mathematical approaches (special relativity) or are directly introduced (dark matter) with the required characteristics to explain the new experimental data (flattening of galaxies' velocity curve) that doesn't fit with the current model (Newton gravitation). This shows the necessity to recognise when the argument 'Experimentally Proven' is a real justification or simply a fallacy to justify mythological concepts. More at www.odomann.com