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

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Overview of Invited Talks and Sessions

(Lecture room: A 060)

Plenary Talks most notable for AGPhil

PV VII	Mon	14:00–14:45	H 0105	**The Genesis and Renaissance of General Relativity** — •Jürgen Renn

Invited Talks

AGPhil 4.1	Wed	9:30–10:15	A 060	**Einstein Equations and Hilbert Action: David Hilbert's Contributions to General Relativity** — •Tilman Sauer
AGPhil 5.1	Wed	15:00–15:45	A 060	**"What is truth?" Einstein on Rods and Clocks in Relativity Theory** — •Marco Giovanelli
AGPhil 7.1	Thu	10:45–11:30	A 060	**A Defence of the Geometrical Interpretation of General Relativity** — •Oliver Pooley
AGPhil 9.1	Fri	9:30–10:15	A 060	**On the seemingly double appearance of the signature in general relativity** — •Harvey Brown
AGPhil 9.2	Fri	10:15–11:00	A 060	**The status of Kottler's premetric program in Newtonian gravity and in electrodynamics: an essay** — •Friedrich W. Hehl, Yakov Itin, Yuri N. Obukhov
AGPhil 11.1	Fri	14:00–14:45	A 060	**A virtuous theorist's theoretical virtues: Einstein on physics vs. math and experience vs. unification** — •Jeroen van Dongen
AGPhil 12.1	Fri	15:30–16:15	A 060	**The Hole Argument and the Problem of Time** — •Karim Thebault

Invited talks of the joint symposium SYGP

See SYGP for the full program of the symposium.

SYGP 1.1	Thu	15:00–15:30	H 0105	**General relativity: a theory born in creative confusion** — •Harvey Brown
SYGP 1.2	Thu	15:30–16:00	H 0105	**Gravitating Non-Abelian Fields: Solitons and Black Holes** — •Jutta Kunz
SYGP 1.3	Thu	16:00–16:30	H 0105	**Geometric principles in the physics of topological matter** — •Alexander Altland
SYGP 1.4	Thu	16:30–17:00	H 0105	**General Covariance in Quantum Field Theory on Curved Spacetimes** — •Thomas-Paul Hack
SYGP 1.5	Thu	17:00–17:30	H 0105	**The (noncommutative) Geometry of the Standard Model of Particle Physics** — •Christoph Stephan

Sessions

AGPhil 1.1–1.3	Tue	14:00–15:30	A 060	**Foundations of Quantum Mechanics**
AGPhil 2.1–2.4	Tue	16:00–18:00	A 060	**Philosophy of Science**
AGPhil 3.1–3.3	Tue	18:00–18:10	A 060	**Poster Session**

AGPhil 4.1–4.4	Wed	9:30–12:00	A 060	**Foundations of Classical Gravity**
AGPhil 5.1–5.4	Wed	15:00–17:30	A 060	**Rods, Clocks, Space and Energy in General Relativity**
AGPhil 6.1–6.2	Thu	9:30–10:30	HFT-FT 101	**Mathematische und Philosophische Grundlagen**
AGPhil 7.1–7.3	Thu	10:45–12:45	A 060	**The role of geometry in gravitational theories**
AGPhil 8.1–8.5	Thu	15:00–17:30	H 0105	**Geometric paradigms in modern physics**
AGPhil 9.1–9.2	Fri	9:30–11:00	A 060	**The role of the metric investigated**
AGPhil 10.1–10.3	Fri	11:15–12:45	A 060	**The role of the present in spacetime theories**
AGPhil 11.1–11.2	Fri	14:00–15:15	A 060	**Extending General Relativity**
AGPhil 12.1–12.2	Fri	15:30–16:45	A 060	**The Problem of Time**
AGPhil 13.1–13.3	Mon	14:00–15:30	A 060	**Alternative Approaches I**
AGPhil 14.1–14.4	Mon	16:30–18:30	A 060	**Alternative Approaches II**
AGPhil 15.1–15.2	Tue	9:30–10:30	A 060	**Alternative Approaches III**

Mitgliederversammlung der Arbeitsgruppe Philosophie der Physik

Donnerstag 19:15–20:00 A 060

- Bericht
- Planung 2015/16
- Verschiedenes

AGPhil 1: Foundations of Quantum Mechanics

Time: Tuesday 14:00–15:30 Location: A 060

AGPhil 1.1 Tue 14:00 A 060

On Causal Explanations of Quantum Nonlocality — •Martin Schuele[1] and Ämin Baumeler[2] — [1]IHPST Paris, France — [2]Institute of Informatics, Università della Svizzera italiana, Switzerland

Quantum nonlocality is the phenomenon that entangled quantum systems can exhibit instantaneous correlations between space-like separated measurements that cannot be explained by local variables, i.e., need communication.

Because such “correlations cry out for explanations”, as Bell put it, a prominent move to interpret nonlocality is by postulating a causal influence between the space-like separated parts of the entangled system, i.e., the correlations are due to a causal connection between the parts of the system. As this assumption seems to be at odds with the causal structure imposed by special relativity, various schemes needed to be proposed to mediate between the quantum-theoretical and experimental findings and special relativity.

We will criticize this approach to an explanation of nonlocality by first reporting on various findings in quantum information science that provide evidence against some superluminal causal influence and, secondly and more generally, by arguing that the counterfactual account of causation usually assumed in these treatments gives a wrong or at least ambiguous picture of causation in this case. Instead, we argue for an interventionist account of causation which says that there is no causal connection between the space-like separated parts of the quantum system showing nonlocality.

AGPhil 1.2 Tue 14:30 A 060

Vorstellungen zu merkwürdigen Ergebnissen der Physik — •Bernd Steffen — Bischofsgruener Weg 85, 12247 Berlin

Folgende Ergebnisse der Physik sind schwer mit unserem Vorstellungsvermögen in Einklang zu bringen: Nichtlokalität in der Quantenmechanik, Wellennatur von Teilchen, Imaginärer Anteil der Wellenfunktion, Verschränkung und ‘spukhafte‘ Fernwirkung, Dunkle Materie, Dunkle Energie. Ausgehend von Ideen von Ghirardi, Rimini and Weber (1986)zu stochastischen Sprungprozessen im Hilbertraum und von Bell(1987, 1989) zu "flashes", beschrieben durch Punkte in der Raumzeit, werden Vorstellungen zu einer nichtlinearen Dynamik entwickelt. Dabei wird für Teilchen eine kurzlebige imaginäre Existenz mit imaginärer Masse und imaginärer Verzerrung des Raumes postuliert im Wechsel mit entprechender realer Existenz. Die Wechselwirkung der imaginären Anteile könnte sich als dunkle Energie äußern. Nichtlineare Prozesse können chaotisches und nichtchaotisches Verhalten zeigen. Herkömmliche Teilchenphysik würde sich in den nichtchaotischen Lösungsbereichen in der Nähe von Attraktoren befinden. Dunkle Materie würde in den chaotischen Lösungsbereichen angesiedelt sein. Eindeutige Teilchen der dunklen Materie wären danach nicht zu erwarten.

AGPhil 1.3 Tue 15:00 A 060

The Einstein field equation in terms of the Schrödinger equation — •Vasil Penchev — Bulgarian Academy of Sciences (Institute for the Study of Societies and Knowledge), Sofia, Bulgaria

The thesis is: The Einstein field equation (EFE) can be directly linked to the Schrödinger equation (SE) by meditation of the quantity of quantum information and its units: qubits.

Arguments:

1. The three of the EFE members are representable as Ricci tensors interpretable as the change of the volume of a ball in pseudo-Riemannian space in comparison to a ball in the three-dimensional Euclidean space (3D).

2. Any wave function in SE can be represented as a series of qubits, which are equivalent to balls in 3D, in which two points are chosen: the one within it, the other on its surface.

3. The member of EFE containing the cosmological constant corresponds to the partial time derivative of the wave function in SE. This involves the energetic equality of a bit and a qubit according to the quantum-information interpretation of SE. The zero cosmological constant corresponds to the time-independent SE.

4. The member of EFE, which is the gravitational energy-momentum tensor, corresponds to zero in SE as it expresses that energy-momentum, which is a result of the space-time deformation.

5. SE represents the case of zero space-time deformation, EFE adds corresponding members being due to the deformation itself.

AGPhil 2: Philosophy of Science

Time: Tuesday 16:00–18:00 Location: A 060

AGPhil 2.1 Tue 16:00 A 060

Die Reduktion physikalischer Theorien nach Erhard Scheibe und die Reduktionsdebatte in der aktuellen Wissenschaftsphilosophie — •Raphael Bolinger — TU Dortmund

Der deutsche Philosoph Erhard Scheibe hat in seinem zweibändigen Werk zur Reduktion physikalischer Theorien (1997 bzw. 1999) eine umfassende Taxonomie intertheoretischer Beziehungen aufgestellt, mit der sich Elemente relevanter physikalischer Theorien auf formaler Ebene miteinander in Beziehung setzen lassen. Als philosophischen Ausgangspunkt seines Ansatzes führt Scheibe unter anderem Arbeiten von Nagel und Woodger bzw. Kemeny/Oppenheim an, auf die sich auch an anderer Stellen in der Reduktionsdebatte der Wissenschaftsphilosophie im Allgemeinen berufen wird. Im Rahmen des Vortrags wird aufgezeigt werden, dass beide Verständnisse des Begriffs einer Theorienreduktion trotz des gemeinsamen Ursprungs kaum miteinander in Einklang gebracht werden können. Es werden Implikationen für den künftigen Umgang mit Theorienreduktionen in der Philosophie der Physik aufgezeigt werden.

AGPhil 2.2 Tue 16:30 A 060

Simplicity to its Extreme - Why Physics Needs to Question the Notion of Space and Time — •Alexander Unzicker — Pestalozzi-Gymnasium München

The question whether the laws of nature must be simple and how simplicity can be defined, definitely touches the border between physics and philosophy. Inspired by the little known correspondence between Albert Einstein and Ilse Rosenthal-Schneider, it is argued that the number of fundamental constants is a key element of simplicity and must be as small as possible. In this view, one must also ask why the most fundamental constants of physics, the speed of light c and Planck’s constant h, do exist at all.

Plainly speaking, both c and h presented anomalies to Newtonian physics that were neither necessary nor predicted by the founder of classical physics. As a consequence, we must ask whether the axiomatic postulates of Newton, space and time, have actually been falsified by the appearance of c and h. Taking this point of view, also relativity and quantum physics would be just workarounds that left fundamental problems untouched. Though it seems to be an unsettling perspective, space and time itself, the very basis of both classical and modern physics, may be inappropriate notions for describing reality.

AGPhil 2.3 Tue 17:00 A 060

Reid’s Foundation of the Geometry of Visibles — •Dieter Suisky — Humboldt University Berlin, dsuisky@physik.hu-berlin.de

It is well-known that the Scottish philosopher Thomas Reid (1710-1796) traced back his methodology to the rules which had been established by Bacon and Newton, especially Newton’s *regulae philosophandi* which ”are maxims practised every day in common life”. Analyzing Reid’s *Geometry of Visibles* (GOV), there is another corner stone being of Newtonian origin which had not been regarded to be equally important for the interpretation of Reid’s theory. It is Newton’s natural philosophy whose role in Reid’s new approach to geometry had been only little investigated until now. In this contribution it will be argued that there are two forms of non-Euclidean geometry which may be distinguished according to their historically determinate difference: (i) the Proclus-Barrow-Newton version which is related to idea that the geometrical objects are generated by a *continual flux* and (ii) the Lambert-Gauß-Lobatschewsky-Bolyai version which is related to the definition and investigation of *parallel lines*. Reid's GOV is currently, however, preferentially interpreted in terms of the second version which was unknown to Reid. It will be demonstrated that Reid made use advantageously of Newton's foundation who considered geometrical objects to be "generated by a continual motion". Reid also accentuated the temporal features. "Prop. 1. Every right line being produced, will at last return into itself." This idea is sufficient to establish a non-Euclidean version which is related to the interior of a sphere whereas it is incompatible with the geometry of an infinite plane.

AGPhil 2.4 Tue 17:30 A 060

from kant's theory of time to relativistic spacetime and causal sets — •riccardo pinosio — institute for logic, language and computation, university of amsterdam

In the context of his work on the foundations of relativity, A. G. Walker developed an axiomatization of Milne's kinematical relativity whose primitive entities are extended durations. These can be thought of as extended timelike subpaths of the world-line of a particle; point-like instants are then defined in terms of durations, and signal axioms on these are imposed so as to recover Milne's kinematical relativity and a large class of models of general relativity.

Walker's analysis of temporal order, particularly in the category-theoretical formulation given to it by Thomason, bears strong similarities to Immanuel Kant's; thus, we used it to develop a mathematical formalization of Kant's theory of time. To achieve this, the axiomatic approach had to be supplemented by a topological treatment, to formalize various notions crucial to Kant's theory, such as continuity and connectedness of time.

As it turns out, using this formalization one can specify precisely those assumptions which make Kant's theory of space and time Newtonian. Furthermore, lifting these assumptions yeilds a generalization of Walker's construction applicable to arbitrary spacetime manifolds, which can provide an approach to discretizing spacetime related to that developed within the causal set framework.

AGPhil 3: Poster Session

Time: Tuesday 18:00–18:10 Location: A 060

AGPhil 3.1 Tue 18:00 A 060

The Spacetime System of Reference and Measurement of Galilean-Newtonian Mechanics — •Ed Dellian — Bogenst. 5, D-14169 Berlin

The law of motion of classical continuum mechanics "force equals mass-acceleration" doesn't refer to a reference system. Galileo's theory is different. In his Discorsi of 1638, Third Day, Galileo's geometrical law of uniform motion is described in relation to two invariant scaled standards, the discrete elements of which are proportional to each other. The first is a standard of "time", the second of "space". The law of motion is a quaternate proportion of measured discrete quantities of space and time implying the elements delta s and delta t of the proportional standards "space" and "time". The constant parameter "delta s over delta t" reveals a quantized structure of the spacetime system of reference and measurement. The same system forms the basis of Newton's authentic theory of motion in discrete real space and real time, the parameter "element of space over element of time" being the proportionality constant required by Newton's second law "The change in motion is proportional (not equal!) to the motive force impressed". Newton's law accordingly reads "delta F over delta p = delta s over delta t = constant = c", or, "delta F = delta p times c". Science would look different had this quantized law of motion in real space and time been known when Einstein developed relativity by erroneously presupposing as Newton's law the continuous f=ma formula of analytical mechanics, which was first conceived in 1750 by Leonhard Euler in Berlin as the basic law of his non-Newtonian "Berlin continuum mechanics".

AGPhil 3.2 Tue 18:00 A 060

Gravity as a resonance of the superstructure of a Field — •Lyubov Nechaj — Donetsk physical-technical Institute of the NAS of Ukraine named after A.A. Galkin, Rosa Luxemburg street 72, 83114, Donetsk, Ukraine

The signal of the Field is related to the energy, mass and other physical quantities. Perturbation in Field is distributed and transmitted randomly. The Huygens principle allows assuming, that the reflection of the perturbation on the infinite sets of elements of symmetry forms the superstructure of the perturbation, which reliably transmits the signal of the Field. Wave, which transmits a Signal and its shape, appears as a higher level of matter. Perturbation - Central fused Field signal has an outer structure in the form of objects that have a lifetime and a variable sets.

The structure of the signal becomes the basis of the causality of events among objects that are signals themselves. Nature has created a technology - time, which allows controlling the flow of signals and makes chaos deterministic system with a universal topological dynamics. In the chaos appear the most probable superstructures, as a reflection of unified communication. The objects back cause changes and disturbances in the Field.

The relationship of objects is the resonance, phenomenon of identification of superstructure of the Field with its perturbation. In this sense, the Gravitational field (and other known fields and interactions), exists as a resonance with the objects Field superstructure.

AGPhil 3.3 Tue 18:00 A 060

The Concept of Cognitive Space — •Olena Dobrovolska — Kharkiv National University of Radioelectronics, Kharkiv, Ukraine

Cognitive space, as the concept of cognitive science, is in the point of intersection of different fields of research: philosophy, linguistics, psychology, anthropology. Despite light discrepancy of its definitions given by different researchers it has one constant base: it is "space" - the traditional subject of philosophical research. Either it is "the set of concepts and relations among them held by a human" (Newby) or "an association of any number of actors bound by a certain shared cognitive element" (Peverelli), it has to have some dimensions, bounds, it has to do with ontology (because it contains some concepts or elements that exist or don't exist) and it has to evolve, to be measured and to be presented. The questions are: Which theory of space can be applicable to cognitive space? Is it absolute or relative? What kind of existence can be applicable to it: is it real, virtual or mental space? Since it is human-dependent, how can different cognitive spaces exist, co-exist, intersect each other? How can it be conceptualised, presented and expanded on human-machine interaction?

AGPhil 4: Foundations of Classical Gravity

Time: Wednesday 9:30–12:00 Location: A 060

Invited Talk AGPhil 4.1 Wed 9:30 A 060
Einstein Equations and Hilbert Action: David Hilbert's Contributions to General Relativity — •Tilman Sauer — Universität Bern

I will discuss how Hilbert arrived at General Relativity in late 1915 and give a characterization of his perspective on the natural sciences in general and on the foundations of space and time in particular.

AGPhil 4.2 Wed 10:15 A 060
Einstein's Physical Strategy, Energy Conservation, Symmetries and Stability — •J. Brian Pitts — University of Cambridge

Work by Renn, Janssen et al. shows that Einstein found his field equations partly by a physical strategy including the Newtonian limit, the electromagnetic analogy, and energy conservation. What energy-momentum complex(es) did he use and why? Given that Lagrange and Jacobi linked symmetries and conservation, did Einstein tie conservation to symmetries, and if so, to which? How did the work relate to emerging knowledge (1911-14) of the canonical energy-momentum tensor and its translation-induced conservation in Herglotz, Mie and Born? After initially using energy-momentum tensors hand-crafted from the gravitational field equations, Einstein used an identity from his assumed linear coordinate covariance x^m'= A^m_n x^n to relate it to the canonical tensor. Whereas Mie and Born were concerned about the canonical tensor's asymmetry, Einstein did not need to worry because his Entwurf Lagrangian is modelled not so much on Maxwell's theory (which avoids negative-energies) as on a scalar theory (the Newtonian limit) with symmetric canonical tensor. The Entwurf theory has 3 negative-energy field degrees of freedom. Thus it fails a 1920s-30s priori particle physics test with roots in Lagrange's stability theorem—c.f. Einstein's 1915 Entwurf critique for not admitting rotating coordinates and not getting Mercury's perihelion right.

This work is partly collaborative with Alex Blum.

15 min. break

AGPhil 4.3 Wed 11:00 A 060
Prediction in General Relativity — •Casey McCoy — University of California San Diego, La Jolla, USA

Various prominent physicists and philosophers have claimed that prediction is essentially impossible in the general theory of relativity, the case being particularly strong, it is maintained, when one fully considers the epistemic predicament of the observer. I argue that the conditions on prediction advocated by these authors rest on philosophically misguided and unphysical intuitions, and should therefore be rejected as inadequately explicating the concept of prediction in general relativity. Along the way I clarify the epistemic situation of observers and discuss the significance of these arguments for cosmology.

AGPhil 4.4 Wed 11:30 A 060
Against Comparativism about Mass in Newtonian gravity — •Niels Carl Maria Martens — Philosophy Department, University of Oxford

The property of having mass is a determinable with two types of determinates: we think of an object with mass as having a determinate intrinsic property, but we also think it stands in determinate mass relationships with other massive objects. Absolutism about mass is the metaphysical position that the intrinsic properties are fundamental; the mass relationships are then grounded in those intrinsic masses. Comparativism is the position that the mass relationships are fundamental; they are all there is to the property of having mass (Dasgupta, 2013). I will defend the original Newtonian (that is absolutist) interpretation of Newtonian Gravity against recent attempts to reformulate Newtonian Gravity in comparativist terms.

AGPhil 5: Rods, Clocks, Space and Energy in General Relativity

Time: Wednesday 15:00–17:30 Location: A 060

Invited Talk AGPhil 5.1 Wed 15:00 A 060
"What is truth?" Einstein on Rods and Clocks in Relativity Theory — •Marco Giovanelli — FORUM SCIENTIARUM Doblerstraße 33 72074 Tübingen

The talk offers a historical overview of Einstein's vacillating attitude towards the role, indispensable or provisional, that rods and clocks play in both special and general relativity. The talk will document the context in which Einstein, at the beginning of 1917, first expressed concerns about the use of complicated material systems as measuring devices. It will consider the circumstances in which, in the 1920s, he felt the urgency to articulate his point of view in public writings, outlining a two-stage epistemological strategy, to which he remained faithful until the end of his life.

In particular it will be shown how Einstein expressed early on the conviction that in relativity theory one seems to be entitled to expect an explanation of how the measuring instruments work, without calling on other branches of physics. However, he was aware of the fact that this epistemological requirement calls into question the very relationship between a theory and the material devices that serve to verify it. Thus, Einstein's plea for a dynamical explanation of rods and clocks should be understood against the background of a truly philosophical question, which - as Einstein himself put it - is nothing but "Pilate's famous question: 'What is truth?'

AGPhil 5.2 Wed 15:45 A 060
The Problem of Space — •Joshua Eisenthal — University of Pittsburgh, Pittsburgh, Pennsylvania, USA

I define the Problem of Space as the problem of delimiting the range of candidate physical geometries, i.e. candidate geometrical descriptions of physical space. I briefly review the nineteenth century approach to this problem, arriving at the so-called "classical solution". This solution centered around the claim, advanced in particular by Helmholtz and Poincaré, that candidate physical geometries were just those structures which could represent the free mobility of rigid bodies. As noted originally by Riemann, then argued for by Helmholtz and proved rigorously by Lie, congruence relations which can represent such free mobility exist only in geometries of constant curvature. Both Poincaré and Helmholtz regarded this fact as pivotal in delimiting the range of candidate physical geometries, and thus solving the Problem of Space.

However, I then review how this view was fatally undermined by the development of General Relativity. I thus turn to explore the twentieth century solution to the Problem of Space advanced by Hermann Weyl. I conclude by reflecting on the significance of this discussion for a relatively recent dispute regarding the status of the metric field in General Relativity. I suggest that this dispute has arisen partially due to a failure to properly appreciate the insights made available by the kind of analysis of geometrical concepts exemplified by Weyl's work. More generally, I argue that the nuances of Weyl's view demonstrate the importance of engaging with the Problem of Space in interpreting General Relativity today.

AGPhil 5.3 Wed 16:15 A 060
Gravitational energy in general relativity — •James Read — Merton College, University of Oxford, OX1 4JD, UK

Recently, various authors have argued both for and against the proposition that the gravitational field described in General Relativity (GR) possesses "genuine" energy. I approach this debate systematically, by (1) presenting the various energy-momentum conservation laws in the theory (both local and global on the one hand, and for either matter energy or matter-plus-gravitational energy via a stress-energy pseudotensor on the other); (2) providing general philosophical principles according to which one can isolate the fundamental form that conservation laws in GR should take (contra much of the literature, this form is not that of an integral conservation law); and (3) using these criteria to identify the energy-momentum conservation laws in GR of greatest significance, and in turn to establish whether gravitational energy really does exist in GR. On (3), I find that, following conservative functionalist principles, genuine gravitational energy does exist in GR, but only in a restricted sense, when certain physical conditions apply. In addition, I argue that one can be a realist about gravitational energy even if one is a relationist about spacetime ontology, as adopting the latter position does not alter the fact that GR contains well-defined quantities which play the functional role of gravitational energy.

15 min. break.

AGPhil 5.4 Wed 17:00 A 060

Operationalization of relativistic energy-momentum — •Bruno Hartmann — Perimeter Institute, Waterloo, Canada — Humboldt Universitaet, Berlin

We present a novel approach to the foundation of physical theory, which begins with interrogations on practical measurements. Last time such approach had been successfully considered was by Einstein for the foundation of relativistic Kinematics. For the (so far unresolved) foundation problem of Dynamics we start from Hermann von Helmholtz analysis of basic measurements, as in known, very old procedure of length measurements by repeated placement of unit sticks one after the other.

We begin from definitions, which have a practical dimension. We introduce the measure of energy and momentum by pre-theoretic comparison (known from work experience): ”more impact potential” (momentum) - if in a collision one object overruns the other - and ”more effect potential” (energy) - if the kinetic effect of one source exceeds the effect of the other. With our calorimeter model (built by coupling congruent standard interactions of irrelevant inner structure) we can express their value also numerically (how many times more). We uncover the origin of true physical quantities of energy, momentum and inertial mass. From simple measurement-methodical principles - without mathematical presuppositions - we derive all fundamental equations of relativistic Dynamics. By genetic explanation of basic measures out of physical operations one can address and understand consequences and limitations of its mathematical formalism.

AGPhil 6: Mathematische und Philosophische Grundlagen

(Gemeinsame Sitzung der AG Phil und des FV MP)

Time: Thursday 9:30–10:30 Location: HFT-FT 101

AGPhil 6.1 Thu 9:30 HFT-FT 101

Classical Field Theory and Intertheoretic Reduction — •Samuel C. Fletcher — Munich Center for Mathematical Philosophy, LMU Munich, Germany

In 1986, Ehlers set out a program on how to understanding the approximative relationships between different physical theories. However, he essentially only investigated the case of classical and relativistic spacetime theories, which have a number of special features that distinguish them from broader classes of physical theories. To what extent, then, can the Ehlers program be successful? I outline some of the challenges facing the program's generalization and argue that they can largely be overcome for classical gauge theories, i.e., theories described by connections on principal bundles, once the program is understood geometrically.

The general strategy is to cast the successfully treated case of general relativity and Newtonian gravitation - really, the geometrized version thereof, Newton-Cartan theory - as a reduction between two gauge theories. Under this guise, one can understand its relation to the theory of group contraction, to associated vector bundles representing matter fields, and to different notions of convergence encoding different ways the matter fields of the limit theory may approximate those of the limiting theory.

AGPhil 6.2 Thu 10:00 HFT-FT 101

Versuch einer Machschen Quantenmechanik — •Bernadette Lessel — Mathematisches Institut der Georg-August-Universität Göttingen

Nach dem Machschen Prinzip sollte eine physikalische Theorie berücksichtigen, dass die Bewegung eines Körpers im Raum nur in Bezug zu allen Körpern im Raum gemessen werden kann und nicht relativ zu einem absoluten Raum stattfindet.

Julian Barbour ist es mit Hilfe der Einführung seiner “Best matching”-Metrik, welche nur den Abstand der Form, “Shape”, von Teilchenkonfigurationen misst, ohne Rückgriff auf die Position der einzelnen Teilchen relativ zu einem absoluten Raum zu nehmen, gelungen, das Machsche Prinzip mit der Newtonschen Theorie zu verbinden.

Andererseits ist durch Max von Renesse bekannt, dass die mathematische Theorie des Optimalen Transportes von Wahrscheinlichkeitsmaßen dazu taugt die Schrödinger-Gleichung derart umzuschreiben, dass sie die Form einer Newtonschen Bewegungsgleichung hat. Gleichzeitig nimmt sie damit aber Bezug auf die Existenz eines absoluten Raumes.

Ähnlich zur Vorgehensweise von Julian Barbour verändern wir die durch den Optimalen Transport definierte Wasserstein-Metrik auf eine Art und Weise, dass sie nur noch den Abstand der “Form” der Wahrscheinlichkeitsmaße misst, aber deren genaue Lokalisation im Raum unberücksichtigt lässt. Wir untersuchen die sich so ergebende geodätische Struktur und deren Konsequenzen für eine Machsche Formulierung der Quantenmechanik.

AGPhil 7: The role of geometry in gravitational theories

Time: Thursday 10:45–12:45 Location: A 060

Invited Talk AGPhil 7.1 Thu 10:45 A 060

A Defence of the Geometrical Interpretation of General Relativity — •Oliver Pooley — Faculty of Philosophy, University of Oxford, UK

According to a popular view, general relativity, in its standard formulation, is fundamentally a theory of spacetime structure; one that explains gravitational phenomena through spacetime curvature. In my talk I will critically review several challenges to this view, from Einstein's rejection of the geometric interpretation of the theory to recent uses of the notorious Hole Argument. Particular attention will be paid to the questions of whether and why the metric field, g_{ab}, is naturally interpreted as representing spacetime geometry (rather than, say, a “gravitational field”). I also hope to clarify the extent to which various principles supposedly satisfied by general relativity (primarily, general covariance and the equivalence principle) bear on this family of interpretative questions.

AGPhil 7.2 Thu 11:30 A 060

General Covariance, Diffeomorphism Invariance, and Background Independence in 5 Dimensions — •Antonio Vassallo — University of Lausanne, Department of Philosophy, CH-1015 Lausanne, Switzerland

The paper considers the ”GR-desideratum”, that is, the way general relativity implements general covariance, diffeomorphism invariance, and background independence. Two cases are discussed where 5-dimensional generalizations of general relativity - namely, the original Kaluza-Klein theory and induced matter theory - run into interpretational troubles when the GR-desideratum is forced upon them. It is then shown how the conceptual problems dissolve when such a desideratum is relaxed. In the end, it is suggested that a similar strategy might mitigate some major issues in modern spacetime physics, such as the problem of time in canonical quantum gravity or the embedding of quantum non-locality into relativistic spacetimes.

15 min. break.

AGPhil 7.3 Thu 12:15 A 060

The neighborhood of General Relativity in the space of (spacetime?) theories — •Dennis Lehmkuhl — IZWT, University of Wuppertal, Einstein Papers Project, Caltech

How 'special' is General Relativity (GR) as compared to other theories? The answer to this question depends on what other theories we compare GR to: other field theories or just other spacetime theories? I will argue that Einstein himself saw GR not primarily as a theory of spacetime, but as a field theory unifying gravity and inertia. I will then show that his interpretation of GR as a unification of gravity and inertia is only possible because of the way the different fields couple in GR, and compare GR to a much later theory (Jordan's theory from the 1950s, the first scalar-tensor theory). The comparison will show that it is the coupling structure that ensures the motion of particles on geodesics, and thus the possibility for Einstein to interpret the theory as a unified field theory (of gravity and inertia).

AGPhil 8: Geometric paradigms in modern physics

Time: Thursday 15:00–17:30 Location: H 0105

Invited Talk AGPhil 8.1 Thu 15:00 H 0105

General relativity: a theory born in creative confusion — •Harvey Brown — Oxford University, Oxford, UK

A number of conceptual guiding principles were behind Einstein's development of general relativity; almost none of them proved to be completely sound. I will concentrate on the various ways Einstein interpreted Mach's Principle before finally abandoning it, and on the late adoption of the action-reaction principle in Einstein's promotion of his theory following correspondence with Moritz Schlick in 1920. The talk will be based on an article jointly published with Dennis Lehmkuhl: arXiv:1306.4902v1.

Invited Talk AGPhil 8.2 Thu 15:30 H 0105

Gravitating Non-Abelian Fields: Solitons and Black Holes — •Jutta Kunz — University of Oldenburg

The Standard Model of Particle Physics involves non-Abelian fields describing the strong and electroweak interactions. The gauge and Higgs fields can form non-perturbative solutions in Minkowski spacetime. In the electroweak sector static finite energy solutions, sphalerons, are present, while no such solutions appear in the color sector. As soon as Einstein gravity is coupled, however, localized globally regular solutions appear. Moreover, hairy black hole solutions arise, i.e., black holes which are no longer uniquely determined by their global charges. Thus the black hole "no-hair" theorem of Einstein-Maxwell theory does not generalize to theories with non-Abelian fields. While all non-Abelian black holes obtained so far are axially symmetric, black holes with only discrete symmetries, e.g. platonic black holes, should exist as well. Moreover, multi-black hole solutions are expected to exist, where gravity and the non-Abelian forces should cancel, leading to balanced configurations.

Invited Talk AGPhil 8.3 Thu 16:00 H 0105

Geometric principles in the physics of topological matter — •Alexander Altland — Institute for theoretical physics, Zülpicher Str. 77, 50937 Köln

'Topological matter' is the overarching term for novel classes of materials distinguished by the presence of robust topological invariants. Topological materials are distinguished by unconventional physical properties (most of which are rooted in the topological protection of their quantum states against decoherence) which make them promising candidates for applications in, e.g., quantum information, or quantum electronics.

In this talk, we will focus on the important subclass of topological insulators to explain how such properties can be understood from a geometric perspective. Starting from the description of a topological insulator's band structure in terms of fibre bundles, we will discuss how their physical properties emerge as a consequence of universal concepts, including Chern-Simons invariants, anomalies, dimensional reduction, topological field theories, and emerging 'holographic principles'.

Invited Talk AGPhil 8.4 Thu 16:30 H 0105

General Covariance in Quantum Field Theory on Curved Spacetimes — •Thomas-Paul Hack — Department of Mathematics, University of Genoa

We highlight the role of general covariance in quantum field theory on curved spacetimes, and review how this principle is implemented at various steps in the perturbative construction of interacting models. We discuss conceptual and phenomenological consequences of the requirement of general covariance, which are of relevance e.g. in Cosmology.

Invited Talk AGPhil 8.5 Thu 17:00 H 0105

The (noncommutative) Geometry of the Standard Model of Particle Physics — •Christoph Stephan — Institut für Mathematik, Universität Potsdam, Potsdam, Deutschland

In the past two decades Connes' Noncommutative Geometry has allowed to gain deeper insights into the geometrical foundations that underly General Relativity as well as the Standard Model of Particle Physics. A fascinating aspect of the theory is the close link between abstract mathematical concepts and experimentally measurable quantities.

The aim of my talk is to provide a basic introduction into the geometrical ideas of Noncommutative Geometry (spectral triples, Dirac operators, spectral actions, etc.) and to give a physical interpretation of the geometrical objects. Furthermore I will show how the notions of Particle Physics (and General Relativity) can be formulated within the framework of Noncommutative Geometry.

The central role in this construction is played by Dirac operators. Using the Connes-Chamseddine Spectral Action one can extract from these Dirac operators measurable physical quantities, for example the mass of the Higgs boson.

AGPhil 9: The role of the metric investigated

Time: Friday 9:30–11:00 Location: A 060

Invited Talk AGPhil 9.1 Fri 9:30 A 060

On the seemingly double appearance of the signature in general relativity — •Harvey Brown — Oxford University, UK

Both Einstein and Schrödinger explicitly based the existence of a metric field in general relativity on the local validity of special relativity. But the Lorentzian nature of the metric in special relativity can be viewed as an emergent property of the dynamics of matter fields, and in particular the electromagnetic field, as Itin and Held carefully demonstrated in 2004. This talk addresses the question as to how this approach to justifying the Lorentzian signature of the space-time metric is supposed to hold in general relativity, if at all.

Invited Talk AGPhil 9.2 Fri 10:15 A 060

The status of Kottler's premetric program in Newtonian gravity and in electrodynamics: an essay — •Friedrich W. Hehl[1], Yakov Itin[2], and Yuri N. Obukhov[3] — [1]U. Cologne, U. Missouri, Columbia — [2]Hebrew U. Jerusalem — [3]RAS Moscow

In the year 1922, Kottler published two articles on 'Newton's law and metric' and on 'Maxwell's equations and metric.' Because of the omnipresence of the gravitational field, the metric g_{ij} (and its reciprocal), according to general relativity, is intervening in most physical laws. The innocently looking raising of an index, $A^i := g^{ik}A_k$, contaminates the electromagnetic 4-potential with the presence of the gravitational potential g^{ik}. The program of Kottler was to investigate where in physics the occurrence of the metric is essential and where it is misleading. Taking the Maxwell equations as our main guinea pig, we show that they are of a "pre-metric" nature. that is, they are independent of the metric altogether. Furthermore we demonstrate how one can derive a metric, up to a factor, from data of local and linear electrodynamics.

H., Obukhov, *Foundations of Classical Electrodynamics: charge, flux, and metric,* Birkhäuser, Boston (2003); Itin, H., *Is the Lorentz signature of the metric of space-time electromagnetic in origin?*, Annals of Physics (NY) 312, 60 (2004); H., Itin, Obukhov, *Recent developments in pre metric classical electrodynamics,* Złatibor Proceedings, see arXiv:physics/0610221 (2006).

AGPhil 10: The role of the present in spacetime theories

Time: Friday 11:15–12:45 Location: A 060

AGPhil 10.1 Fri 11:15 A 060

Trajectory, Eigenzeit and Lapse of Time — •Thorben Petersen — Department of Philosophy, University of Bremen

Ever since its discovery, the theory of relativity has intrigued philosophers because of its implications for the metaphysics of time and, in particular, as regards the question whether time does pass. The goal is to develop a conception of the so-called passage or lapse of time, which is (i) properly relativistic (i.e. which takes spacetime to be a four-dimensional entity and acknowledges the relativity of simultaneity) but (ii) does not fall back on the counterintuitive though prevalent idea that this phenomenon is an illusion or mere construction of our minds. In this talk, I show that these criteria can be met if we accept that the lapse of time is grounded, locally, in how the development of integral wholes (such as an organism) is represented. To this end, I draw attention to the (usually overlooked) notion of parameter time. In particular, I argue that integral wholes follow trajectories in spacetime, which can be operationalized by co-moving clocks, measuring the Eigenzeit of these trajectories. To say that a certain integral whole develops, then, is to say that the whole is located, at different moments of its Eigenzeit, at different points (or parts) of its trajectory.

AGPhil 10.2 Fri 11:45 A 060

Physics and The End of Time — •yuval dolev — Bar Ilan University, Ramat Gan, Israel

Contrary to the received view, I will argue that, not only can relativity theory, both special and general, accommodate a global present, it in fact must do so. I will present this claim in the context of a broader assessment of the manners in which relativity has revolutionized our understanding of time and the degree to which is has done so. I will distinguish between "technological" and "philosophical" lessons we learn from the theory, and argue that while the former are momentous, the later have been exaggerated. Specifically, tense and passage, supposedly ousted by the theory, remain crucial and irremovable in our conception of reality itself, and not merely as aspects of how we apprehend it. I will discuss recent attempts to make this claim from within physics, focusing on Smolin's Time Reborn, and evaluate their merits, weaknesses, and effectiveness. My conclusion will be a reconfirmation of Einstein's own view that there's no room for a Now in physics, and hence no way to retrieve tense from within physics. But rather than deducing, like Einstein, the illusoriness of tense and passage, I will suggest that a real Now is compatible with physics, and actually plays a vital role in the experience of physicists, a role without which physics itself would be unimaginable.

AGPhil 10.3 Fri 12:15 A 060

Social particles. On the common roots of aggression, altruism, co-operation and grouping — •Karl Theodor Kalveram — Tu Darmstadt and Uni Duesseldorf

We are accustomed of the strange outcome of the interaction of particles: particles that annihilate if meeting each other and re-emerge from vacuum. Some attract and some refute others. Their demeanor, however, is, temporal stationarity presumed, only describable statistically, and governed by equations proposed by Schroedinger or Heisenberg. Now we look at another type of particles interacting, too, with randomly varying outcomes. Their properties, however, can change over time, some rules of which being formulated first by Darwin. Here I present a mathematical formalism describing behavior and evolution of a selection called 'social particles'.

The formalism considers population dynamics as dependent on the particles' average birth and death rate, the average outcome of social interactions as influencing this ratio, and the reproduction ratio (birth rate/death rate) as fitness. A special 'gene setting' passed to offspring determines a particle's behavior in encounters. Following Dawkins, particles sharing the same gene setting (here called gene-relatives) should favor each other or exempt from harm in an encounter, but type one and type two errors hamper a correct behavioural decision. Inserting pay-off matrices characterizing aggression, altruism, co-operation or grouping into the formalism reveals, how the respective social particles' frequency develops in domains with limited resources.

AGPhil 11: Extending General Relativity

Time: Friday 14:00–15:15 Location: A 060

Invited Talk AGPhil 11.1 Fri 14:00 A 060

A virtuous theorist's theoretical virtues: Einstein on physics vs. math and experience vs. unification — •Jeroen van Dongen — University of Amsterdam/Utrecht University

When Albert Einstein formulated the general theory of relativity, he combined a physical and mathematical approach, as Renn c.s. have shown. He retained and explicitly referred to these categories also in his later work in unified field theory, but emphasized their usefulness differently, just as his later recollections of how he found general relativity gradually changed. These altered recollections were not only the consequence of his new, highly mathematical unification program, but also served as an advertisement for that program: Einstein enlisted idealizations of his self as justification for his highly controversial work.

AGPhil 11.2 Fri 14:45 A 060

The Schism - The Origins of Canonical and Covariant Quantum Gravity — •Alexander Blum — Max-Planck-Institut für Wissenschaftsgeschichte

The split between covariant and canonical approaches to quantum gravity is today well established and manifests itself in the contemporary divide between the two main approaches, string theory and loop quantum gravity. I trace the origin of this divide to two attempts in the 1930s to go beyond the equal-time commutators, which were the standard quantization technique in the quantum electrodynamics of the day: On the one hand, the covariant commutation relations of Paul Dirac's interaction representation, developed in 1932. On the other hand, the generalized commutation relations on space-like surfaces, developed by Paul Weiss in the years 1936-1938. I will further outline, how the former were adopted by the quantum community, because the split between kinematics and dynamics that they implied became conceptually important in renormalization theory, while the latter were adopted by the general relativity community, precisely because they allowed to avoid this split.

AGPhil 12: The Problem of Time

Time: Friday 15:30–16:45 Location: A 060

Invited Talk AGPhil 12.1 Fri 15:30 A 060
The Hole Argument and the Problem of Time — •Karim Thebault — Munich Center for Mathematical Philosophy, LMU Munich

The canonical formalism of general relativity affords a particularly interesting characterisation of the infamous hole argument. It also provides a natural formalism in which to relate the hole argument to the problem of time in classical and quantum gravity. In this talk I will examine the connection between these two key problems in the foundations of spacetime theory along a number of interrelated lines. First, from a formal perspective, I will consider the extent to which the two problems can and cannot be precisely and distinctly characterised in classical and quantum canonical gravity. Second, from a philosophical perspective, I will consider the ontological implications of various responses to the problems, with a particular focus upon the relationalist/substantivalist debate. Third, from a methodological perspective, I will consider why the respective importance of the problems is differently evaluated by physicists and philosophers. My conclusions shall constitute a call to arms: important issues remain regarding the hole argument and the problem of time; these issues relate to conceptual and formal inadequacies within the representative language of canonical gravity; collaborative work to resolve these inadequacies will be of mutual benefit to both physicists and philosophers.

AGPhil 12.2 Fri 16:15 A 060
The Grammar of the Problem of Time — •Neil Dewar — University of Oxford, Oxford, UK

In this paper, I will argue that the problem of time in General Relativity is best understood as a kind of grammatical mistake; by doing so, we are able to assimilate the problem of time to analogous issues in the philosophy of language. Linguistic acts of description involve two components: the use of language to refer to some particular part of the world, followed by its use to predicate certain qualities or attributes of that part. The Hamiltonian formalism draws an analogous distinction between time variables (serving the referential function) and other variables (serving the predicative function), but this distinction is ignored by the Dirac reduction procedure. Hence, the problem of time is, at heart, a problem about how the referential use of language achieves its function, and how it interacts with the predicative use of language. I therefore look at how various programs for solving or dissolving the problem of time relate to philosophical treatments of this issue. This approach has the virtue of making the purely conceptual issues a little more perspicuous, as we can separate them from mathematical complications. I conclude, therefore, with some lessons that can be imported from the philosophy to the physics.

AGPhil 13: Alternative Approaches I

Time: Monday 14:00–15:30 Location: A 060

AGPhil 13.1 Mon 14:00 A 060
100 Years after Einstein's GR, 115 Years after Planck's Quanta - Viewing Our World 5 Years after Their Consistent Unification — •Claus Birkholz — Seydelstr. 7, D-10117 Berlin

This is a review on how 5 years ago - after the end of a long period of stagnation - Einstein's GR expanded to a consistent Quantum Gravity on a quantized bent space-time by unifying itself with Quantum Theory traced back to Planck. By still incorporating Gell-Mann's Quark Model, it proceeded to a Grand Unification (GUT/ToE) of all forces of nature.

By extracting a New Physics to replace the inconsistent "Standard Model", particle physics became tightly related to cosmology, answering the great questions like what is space, what time. Dark Matter emerged explicitly, not consisting of "wimps".

Beside series of experimental checks in cosmology, gravity, particle and atomic physics, the existence of virtual states had been identified as a mere effect of GR, which, thus, revealed as the motor of particle physics challenging philosophy. And, as a typical representative of Old Physics, Bell's theorem on "hidden" parameters, does not apply to New Physics.

By Dirac, New Physics might as well be considered as a "String Model" - however one giving physical results and in accord with experiment.

For more information on QG and GUT see www.q-grav.com.

AGPhil 13.2 Mon 14:30 A 060
Urknall, Evolution und Moral — •Klaus Hofer — Uni Bielefeld, W.-Bertelsmannstr. 10, 33602 Bielefeld

Jeder Urknall markiert die Geburt eines neuen Universums, welches dann als organischer Schöpfungskörper sich selbst überlassen durch Raum und Zeit treibt. Während seiner langen Lebensphase unterliegt ein Universum den Regeln der Evolution, wobei die Komplexität und Intelligenz der evolutionären Schöpfungsprodukte kontinuierlich zunimmt (Strings- Atome- Materie- Planeten- Gene- Organe- Lebewesen). Für den Zusammenhalt und die Weiterentwicklung alles Stofflichen stehen der Evolution die beiden physikalischen Größen Energie und Masse sowie die immaterielle Größe Information zur Verfügung. Da die stoffliche Vielfalt eines Universums lediglich auf diesen drei elementaren Naturgrößen basiert, liegt hierin auch der Schlüssel für den Übergang von toter zu lebender Materie. Denn Lebewesen sind hochcodierte Materiehaufen, die von einer übergeordneten Schwarminformation formatiert und gesteuert werden. Aus diesem erweiterten Blickwinkel ist die Existenz von Lebensformen in und auf Atomen ebenso real, wie außerirdisches Leben auf anderen Planeten oder wie ganze Galaxien als organische Lebewesen wachsen und sterben müssen. Unter Berücksichtigung der neuesten Erkenntnisse moderner Philosophie, String-Physik, Hirnforschung und Neurowissenschaften präsentiert dieser Beitrag ein geschlossenes Weltbild, welches die evolutionäre Schöpfungsvielfalt vom Urknall über die Entstehung von Materie und Leben bis hin zum fühlbaren Moralcode in unserem vorderen Hirnlappen transparent und begreifbar macht.

AGPhil 13.3 Mon 15:00 A 060
Die Rolle von Prinzipien und Symmetrien in der Physik — •Albrecht Giese — Taxusweg 15, 22605 Hamburg

Die heutige "moderne" 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 Bezug auf tiefer liegende Gesetze. Die Verallgemeinerung dieser Vorgehensweise ist das reduktionistische Weltbild, welches die Grundlage des heutigen Wissenschaftsverständnisses gebildet hat.

Vor etwa einem Jahrhundert, in der Zeit der Neuorientierung durch Relativitätstheorie und Quantenmechanik, entstand 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.

Further info: www.ag-physics.org

AGPhil 14: Alternative Approaches II

Time: Monday 16:30–18:30 Location: A 060

AGPhil 14.1 Mon 16:30 A 060

A local realistic interpretation of experiments in quantum optics — •Falk Rühl — Auf der Alm 14, D-52159 Roetgen

The space/time statistics of quantum counting events, as well as the observed spectral selection rules are derived from a classical local realistic model of the interaction of a very large, but still finite, number of uncorrelated charged oscillators, having finite binding energies, via classical EM-waves propagating in $\mathbb{R}^3$.

The interpretation of key experiments in quantum optics based on this model is both strikingly simple, as well as free of the paradoxes associated with the Copenhagen interpretation of quantum generation and propagation, like *which way*, *delayed choice*, *action at a distance*, *possible histories*, *Schrödingers cat* etc..

The model provides a continuous transition across the *quantum classical divide*, explains the observation of line spectra and the associated selection rules without *quantized energy states* or *quantum jumps*, and the nature of the *EM vacuum field*.

The model restricts the range of parameters, where predictions based on the Copenhagen interpretation can be made consistent with experiments, without having to resort to *non-classical properties*, and also restricts the types of problems, that can be solved with technical systems based on quantum detection.

AGPhil 14.2 Mon 17:00 A 060

Die Geschwindigkeit eines Impulses auf einer elektrischen Leitung — •Rudolf Germer — TU-Berlin — ITPeV,germer@physik.tu-berlin.de

In einem Weg - Zeit - Diagramm breitet sich der elektromagnetische Impuls auf einer Leitung längst der Lichtgeraden aus. Fügt man als dritte Koordinate den Strom oder die Spannung hinzu, dann liefern Projektionen des Impulses auf die Strom-Zeitebene eine Ladung und auf die Spannungs-Zeitebene einen magnetischen Fluß. Das Pendant auf der Ebene mit der Raumachse sind die magnetische Polstärke (Monopol) und der elektrische Fluß. Diese vier Größen sind von gequantelter Natur. Ihre zeitlichen und räumlichen Abstände sind Dauern und Längen. Ihre gegenseitige Zuordnung erfolgt über zwei Größen mit der Einheit "Geschwindigkeit". Ihr Mittelwert ist die Lichtgeschwindigkeit, ihr Verhältnis wird durch die Feinstrukturkonstante bestimmt. Schrotrauschen und die Unbestimmtheitsrelation (als Digitalisierungsunschärfe)1 bestimmen die möglichen Beobachtungen.

1 R. Germer: die abzählbare Physik, in Vorbereitung

AGPhil 14.3 Mon 17:30 A 060

Der elektromagnetische Quader — •Rudolf Germer — TU-Berlin — ITPeV,germer@physik.tu-berlin.de

Physikalische Effekte können beobachtet werden, wenn Beziehungen zwischen mindestens zwei Objekten bestehen. So stoßen sich zwei Elektronen ab oder ein Magnetfeld beeinflußt die Bewegung der Ladung. Sortiert man alle Wechselwirkungen zwischen den elektromagnetischen Quanten, so kann man dies mit einem Quader darstellen, der die Naturkonstanten Lichtgeschwindigkeit, Klitzingwiderstand, Vakuumimpedanz, die Dielektrizitätskonstante, Permeabilität und Feinstrukturkonstante als verbindende Größen enthält. Zur Konstruktion dieses Quaders reichen neben der Elementarladung drei Naturkonstanten, die übrigen lassen sich dann daraus ableiten. Auch die im vorherigen Beitrag beobachteten Geschwindigkeiten treten wieder auf und bieten eine der Möglichkeiten, die Lichtgeschwindigkeit zu realisieren.

AGPhil 14.4 Mon 18:00 A 060

The universe: A frequency communication system without intermodulation — •Paul Wilfried Bücking — Schallstadt, Germany

The fourth order perfect Golomb ruler is an intelligible mathematical object that was discovered to exist. This implies that its geometrically expressed logical structure exists metaphysically a priori. When sorting fundamental matter and antimatter particles by their electric charges an identical, solely number-shifted, logical structure appears. An unknown duality relation between metaphysics and physics shows up. The primordial logic represents the only possible solution to the problem of intermodulation avoidance in a frequency communication system. The solution is a minimal frequency bandwidth of least energy. In its physical duality it is defined by the charges of an electron and a positron lepton. The two asymmetrically implemented internal frequencies at distinct mirrored complementary positions within the bandwidth correspond to the two quarks of matter or antimatter. The universe reveals to be a uniquely possible system without intermodulation at the fundamental scale of leptons and quarks. This implies that particles different from the ones specified, multiverses and different physical laws can/do not exist. The primordial logical structure of the fourth order perfect Golomb ruler specifies the physical realization of the universe in all its details at the fundamental scale. It fulfills all criteria that are associated with the notion of a world formula.

AGPhil 15: Alternative Approaches III

Time: Tuesday 9:30–10:30 Location: A 060

AGPhil 15.1 Tue 9:30 A 060

How space-time can emerge as a secondary construct — •Ewoud Halewijn — Voorburg; Netherlands

Can space-time emerge as a secondary construct from a deeper level of reality? I defend that it can, even if space-time already looks real enough in itself. I propose an ontology wherein space and time emerge from minuscule triplets. Each triplet consists of one quantum-mechanical measurement result, one Planck time scale duration parameter and a property-less quantum-mechanical observer to behold the first two components.

Firstly, I show that scientific representation gaps can be treated in relativity theory just like in Relational Quantum Mechanics. Secondly, I show that classical observers can be constructed from discrete quantum-mechanical observers in series of triplets. Thirdly, I show that continuous time emerges from discrete series of durations, and space from series of position measurement results. Fourthly, I discuss the relationship between observer-specific information and what looks like "real" space-time to both human beings and measurement devices.

I just defend that in this ontology - in which our universe consists of these triplets - time dilation and space contraction do not entail conceptual problems. The measurement "problem" in quantum mechanics does not look "weird" in it either. The ontology provides an interpretation, but it does not enhance existing theories. Yet it contradicts conventional Western convictions about reality, at least in between measurements.

AGPhil 15.2 Tue 10:00 A 060

From Einstein and Eddington*s Movie to New Materialism: The New Genealogy of Relativity, The Physics of Immateriality and The Immateriality of Physics — •Fadlan Khaerul Anam — University of Indonesia, Depok, Indonesia

Through Einstein and Eddington, Einstein*s Sobral discovery to New Materialism, this paper promises a new genealogy that contrary with the Cartesian rift interpretation on the Einstein*s genealogy of relativity. In Einstein and Eddington, the debate between Eddington and Lodge that associated the defense of Newtonian tradition with Lodge*s child death, and Einstein*s desire for prove his theory after an outburst against. Einstein verified in Sobral, a new conception of cosmology that presenting new consequences for the human race and modern science. New materialism was trying to mediate natural and cultural relations, the ideal and the material with idealizing material, materializing ideal. This gives us the neglected fact: theorization is not only catching externalities, but theorization of space-time is theorization on the material-cultural process of relativity. Genealogically, relativity is not started from the universe, but the first time through observation which is actually a meeting and gluing us and the universe become one, this by idealizing material. This meeting brought together the materiality of the universe with the immateriality of the universe that grows in our reason (I call the physics of immateriality). Materializing ideal, bring our cultural and mix with the previous meeting (I call the immateriality of physics).