Working Group on Philosophy of Physics
Arbeitsgruppe Philosophie der Physik (AGPhil)

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Overview of Invited Talks and Sessions

(Lecture room VMP6 HS G)

Plenary Talks most notable for AGPhil

PV I	Di	11:00–11:45	VMP4 Audimax 1	**Quantum Gravity: An Overview** — •Abhay Ashtekar
PV III	Mi	9:00– 9:45	VMP4 Audimax 1	**Microscopic black holes and their significance in quantum theories of gravity** — •Gerard 't Hooft

Invited Talks

AGPhil 2.1	Di	9:10– 9:55	VMP6 HS G	**Nineteenth century optics and three tales of success-to-truth inferences** — •Michela Massimi
AGPhil 3.1	Di	13:15–14:00	VMP6 HS G	**Individuation, Entanglement and Composition for Fermions** — •Adam Caulton
AGPhil 4.1	Di	16:45–17:30	VMP6 HS G	**Progress and Gravity: Overcoming Divisions among General Relativity, Particle Physics and the History and Philosophy of Science** — •J. Brian Pitts

Invited talks of the joint symposium SYQG

See SYQG for the full program of the symposium.

SYQG 1.1	Mi	13:30–14:10	VMP4 Audimax 1	**Quantum Tests of Gravity** — •Markus Aspelmeyer
SYQG 1.2	Mi	14:10–14:50	VMP4 Audimax 1	**A Practitioner's View on Quantum Gravity** — •Renate Loll
SYQG 1.3	Mi	14:50–15:30	VMP4 Audimax 1	**Standard Model Fermions and N=8 Supergravity** — •Hermann Nicolai
SYQG 1.4	Mi	15:30–16:10	VMP4 Audimax 1	**Quantum and gravity: blend or mélange?** — •Christian Wüthrich

Sessions

AGPhil 1.1–1.4	Mo	16:45–18:45	VMP6 HS G	**Philosophy of Physics 1**
AGPhil 2.1–2.2	Di	9:10–10:25	VMP6 HS G	**Philosophy of Physics 2**
AGPhil 3.1–3.5	Di	13:15–16:15	VMP6 HS G	**Philosophy of Physics 3**
AGPhil 4.1–4.4	Di	16:45–19:00	VMP6 HS G	**Philosophy of Physics 4**
AGPhil 5.1–5.4	Mi	13:30–16:10	VMP4 Audimax 1	**Symposium Quantentheorie und Gravitation**
AGPhil 6.1–6.2	Mi	16:45–17:45	VMP6 HS G	**Philosophy of Physics 5**

Annual General Meeting of the Working Group on Philosophy of Physics

Dienstag, 1.3.2016 19:00–19:30 Raum VMP6 HS G

- Bericht 2015/16
- Sprecherwahl
- Planung 2016/17
- Verschiedenes

AGPhil 1: Philosophy of Physics 1

Zeit: Montag 16:45–18:45 Raum: VMP6 HS G

AGPhil 1.1 Mo 16:45 VMP6 HS G

Elemente einer dissipativen Quantenfeldtheorie — •Hans Christian Öttinger — ETH Zürich, HCP F 47.2, CH-8093 Zürich

Renormierung geht mir der Eliminierung von Freiheitsgraden einher. Für dynamische Systeme bedeutet dies, daß für Vorgänge auf kurzen Längen- und Zeitskalen die Reversibilität verloren geht und Dissipation zu erwarten ist. Im Rahmen der Quantenfeldtheorie hat ein dissipativer Beitrag zur Dynamik eine Reihe wichtiger mathematischer und philosophischer Konsequenzen, z.B.: (1) Dissipative Quantensysteme können durch Quanten-Mastergleichungen für Dichtematrizen beschrieben werden. Deren thermodynamisch konsistente Formulierung führt zu Nichtlinearitäten. (2) Eine Beschreibung auf der Basis von Dichtematrizen legt nahe, alle physikalisch interessierenden Größen als Korrelationsfunktionen auszudrücken (mit entsprechenden Konsequenzen für das Meßproblem). (3) Dissipation führt zu einer dynamischen Variante der UV-Regularisierung. Paart man diese mit einer IR-Regularisierung durch Wahl eines endlichen Volumens, verschwinden alle Singularitäten aus der Quantenfeldtheorie. (4) Die Umformulierung von Quanten-Mastergleichungen in stochastische Prozesse mit Sprüngen im Hilbertraum eröffnet neuartige Simulationsmöglichkeiten in der Quantenfeldtheorie. (5) Die Entwicklung eines robusten mathematischen Bildes für die Teilchenphysik steht in engster Wechselwirkung mit philosophischen Überlegungen. Alle Details und eine ausführliche Diskussion der philosophischen Grundlagen finden sich in der folgenden Arbeit: H. C. Öttinger, Quantum Field Theory as a Faithful Image of Nature (arXiv:1509.09278).

AGPhil 1.2 Mo 17:15 VMP6 HS G

Modellbildung, aus philosophischer und physikalischer Sicht — •Irena Doicescu — Technische Universität Dresden, Fachrichtung Physik, Didaktik der Physik, 01062 Dresden

Modellbildung spielt nicht nur in der Physik eine wesentliche Rolle, sondern auch in der Philosophie, vor allem wenn es um die Frage geht, in welcher Sprache Physik eigentlich stattfindet, und eignet sich als interdisziplinärer Zugang. Wie Werner Heisenberg treffend bemerkte, 'Mit dem Prozess der Erweiterung unserer wissenschaftlichen Kenntnisse erweitert sich auch die Sprache. Neue Begriffe werden eingeführt und die alten werden in einem weiteren Gebiet oder anders angewendet als bei ihrem Gebrauch in der gewöhnlichen Sprache.' Physikalische Modelle können im experimentellen Kontext entstehen, oder aus den Theorien selbst. Sie dienen als Vermittler zwischen den mathematisch formulierten Theorien und den experimentell zugänglichen Erscheinungen. Die aktuelle Wissenschaftstheorie, resp. die Physikphilosophie, haben ein effizientes Instrumentarium zur logischen (syntaktischen) und semantischen Analyse der Modellbildung entwickelt, dessen wesentlichen Aspekte in diesem Vortrag vorgestellt werden soll. Die physikalische und philosophische Explizierung des Modellbegriffs spielt eine tragende Rolle in wissenschaftstheoretischen Grundlagendiskussionen und bildet deshalb eine gleichsam natürliche Basis für den interdisziplinären Dialog von Physik und Philosophie. Es ist naheliegend, dass diese Diskussionen, ohne einen stets aktualisierten Input aus der Physik selbst, inhaltlich verlieren. Im Vortrag sollen deshalb auch Praxisbeispiele der Modellentstehung betrachtet werden.

AGPhil 1.3 Mo 17:45 VMP6 HS G

The Notion and Practice of Unification in Modern Physics — •Kian Salimkhani — Institut für Philosophie, Universität Bonn

Unification constitutes an important methodological principle of physics. However, it seems unclear what exactly we should mean by that. Should we understand it in a weaker sense, i.e. that physics (as all natural sciences) is implicitly concerned with unification as an abstraction from singular events, or do physicists, in a stronger sense, explicitly refer to some paradigm of unification? In other words: Are particular questions and programs at the frontier of physical research solely generated by the assumption of some kind of unity of nature?

Indeed, it is often argued that all approaches to Quantum Gravity (QG) rest on such an external paradigm. Not only does it seem to be the case that "the real justification for quantizing gravity has yet to be articulated" (Mattingly, 2005), one could even conjecture "that the conceptual disunity of the two theories reflects a disunity in nature" (Wüthrich, 2005).

On the contrary, I claim that modern high energy physics does not need to rely on such an explicit methodological principle in addition - or even opposition - to empirical adequacy, but that in particular the quest for a theory of QG should be understood as a result of an immanent analysis of our best theoretical framework, namely quantum field theory.

Mattingly (2005), Is Quantum Gravity Necessary? Wüthrich (2005), To Quantize or Not to Quantize.

AGPhil 1.4 Mo 18:15 VMP6 HS G

Classical Electrodynamics and Quantization — •Gunnar Kreisel — Gottfried Wilhelm Leibniz Universität

Quantization means that electromagnetic radiation emerges in whole numbered multiples of a constant fundamental quantum. As early as 1900, Max Planck described quantization as an effect resulting from the conditions of electromagnetic radiation that is emitted in a cavity in thermodynamic equilibrium. Seemingly without connection to PLANCK*S assumption, electric elementary charge was determined by using three fundamental laws in 1911 (E.g. Faraday*s law of electrolysis). In classical electrodynamics it was not basically discussed that both the nature of quantization and that of electric elementary charge are each consequences of the special properties of electromagnetic waves. The source of electromagnetic waves (radiation) is the oscillation of an electric charge. Based on the constitution of the oscillating charge the quantization of electromagnetic radiation is but not a trivial consequence simply because the properties of electromagnetic waves are not only fixed by the composition of the oscillating charge but e.g. by frequency, too. This fact along with other relevant properties of electromagnetic waves will be discussed in a wider sense. Within this, an important aspect are the epistemological conclusions of the consequences of the special properties of electromagnetic waves.

AGPhil 2: Philosophy of Physics 2

Zeit: Dienstag 9:10–10:25 Raum: VMP6 HS G

Hauptvortrag AGPhil 2.1 Di 9:10 VMP6 HS G

Nineteenth century optics and three tales of success-to-truth inferences — •Michela Massimi — Philosophy, University of Edinburgh, Edinburgh EH8 9AD, UK

In philosophy of science, success-to-truth inferences have been the realist stronghold for long time. Scientific success has been the parameter by which realists have claimed to discern true theories from false ones (via the so-called No Miracles Argument). But the notion of scientific success has not been scrutinized as it should.

In this paper, I tell the tale of success-to-truth inferences three times, by considering success from nowhere, success from here now, and success from within. My tale focuses on nineteenth century optics and Augustin Fresnel's lasting contribution.

I ultimately argue for a suitable version of success from within that can do justice to the historically situated nature of scientific knowledge while also delivering on the promise of realism about science. The outcome is a new way of thinking about success-to-truth inferences that can help us re-assess some entrenched views about winners and losers in the history of science.

AGPhil 2.2 Di 9:55 VMP6 HS G

Computer simulations as media of knowledge production in the practice of quantum theory — •Arianna Borrelli[1,2], Anne Dippel[1,3], and Martin Warnke[1] — [1]DFG-Kollegforschergruppe "Media Cultures of Computer Simulations (MECS)", Leuphana, Lüneburg — [2]TU Berlin und MECS — [3]HU Berlin , Uni Jena und MECS

Computer simulations are today a necessary element of research practices in all branches of physics, and their possible epistemic significance as a (new) form of experiment has been the subject of much philosophical debate. However, computer simulations may also be regarded as a new form of theoretical description of physical phenomena, replacing the conventional mathematics, and as such they might also be seen as a new language (re)shaping the practice of physical-mathematical theorizing, as was the case with algebraic formalisms, infinitesimal calculus or Feynman diagrams. To put it differently: computer simulations are media for knowledge production.

Choosing a bottom up case studies approach including ethnographic methodologies for investigating this hypothesis, the paper takes a closer look both at instances of theorizing in quantum physics in which computer simulations contribute to the formation of concepts and theoretical structures, and at experimental practices that need computer simulations as a guiding means of the apparatus setup. The examples discussed range from the simulations of very simple quantum-mechanical phenomena to the complex micro-systems of lattice QCD.

AGPhil 3: Philosophy of Physics 3

Zeit: Dienstag 13:15–16:15 Raum: VMP6 HS G

Hauptvortrag AGPhil 3.1 Di 13:15 VMP6 HS G

Individuation, Entanglement and Composition for Fermions — •Adam Caulton — MCMP, LMU Munich, Germany

Permutation symmetry in many-particle quantum mechanics can take one of two interpretations. According to the first interpretation, the transformations under which physical quantities (such as the joint Hamiltonian) are invariant represent a literal permutation of the constituent particles. According to the second interpretation, those transformations are construed as “gauge”, i.e. a reshuffling of non-representative elements in the mathematical formalism. My talk explores the consequences of taking this second interpretation, especially for fermions.

The first consequence I will explore concerns the individuation of particles. I show how single-particle quantities may be found, and even reduced density operators may be defined, in a permutation-invariant way.

The second consequence concerns entanglement. In particular, non-separability of the joint state can no longer be taken as a sufficient condition for entanglement between the constituent systems. A natural surrogate may be defined, which agrees with the proposals of Ghirardi, Marinatto and Weber (2002). This surrogate is further justified by an analogue of Gisin’s theorem for permutation-invariant systems.

The third and final consequence, which is a little more metaphysical, concerns the composition of fermionic joint systems. I argue that fermionic systems disobey classical mereology, the theory of parts and wholes developed by Leśniewski and Leonard & Goodman.

AGPhil 3.2 Di 14:00 VMP6 HS G

The Einstein-Reichenbach Correspondence on the Geometrization of the Electromagnetic Field — •Marco Giovanelli — FORUM SCIENTIARUM Doblerstraße 33 72074 Tübingen

This paper analyzes a correspondence between Reichenbach and Einstein from the spring of 1926, concerning what it means to ’geometrize’ a physical field. The content of an unpublished typewritten note that Reichenbach sent to Einstein on that occasion is reconstructed, showing that it was an early version of sec.49 of the Appendix to Philosophie der Raum-Zeit-Lehre, on which Reichenbach was working at the time. In the note Reichenbach proposed a toy-geometrization of the electromagnetic field: general relativistic equations of motion are rewritten in a way that also charged particles, under the influence of an electromagnetic field, follow their ’natural path’ defined by a non-symmetric affine connection. Einstein criticized Reichenbach’s note from a technical point view (in particular charged particles cannot all move on geodesics of a single connection), but agreed with its philosophical point: the geometrization does not mean something essential. The paper draws two lessons from this episode: From a historical standpoint, the correspondence inaugurated a philosophical reflection about the role played by geometric considerations in physical theories. From a systematical standpoint, pace Reichenbach, his theory shows the limits of any attempt to impose geodesic equations of motion to a non-universal force.

AGPhil 3.3 Di 14:30 VMP6 HS G

The Friedmann Equations. From a Historical and Philosophical Point of View — •Andrea Reichenberger — Alfried Krupp School Laboratory, Ruhr-University Bochum

In this paper a critical review of the Friedmann equations is provided from a historical and philosophical point of view. In the early twenties of the last century the Russian physicist Alexander Friedmann presented solutions of Einstein’s field equations which permit models of the universe that are homogeneous and isotropic, but not static (as opposed to Einstein’s assumption that the universe is static). Nowadays the expansion of the universe has been strongly confirmed by experiment, observation and calculation, in particular by precision measurements of the Cosmic Microwave Background Radiation and by studies of galaxy clustering. However, one lesson we can learn from history is that expanding universe models sets additional restrictions regarding conditions of space-time orientability and stable causality. Friedmann himself was fully aware of that fact. Deeply influenced by David Hilbert’s foundational program for the “axiomatization of physics”, he found his nonstatic solutions of the field equations through critical reflection on Hilbert’s interpretation of the principle of causality.

15 min. break

AGPhil 3.4 Di 15:15 VMP6 HS G

Topos Quantum Theory and Quantum Set Theory: a Unification — •Benjamin Eva — University of Bristol, Bristol, United Kingdom

In this paper, we will present a new formal framework that unifies two long running research programmes in the foundations of quantum theory: topos quantum theory (TQT) and quantum set theory (QST). In particular, we will show how this new framework allows us to transfer ideas and results between the two settings in a natural way that greatly improves the expressive power and the physical significance of both formalisms. The presentation will focus on the logical aspects of the new framework, and show how the traditional quantum logic of QST can be related to the intuitionistic quantum logic of TQT via a new form of paraconsistent quantum logic that arises naturally from the representation of the orthcomplement operation in TQT.

AGPhil 3.5 Di 15:45 VMP6 HS G

On the Einsteinian View of Quantum States — •Florian Boge — Philosophisches Seminar, Universität zu Köln, Deutschland

The status of state descriptions by wave functions in quantum mechanics (QM) has always been subject to heavy debates, since at any given time these can only assign definite values to a limited subset of measurable magnitudes. Von Neumann’s analysis of the measurement process lead to cats ending up ‘dead and alive at the same time’.

Some, most notably Einstein, have hence urged to regard wave functions merely as a measure of our *knowledge* about a system’s true state. Despite many difficulties, this view has become fashionable again in recent years. N. Harrigan and R. W. Spekkens have developed a formal framework for construing the quantum state of a system in terms of knowledge. For so called *ψ-epistemic models* it is required that probability distributions $p_\psi(\lambda)$ and $p_\phi(\lambda)$, associated with quantum states ψ and ϕ, can have non-trivially overlapping supports. This makes the true states λ hidden variables.

Of course we know from Bell’s theorem that such hidden variables must be *nonlocal*, but Spekkens and Bartlett et al. have developed models which—seemingly—reproduce significant parts of QM locally, including interference phenomena. Building on a theorem by Hardy and the Reeh-Schlieder theorem, I will demonstrate that the ψ-epistemicist ultimately has to appeal to nonlocal elements in his models of interference, which undermines the apparent success.

AGPhil 4: Philosophy of Physics 4

Zeit: Dienstag 16:45–19:00 Raum: VMP6 HS G

Hauptvortrag AGPhil 4.1 Di 16:45 VMP6 HS G
Progress and Gravity: Overcoming Divisions among General Relativity, Particle Physics and the History and Philosophy of Science — •J. Brian Pitts — University of Cambridge, UK

Space-time physics can be illuminated by stronger interaction among GR, particle physics, and the history and philosophy of science. Sometimes old answers make more sense; sometimes new answers or even new questions arise.

Bayesianism shows the value of simplicity, the need for rival theories, and the role of evidence.

Noether's first theorem ties each rigid symmetry of the action to local conservation. GR has an infinity of translations but supposedly 0 local conservation laws. Can one take Noether's theorem more seriously?

A 1950s particle physics spin-2 derivation split the total stress-energy into a term 0 on-shell and a curl to derive Einstein's equations. Hilbert, Klein and Noether started with GR and found such a split; Noether proved the converse. Did Noether invent spin 2 derivations of GR?

Perturbative expansions can be conceptually illuminating. They diagnose Einstein's 1917 'graviton mass'-Lambda confusion. Ogievetsky and Polubarinov invented an infinity of massive spin 2 gravities. Maheshwari showed one to be nonlinearly ghost-free in 1971, but no one noticed. Since 2010-11, 3 ghost-free mass terms are known.

Weyl said that GR spinors couldn't be spinorial in coordinates and used a tetrad. Ogievetsky and Polubarinov invented a nonlinear metric-dependent group realization of spinors in coordinates (near the identity) in 1965. What happens far from the identity?

AGPhil 4.2 Di 17:30 VMP6 HS G
Energy Conditions in Quantum Field Theory on Curved Spacetime — •Erik Curiel — MCMP, Munich

The standard energy conditions play a central, fundamental role in general relativity: as assumptions in essentially all of the deepest and farthest-reaching results (e.g., all singularity theorems and the Laws of Black-Hole Mechanics); and their failure allows for every kind of pathological behavior (e.g, closed timelike curves, white holes, naked singularities). The status and physical interpretation of those energy conditions is still an open problem. Their status in quantum field theory on curved spacetime (QFT-CST) is yet more problematic. First, it is not clear even how to formulate them in a clear and precise way, given the technical and interpretational problems attending attempts to represent stress-energy in a way that respects both the quantum nature of the fields and the classical nature of the underlying metrical structure. Second, once one has fixed any of the known formulations, it is almost ridiculously easy to construct physically reasonable generic violations of it. The problems raised by these two issues ramify into essentially every philosophically important question surrounding the relationship between quantum physics and gravitational phenomena, including: whether quantum field theory and general relativity are necessarily inconsistent; whether the semi-classical approximation of QFT-CST is physically well motivated and, if so, what the proper interpretation of its results are; and whether or how the effects of QFT-CST (e.g., Hawking radiation) can give insight into a possible theory of quantum gravity.

AGPhil 4.3 Di 18:00 VMP6 HS G
Taking up superspace- What would it take to be a realist about superspace? — •Tushar Menon — Balliol College, University of Oxford

Modern supersymmetric theories present an interesting interpretative challenge. As a result of consistency conditions on the algebra of the supersymmetry (SUSY) generators, one is led to the idea that SUSY, although traditionally defined as a dynamical symmetry between bosons and fermions, could also be thought of as a spacetime symmetry in some extended spacetime, known as superspace. Supersymmetry is, among other things, a crucial part of the string theoretic framework for a theory of quantum gravity. This paper focuses on what it would take to argue for an interpretation that favours the superspace formulation. After setting up the relevant terminology and distinctions, I introduce a stripped down toy model of a supersymmetric field theory and argue for a special case of a more general thesis— that one needs some pre-existing philosophical commitment to favour one mathematical formulation over another. I then consider three extant arguments from the literature on the philosophy of spacetime as candidates for such a position in the context of supersymmetric theories.

AGPhil 4.4 Di 18:30 VMP6 HS G
Particles creation and annihilation: A Bohmian approach — •Andrea Oldofredi — Université de Lausanne, Switzerland — Faculté des Lettres, Section de Philosophie — 1015 Lausanne

Though standard Quantum Field Theory (QFT) is generally defined as the combination of the axioms of Quantum Mechanics (QM) and Special Relativity (SR), there exists a class of non-relativistic models which are generalizations of Bohmian Mechanics (BM) to the phenomena of particles creation and annihilation reproducing the statistics of QFT experiments. These models share a common particle ontology being insensible to the conclusions of several no-go theorems which exclude the possibility of a proper particle theory in the context of QFT (they involve specific relativistic constraints which are violated in BM). In this talk my aim will be to present two different models of Bohmian QFTs with different physical content as serious alternatives to the standard formulation of QFT. These models are the Bell-type QFT and the Dirac sea approach. The virtue of these theories is the clear mathematical and ontological structure. They specify a primitive ontology (determination of the fundamental entities the theory is about) and dynamical variables which constraint the motion of the primitive variables. These models reproduce the experimental results of QFT since the Born's distribution holds. They exemplify how a clear metaphysical stance could help in constructing rigorous physical theories.

AGPhil 5: Symposium Quantentheorie und Gravitation

Zeit: Mittwoch 13:30–16:10 Raum: VMP4 Audimax 1

Hauptvortrag AGPhil 5.1 Mi 13:30 VMP4 Audimax 1
Quantum Tests of Gravity — •Markus Aspelmeyer — University of Vienna, Faculty of Physics, Vienna Center for Quantum Science and Technology (VCQ), Vienna, Austria

The early pioneering experiment by Colella, Overhauser and Werner demonstrates the effect of Earth's gravitational potential on quantum interference fringes in a neutron interferometer. It was the first experiment that required the use of both Planck's constant and Newton's constant to describe the observed fringe pattern. Over the following decades, the development of new tools significantly expanded the available quantum experiments that test the effects of weak gravitational fields, including atom interferometers, gravitationally bound states of neutrons or atomic clock tests of the gravitational red shift. The last few years have seen a renewed interest and a significant increase of experiments and experimental proposals to explore the interface between quantum physics and gravity. Quantum optics and cold atom experiments have been pushing the sensitivity of measurements of space and time to unprecedented regimes. Recent proposals even suggest that table-top experiments may allow to falsify low-energy consequences of quantum theories of gravity. On the other hand, the fast progress in macroscopic quantum experiments may soon allow to study quantum superposition states involving clocks or of increasingly massive objects, opening up a completely new regime of experiments in which the source mass character of the quantum system starts to play a role. I will review the current state of the art and discuss some of the challenges and prospects for such quantum tests of (quantum) gravity.

Hauptvortrag AGPhil 5.2 Mi 14:10 VMP4 Audimax 1
A Practitioner's View on Quantum Gravity — •Renate Loll — Radboud University, Nijmegen, The Netherlands

Quantum gravity is a subject difficult to grasp for outsiders. Which lofty ideas of exotic structures at the Planck scale will turn out to be right? Do theorists agree on what "quantum gravity" means and what questions such a theory should answer? How far are we from obtaining answers?

My collaborators and I are trying to show by explicit construction that understanding nonperturbative quantum gravity does not require hitherto unseen symmetries, dimensions, strings, loops or branes, which appear to lead us ever further away from a unique theory. Staying within the framework of quantum field theory, but adapting it to the situation where spacetime itself is dynamical, Quantum Gravity from Causal Dynamical Triangulations (CDT) is a promising candidate theory of this type. It is a gravitational analogue of obtaining nonperturbative QCD as the scaling limit of a lattice theory, and is unique in producing evidence of a good semiclassical limit. Not only may this approach lead us to the correct theory of quantum gravity, it also provides a concrete and extremely useful computational framework to study fundamental questions, as I will try to illustrate. One example is the recent demonstration that a renormalization group analysis can be set up and performed in CDT quantum gravity despite its background-free character.

Hauptvortrag AGPhil 5.3 Mi 14:50 VMP4 Audimax 1
Standard Model Fermions and N=8 Supergravity — •Hermann Nicolai — Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Am Mühlenberg 1, Potsdam-Golm

In a scheme originally proposed by Gell-Mann, and subsequently shown to be realized at the SU(3) × U(1) stationary point of maximal gauged SO(8) supergravity, the 48 spin-1/2 fermions of the theory remaining after the removal of eight Goldstinos can be identified with the 48 quarks and leptons (including right-chiral neutrinos) of the Standard model, provided one identifies the residual SU(3) with the diagonal subgroup of the color group $SU(3)_c$ and a family symmetry $SU(3)_f$. However, there remained a systematic mismatch in the electric charges by a spurion charge of ± 1/6. We here identify the "missing" U(1) that rectifies this mismatch, and that takes a surprisingly simple, though unexpected form, and show how it is related to the conjectured R symmetry K(E10) of M Theory.

Hauptvortrag AGPhil 5.4 Mi 15:30 VMP4 Audimax 1
Quantum and gravity: blend or mélange? — •Christian Wüthrich — University of Geneva

Do we need to quantize gravity, as it is tacitly assumed in much of fundamental physics? The standard lore falls short of justifying an affirmative answer. Black hole thermodynamics is widely considered, faint though it may be, our firmest hint at a quantum theory of gravity—despite the failure to date to observe Hawking radiation or any other effect that would require going beyond a classical description of black holes. Hawking radiation hitherto merely enjoys a theoretical derivation in a semi-classical theory combining quantum matter with classical gravity. But how can a semi-classical mélange of physical principles possibly justify that the quantum and gravity are blended into a unified fundamental theory when the latter is generally expected to reject at least some of the principles in the former?

AGPhil 6: Philosophy of Physics 5

Zeit: Mittwoch 16:45–17:45 Raum: VMP6 HS G

AGPhil 6.1 Mi 16:45 VMP6 HS G
Die Rolle von Prinzipien und Symmetrien in der Physik — •Albrecht Giese — Taxusweg 15, 22605 Hamburg

Die heutige theoretische Physik ist bestimmt von Prinzipien und Symmetrien.

Diese Vorgehensweise ist jedoch nicht wirklich neu, sondern wurde im Grundsatz vom Philosophen Plato entwickelt. Sie wurde später von Newton ersetzt durch den Bezug auf tiefer liegende Gesetze. Die Verallgemeinerung dieser Vorgehensweise ist das reduktionistische Weltbild, welches die Grundlage des heutigen Wissenschaftsverständnisses ist.

Vor etwa einem Jahrhundert, in der Zeit der Neuorientierung durch Relativitätstheorie und Quantenmechanik, entstand daneben eine Rückbesinnung auf den platonischen Ansatz, der - vor allem gefördert durch Heisenberg - bis heute die sog. "moderne Physik" beherrscht.

Es ist die Frage zu stellen, ob dieser Bezug auf Prinzipien und Symmetrien hilfreich ist oder gar notwendig. Dazu werden Beispiele aus Relativitätstheorie und Quantenmechanik vorgestellt, welche zeigen, welchen Weg die Physik hätte nehmen können, wenn sie bei Newtons Reduktionismus geblieben wäre.

AGPhil 6.2 Mi 17:15 VMP6 HS G
Physik, Philosophie und Moral — •Klaus Hofer — Uni Bielefeld

Auf der Basis moderner Physik, Philosophie und Hirnforschung wird ein geschlossenes Weltbild begründet, welches vom Urknall über die Entstehung von Atomen, Materie und Leben bis hin zum Evolutionären Moralcode im menschlichen Gehirn reicht. Eine entscheidende Rolle spielt dabei unser Verstand, welcher die Wahrheit nicht erschafft, sondern nur vorfindet bzw. erkennt (Aurelius Augustinus). Diese Fähigkeit erhebt den Verstand zur alleinigen Moralinstanz für uns Menschen. In diesem Beitrag soll die Wahrheit bezüglich Wohlstand, Umwelt und Moral aus den Blickwinkeln der Physik und der Philosophie beleuchtet werden. Dabei wird zunächst die physikalische Messlatte zwischen einem umweltfreundlichen und umweltschädlichen Energie- und Rohstoffverbrauch (Ökologischer Fußabdruck) quantifiziert. Danach wird die philosophische Grenzlinie zwischen einem moralischen und amoralischen Konsumverhalten über den sogenannten Slaveryfootprint hergeleitet. Doch erst die Verknüpfung mit dem evolutionären Moralcode, der jedem Menschen über die Gene in den vorderen Schläfenlappen eingebrannt wird, macht den Erkenntniskreis rund. Summa Summarum bedeutet das für menschliches Leben und Sterben, dass die Evolutionäre Moral in unseren Köpfen der alleinige Schlüssel für einen würdigen Tod und für Globale Gerechtigkeit ist.