Fachverband Theoretische und Mathematische Grundlagen der Physik (MP)

Andreas Wipf
Theoretisch-Physikalisches-Institut
Friedrich-Schiller-Universität Jena
Max-Wien-Platz 1
07743 Jena
wipf@tpi.uni-jena.de

Die Mehrzahl der Vorträge handeln von Quantenfeldheorie im flachen und gekrümmten Raum oder auf einem Raumzeitgitter, AdS/CFT, (Quanten)Information, Entropie und Komplexität, Verschränkung und Quantengravitation. Den Plenarvortrag unseres Fachverbandes hält Martin Zirnbauer (Köln) über „Particle-hole symmetries in condensed matter“.

Gemeinsam mit anderen Fachverbänden organisieren wir am Dienstag um 16:30 Uhr ein Symposium über „Modellbildung in der Kosmologie“. Als Sprecher/in zugesagt haben Mauro Carfore, George Ellis und Michela Massimi. Am Mittwoch um 17:00 Uhr haben wir eine gemeinsame Sitzung mit dem FV GR über „Quantengravitation„. Hier sprechen Stefan Hofman (Hauptvortrag), Kristina Giesel, Thorsten Lang, Christian Pfeifer und Robert Seeger.

Am Sonntag von 16 bis 18 Uhr organisiert die jDPG ein Tutorium über „Quantum Information and Entanglement“. Hier geben Mario Flory und Tobias Osborne (beide halten auch in unserem FV Vorträge) Einführungen in dieses spannende Gebiet der Theoretischen und Mathematischen Physik.

Übersicht der Hauptvorträge und Fachsitzungen

(HS 23)

Tutorial Quantum Information and Entanglement (jointly with AKjDPG)

MP 1.1	So	16:00–17:00	HS 2	**The role of Entanglement in AdS/CFT** — •Mario Flory
MP 1.2	So	17:00–18:00	HS 2	**An introduction to quantum information and entanglement** — •Tobias Osborne

Plenarvortrag von Martin Zirnbauer

PV VIII	Mi	9:15–10:00	Plenarsaal	**Particle-hole symmetries in condensed matter** — •Martin Zirnbauer

Hauptvorträge

MP 2.1	Mo	16:15–16:55	HS 23	**How entangled are quantum fields?** — •Ko Sanders, Stefan Hollands, Onirban Islam
MP 3.1	Mo	17:30–18:10	HS 23	**Ricci Flow from the Renormalization of Nonlinear Sigma Models in Euclidean Algebraic Quantum Field Theory** — •Claudio Dappiaggi, Mauro Carfora, Nicolò Drago, Paolo Rinaldi
MP 4.1	Di	11:00–11:40	HS 23	**Dynamics and fields for holographic codes** — •Tobias Osborne
MP 5.1	Di	14:00–14:40	HS 23	**Tensor Networks and their use for Lattice Gauge Theories** — •Maria Carmen Banuls
MP 7.1	Mi	11:00–11:40	HS 23	**String-localized potentials - a Hilbert space approach to gauge theories** — •Karl-Henning Rehren
MP 8.1	Mi	14:00–14:40	HS 23	**Quantum Marginals, Entanglement, and Symmetries** — •Michael Walter
MP 9.1	Mi	17:00–17:40	HS 4	**Geodesic Incomplete but Quantum Complete Spacetimes** — •Stefan Hofmann

Hauptvorträge des fachübergreifenden Symposiums SYMD

Das vollständige Programm dieses Symposiums ist unter SYMD aufgeführt.

SYMD 1.1	Mo	14:00–14:30	Plenarsaal	**Analysis of historical solar Ca II K and sunspot data for irradiance studies** — •Theodosios Chatzistergos, Natalie A Krivova, Sami K Solanki, Ilaria Ermolli, Ilya Usoskin, Gennady Kovaltsov
SYMD 1.2	Mo	14:30–15:00	Plenarsaal	**MUSiC: A Model Unspecific Search for New Physics** — •Deborah Duchardt, Thomas Hebbeker
SYMD 1.3	Mo	15:00–15:30	Plenarsaal	**Search for solar chameleons with an InGrid based X-ray detector at the CAST experiment** — •Christoph Krieger
SYMD 1.4	Mo	15:30–16:00	Plenarsaal	**Positron Annihilation Spectroscopy throughout the Milky Way** — •Thomas Siegert

Hauptvorträge des fachübergreifenden Symposiums SYKM

Das vollständige Programm dieses Symposiums ist unter SYKM aufgeführt.

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

Hauptvorträge des fachübergreifenden Symposiums SYPS

Das vollständige Programm dieses Symposiums ist unter SYPS aufgeführt.

SYPS 1.1	Mi	15:00–15:40	HS 5	**Black-hole superradiance: Probing ultralight bosons with compact objects and gravitational waves** — •Paolo Pani
SYPS 1.2	Mi	15:40–16:10	HS 5	**Modelling and analyzing a binary neutron-star merger: Interpreting a multi-messenger picture** — •Tim Dietrich
SYPS 1.3	Mi	16:10–16:40	HS 5	**What can neutron-star mergers reveal about the equation of state of dense matter?** — •Ingo Tews

Fachsitzungen

MP 1.1–1.2	So	16:00–18:00	HS 2	**Tutorial Quantum Information and Entanglement (joint session AKjDPG/MP)**
MP 2.1–2.2	Mo	16:15–17:15	HS 23	**Verschränkung und Quanteninformation**
MP 3.1–3.3	Mo	17:30–18:50	HS 23	**Quantenfeldtheorie**
MP 4.1–4.4	Di	11:00–12:40	HS 23	**Quanteninformation und AdS/CFT**
MP 5.1–5.5	Di	14:00–16:10	HS 23	**Gittertheorien und Spinmodelle**
MP 6	Di	18:45–19:45	HS 23	**Mitgliederversammlung**
MP 7.1–7.3	Mi	11:00–12:20	HS 23	**Eichtheorien**
MP 8.1–8.5	Mi	14:00–16:10	HS 23	**Quanteninformation und Kontrolle**
MP 9.1–9.5	Mi	17:00–19:10	HS 4	**Quantengravitation (joint session MP/GR)**
MP 10.1–10.4	Do	11:00–12:20	HS 23	**Gravitation, Felder und Schwarze Löcher**
MP 11.1–11.2	Do	14:00–14:40	HS 23	**Teilchen und ihr Wechselwirkungen**
MP 12.1–12.4	Do	14:50–15:50	HS 23	**Superheavy bosons**
MP 13.1–13.6	Do	16:20–18:00	HS 23	**Grundlegende Probleme und Alternative Ansätze**
MP 14.1–14.5	Fr	9:00– 9:00	HS 23	**Posters (Montag - Donnerstag)**

Postersitzung

Die Poster können von Montag Nachmittag bis Donnerstag Abend an den Posterwänden vor HS 23 angebracht werden.

Mitgliederversammlung Fachverband Theoretische und Mathematische Grundlagen der Physik

Dienstag 18:15–19:15 HS 23

- Tagesordnung
- Bericht des Leiters
- zukünftige Aktivitäten
- Wahl von Leiter und Beirat
- Verschiedenes

MP 1: Tutorial Quantum Information and Entanglement (joint session AKjDPG/MP)

Zeit: Sonntag 16:00–18:00 Raum: HS 2

Tutorium MP 1.1 So 16:00 HS 2

The role of Entanglement in AdS/CFT — •Mario Flory — Jagiellonian University, Łojasiewicza 11, 30-348 Kraków, Poland

In this tutorial, we start with an accessible introduction to the Anti-de Sitter/Conformal Field Theory (AdS/CFT) correspondence, which is a conjecture that relates the physics of a quantum field theory with conformal symmetry to the physics of a higher dimensional gravity theory with a negative cosmological constant. One result of particular importance in AdS/CFT is the Ryu-Takayanagi formula, which equates entanglement entropy on the CFT-side of the correspondence to a generalisation of the Bekenstein-Hawking black hole entropy on the AdS-side. We will explore how this result shapes our modern understanding of the AdS/CFT correspondence, and of how the curved geometry of the AdS-space arises from quantum information theoretic aspects of a CFT.

Tutorium MP 1.2 So 17:00 HS 2

An introduction to quantum information and entanglement — •Tobias Osborne — Institut für Theoretische Physik, Appelstr. 2, 30167 Hannover

In this tutorial I will give an introduction to the theory of quantum information and quantum entanglement. Particular emphasis will be given to the foundational protocols of quantum information theory, inluding, teleportation and superdense coding, and also on the operational definition and quantification of entanglement. Applications in high energy physics and holography will be sketched.

MP 2: Verschränkung und Quanteninformation

Zeit: Montag 16:15–17:15 Raum: HS 23

Hauptvortrag MP 2.1 Mo 16:15 HS 23

How entangled are quantum fields? — •Ko Sanders[1], Stefan Hollands[2], and Onirban Islam[3] — [1]Dublin City University, Dublin, Irland — [2]Universität Leipzig — [3]University of Leeds, Leeds, United Kingdom

Entanglement is a quintessential aspect of quantum physics and a key experimental resource, e.g. in quantum computing. It is the source of such counterintuitive phenomena as teleportation, where perhaps the most extreme case occurs in quantum field theory: the entanglement of the vacuum state allows us (theoretically) to teleport information even despite the absence of particles.

The amount of entanglement that is present in a system can be quantified using an entanglement measure. In this talk I will present an overview of one such measure, the relative entanglement entropy, which originated in quantum information theory. This entanglement measure extends to quantum field theories, even in curved spacetimes, where it exhibits a surprisingly close relation to the spacetime geometry. Many details of this relation are still under active investigation.

MP 2.2 Mo 16:55 HS 23

The quantum information bottleneck method — •Daniela Cadamuro — Institut für Theoretische Physik, Universität Leipzig, Brüderstraße 15, 04103 Leipzig, Deutschland

In information theory one is interested in compressing information, of which only some part is relevant. Specifically, here we consider a quantum compression-decompression channel where sender and receiver share some side information. We compute the rate at which information can be sent through the channel so that the compressed signal retains a fixed amount of correlation with the side information, and find the optimum compression channel. Classically, this procedure was called the Bottleneck method, which we extend here to the quantum information domain.

MP 3: Quantenfeldtheorie

Zeit: Montag 17:30–18:50 Raum: HS 23

Hauptvortrag MP 3.1 Mo 17:30 HS 23

Ricci Flow from the Renormalization of Nonlinear Sigma Models in Euclidean Algebraic Quantum Field Theory — •Claudio Dappiaggi[1,2,3], Mauro Carfora[1,2,3], Nicolò Drago[1,2,3], and Paolo Rinaldi[1] — [1]University of Pavia, Pavia, Italy — [2]INFN, Sezione di Pavia, Pavia, Italy — [3]INDAM, Sezione di Pavia, Pavia, Italy

We discuss the perturbative approach to nonlinear Sigma models and the associated renormalization group flow within the framework of Euclidean algebraic quantum field theory and of the principle of general local covariance. In particular we show how to define Wick ordered powers of the underlying quantum fields and we classify the freedom in such procedure by extending to this setting a recent construction of Khavkine, Melati and Moretti for vector valued free fields. As a by-product of such classification, we prove that, at first order in perturbation theory, the renormalization group flow of the nonlinear Sigma model is the Ricci flow.

MP 3.2 Mo 18:10 HS 23

Asymptotic Completeness in Wedge-local Quantum Field Theory — •Maximilian Duell and Wojciech Dybalski — Zentrum Mathematik, Technische Universität München, Deutschland, 85748 Garching

We show that an interacting wedge-local QFT in four-dimensional Minkowski spacetime constructed by Grosse and Lechner has a complete particle interpretation. The scattering states are constructed with our recently developed wedge-local N-particle Haag-Ruelle scattering theory. This theory dispels a long-standing belief that only two-particle states are meaningful in the wedge-local setting.

MP 3.3 Mo 18:30 HS 23

Asymptotic constants of motion for the Maxwell-Newton system — Wojciech Dybalski[1] and •Duc Viet Hoang[2] — [1]TUM, Munich, Germany — [2]LMU, Munich, Germany

We consider the model of extended charges in interaction with the classical electromagnetic field. In this approach, we couple the Maxwell equations with Newton's equation to study the dynamics of charges. Relying on the work of Spohn et al. on this system of differential equations, we found asymptotic constants of motion of the form $\lim_{|x|\to\infty} x^2 E(x,t)$ and $\lim_{|k|\to 0} |k|\hat{E}(k,t)$, where E and $\hat{E}$ are the electric field and its Fourier transform, respectively. This gives a rigorous proof of conservation of the spacelike asymptotic flux of the electric field, which is relevant for infrared problems. Perspectives for proving soft-photon theorems for the Maxwell-Newton system will also be discussed.

MP 4: Quanteninformation und AdS/CFT

Zeit: Dienstag 11:00–12:40 Raum: HS 23

Hauptvortrag MP 4.1 Di 11:00 HS 23
Dynamics and fields for holographic codes — •Tobias Osborne — Institut für Theoretische Physik, Appelstr. 2, 30167 Hannover

I describe how to introduce dynamics for the holographic states and codes introduced by Pastawski, Yoshida, Harlow and Preskill as quantum-information inspired toy models of the AdS/CFT correspondence. This task requires the definition of a continuous limit of the kinematical Hilbert space of a finite which may be achieved via the semicontinuous limit of Jones. Dynamics is then introduced by building a unitary representation of a group known as Thompson's group T, which is a discretised analogy of the conformal group conf(R^{1,1}). Field operators may be defined for the boundary theory yielding a theory with discrete scaling symmetry.

MP 4.2 Di 11:40 HS 23
Complexity change under conformal transformations in AdS_3/CFT_2 — •Mario Flory[1] and Nina Miekley[2] — [1]Jagiellonian University, Łojasiewicza 11, 30-348 Kraków, Poland — [2]Universität Würzburg, Am Hubland, 97074 Würzburg, Germany

We compute the change of "holographic complexity" caused by a small conformal transformation in AdS_3/CFT_2. This computation is done perturbatively to second order. We present our results and discuss some important observations. As operators generating such conformal transformations can be explicitly constructed in CFT terms, these results allow for a comparison between holographic methods of defining and computing computational complexity and purely field-theoretic proposals. A comparison of our results to such proposals is given.

MP 4.3 Di 12:00 HS 23
Holographic Majorana dimer models and quantum error correction — •Alexander Jahn, Marek Gluza, Fernando Pastawski, and Jens Eisert — Dahlem Center for Complex Quantum Systems, Freie Universität Berlin, 14195 Berlin, Deutschland

In this talk, we present a class of ground states of quadratic Hamiltonians characterized by a non-local pairing of Majorana fermions. These dimer-like states appear in stabilizer codes used for quantum error correction. We establish a rigorous framework accompanied by an intuitive diagrammatic representation, which makes tensor contraction and explicit computation of entanglement entropies straightforward. Applied to the holographic pentagon code - a toy model for the AdS/CFT correspondence - our approach provides a concrete bulk/boundary operator mapping, yielding new insights into the correlation structure of holographic tensor networks.

MP 4.4 Di 12:20 HS 23
Subregion complexity at finite temperature in AdS/CFT — •Nina Miekley and Johanna Erdmenger — Julius-Maximilians-Universität Würzburg, Germany

The AdS/CFT correspondence relates strongly coupled field theories to theories containing gravity. In previous work, we studied the holographic entanglement entropy in d-dimensional finite temperature CFTs dual to Schwarzschild-AdS. We continue this study by investigating the volume inside the Ryu-Takayanagi surface. This volume is proposed to be the complexity of the associated reduced state of the boundary field theory. We derive a closed, analytic form of this subregion complexity for strips and investigate its properties.

MP 5: Gittertheorien und Spinmodelle

Zeit: Dienstag 14:00–16:10 Raum: HS 23

Hauptvortrag MP 5.1 Di 14:00 HS 23
Tensor Networks and their use for Lattice Gauge Theories — •Maria Carmen Banuls — Max-Planck-Institut für Quantenoptik, Garching b. München, Germany

Tensor Network States (TNS) are Ansätze for the efficient description of the state of a quantum many-body system. They can be used to study static and dynamic properties of strongly correlated states.

Lattice Gauge Theories, in their Hamiltonian version, offer a challenging scenario for these techniques. While the dimensions and sizes of the systems amenable to TNS studies are still far from those achievable by Monte Carlo simulations, Tensor Networks can be readily used for problems which more standard techniques cannot easily tackle, such as the presence of a chemical potential, or out-of-equilibrium dynamics.

In this talk I will present some recent work on the application of these techniques to study Lattice Gauge Theories. In particular, using the Schwinger model as a testbench, we have shown that TNS are suitable to approximate low energy states precisely enough to allow for accurate finite size and continuum limit extrapolations of ground state properties, mass gaps and temperature dependent quantities. The feasibility of the method has already been tested also for non-Abelian models, out-of-equilibrium scenarios, and non-vanishing chemical potential.

MP 5.2 Di 14:40 HS 23
Inhomogeneous Phases at Finite Flavor Numbers in 2D Gross-Neveu Models — •Julian Lenz[1], Laurin Pannullo[2], Marc Wagner[2], Björn Wellegehausen[1], and Andreas Wipf[1] — [1]Theoretisch-Physikalisches Institut, FSU Jena — [2]Institut für theoretische Physik, Universtiät Frankfurt

In the limit of infinite number of flavors Nf the Gross-Neveu model in two dimensions becomes solvable analytically. About 15 years ago Thies et al. found inhomogeneous phases for non-vanishing chemical potential in that limit and since then a revisited phase diagram for infinite Nf was established. However, for a long time it was unclear if this is an artifact of the infinite flavor number or survives the transition to finite Nf. We present lattice Monte-Carlo results that indicate the existence of inhomogeneous condensates for all (even) flavor numbers Nf.

10 Minuten Pause

MP 5.3 Di 15:10 HS 23
On Phase-Space Representations of Spin Systems and Their Relations to Infinite-Dimensional Quantum States — •Bálint Koczor, Robert Zeier, and Steffen J. Glaser — Technische Universität München, Garching, Germany

Classical phase spaces have been widely applied in physics, engineering, economics or biology. I will give an overview of our recent works on phase spaces of quantum systems, which are a powerful tool for describing, analyzing, and tomographically reconstructing quantum states. We provide a complete phase-space description of (coupled) spin systems including their time evolution, tomography, large-spin approximations and their infinite-dimensional limit, which recovers the well-known case of quantum optics. We calculate time evolutions using spin-weighted spherical harmonics of Newman and Penrose and approximate phase-space representations of quantum states that are challenging to calculate for large spin numbers.

Refer to the recent preprints arXiv:1711.07994 and arXiv:1808.02697.

MP 5.4 Di 15:30 HS 23
Lattice gauge theory: operator algebras and renormalization — •Alexander Stottmeister — Mathematisches Institut, Westfälische Wilhelms-Universität Münster

We discuss Hamiltonian lattice gauge theory and the implementation of Wilson's approach to the renormalization group from an operator-algebraic perspective. We indicate how the problem of identifying suitable continuum limits can be used to construct interesting examples of von Neumann algebras. Moreover, we relate the latter with a recent proposal of Jones for the construction of representations of the Thompson groups. As a working example, we present the construction of Yang-Mills theory on a space-time cylinder and relate it with quantum stochastic processes.

MP 5.5 Di 15:50 HS 23

Hamilton's equations of motion for quantum systems — •Michael Beyer[1], Jeanette Köppe[2], Markus Patzold[1], and Wolfgang Paul[1] — [1]Martin-Luther-Universität Halle-Wittenberg — [2]Westfälische Wilhelms-Universität Münster

Quantum systems can be described in terms of kinematic and dynamic equations within the stochastic picture of quantum mechanics where the particles follow some conservative diffusion process. We show that the reformulation of the quantum Hamilton principle as a stochastic optimal control problem allows us to derive these quantum Hamilton equations of motion for multidimensional systems which can be seen as a generalization of Hamilton's equations of motion to the quantum world. Due to their similar structure it is possible to draw analogies to classical mechanics where one encounters some similarities for quantum systems, e.g. the decoupling of the center-of-mass motion in multi-particle systems or the Kepler problem as the special case of the two-body problem where we present numerical results for the hydrogen atom.

MP 6: Mitgliederversammlung

Zeit: Dienstag 18:45–19:45 Raum: HS 23

Mitgliederversammlung

MP 7: Eichtheorien

Zeit: Mittwoch 11:00–12:20 Raum: HS 23

Hauptvortrag MP 7.1 Mi 11:00 HS 23

String-localized potentials - a Hilbert space approach to gauge theories — •Karl-Henning Rehren — Institut für Theoretische Physik, Uni Göttingen

For the perturbative description of interactions (like QED or weak interactions) one may use vector potentials that are defined on the physical Hilbert space, but enjoy weaker properties of covariance and locality than are usually required for observables. This increases the mathematical challenges for renormalization, but provides new structural insights and opens new paths towards theories with higher spin.

MP 7.2 Mi 11:40 HS 23

Local charge operators for massless spin-1-fields — •Moritz Heep and Karl-Henning Rehren — Institut für theoretische Physik, Universität Göttingen, Deutschland

Local generators are local operators that implement a global symmetry locally. They are usually given by integrating the zero-component of a covariant conserved local current over a finite region.

However, for massless particles of helicity ≥ 1 the Weinberg-Witten theorem asserts that such a current does not exist on the Hilbert space. Having said that, the abstract existence of local generators is a consequence of the split property that was recently established for Maxwell fields (and fields of higher helicity) with $U(1)$ symmetry by Longo, Morinelli and Rehren.

This talk will give an insight into the mathematical problems of finding a concrete representation of these operators and present most recent results.

MP 7.3 Mi 12:00 HS 23

Equivalence of two different gauges in External Current QED — •Benedikt Wegener[1] and Wojciech Dybalski[2] — [1]Department of Mathematics, University of Rome Tor Vergata, Italy — [2]Department of Mathematics, Technical University Munich, Germany

We study the connection between QED in the axial gauge and the Coulomb gauge in the external current approximation. To avoid the severe singularities present in the axial gauge, we use Yngvason-Mund-Schroer type angular smearing. In this formulation, the problem of unitary equivalence of the two gauges can be rigorously posed. We will show that such equivalence holds if the total electric charge of the system is zero. Interestingly, for non-zero electric charge, the equivalence appears to fail due to a different low-energy behaviour of the two gauges. The problem of obtaining the Yngvason-Mund-Schroer potential by canonical quantisation (with constraints) of a certain classical theory will also be discussed.

MP 8: Quanteninformation und Kontrolle

Zeit: Mittwoch 14:00–16:10 Raum: HS 23

Hauptvortrag MP 8.1 Mi 14:00 HS 23

Quantum Marginals, Entanglement, and Symmetries — •Michael Walter — University of Amsterdam

Given a collection of local density matrices, are they compatible with a global state? This question is known as the quantum marginal problem and it is of import in several areas, ranging from quantum information and entanglement theory to quantum chemistry. In this talk, I will give an introduction to this problem and present an efficient algorithmic solution, which opens up the possibility for numerically studying quantum marginals in many-body systems and larger atoms or molecules. Our quantum-inspired algorithm is based on mathematical insight from invariant theory and I will sketch this surprising connection.

MP 8.2 Mi 14:40 HS 23

Exploring the Limits of Quantum Dynamics – I: Lie-Algebraic Frame and Recent Results — •Thomas Schulte-Herbrüggen[1], Frederik vom Ende[1], Gunther Dirr[2], and Michael Keyl[3] — [1]Technical University of Munich (TUM) — [2]University of Würzburg — [3]Free University of Berlin (FUB)

Quantum systems theory emerges from a rigorous Lie-theoretical framework for answering questions of "what one can do" with a given quantum dynamical system in terms of controllability, accessibility, reachability, stabilisability, and simulability. It thus describes both potential and limits of dynamical systems, e.g., in quantum technology.

The broad class of *bilinear quantum control systems* is of the form $\dot{X}(t) = -\big(i\,\mathsf{ad}_{H_0} + \Gamma + i\sum_j u_j(t)\mathsf{ad}_{H_j}\big)X(t)$, where the drift is governed by the system Hamiltonian H_0 and eventually a (Markovian) dissipator Γ, while the control Hamiltonians H_j are switched by (piecewise constant) amplitudes $u_j(t)$. The class thus comprises coherently controlled Schrödinger (or Liouville) equations of closed systems as well as controlled Markovian master equations of GKS-Lindblad form.

We symmetry-characterise this class of dynamical systems to explore "what one can do" and give recent examples taking the dynamics of closed or open systems to their (symmetry-induced) experimental limits.

10 Minuten Pause

MP 8.3 Mi 15:10 HS 23

Exploring the Limits of Quantum Dynamics - II: Markovian Reachability — •Frederik vom Ende[1], Gunther Dirr[2], and Thomas Schulte-Herbrüggen[1] — [1]TU Munich, 85748 Garching, Germany — [2]University of Würzburg, 97074 Würzburg, Germany

Which quantum states can be reached by coherently controlling n-level quantum systems coupled to a thermal bath in a switchable Markovian way?

Questions of this kind form a challenging problem class. For solving them, we combine recent extensions of majorization techniques and Lie-geometrical control theory. We give inclusion relations deduced from dissipative actions on diagonal forms of quantum states and their unitary orbits. The inclusions hold for temperatures $0 < T \leq \infty$, while exact bounds exist for $T = 0$ (amplitude damping) and unital noise (bit flip), the latter being a standard example of a "normal" channel. Moreover, one can structure the whole class of normal Lindblad generators in terms of reachability given full unitary control.

These techniques may also be useful in view of related thermalization problems.

MP 8.4 Mi 15:30 HS 23

Quantum control in infinite dimensions and Banach-Lie algebras — •Michael Keyl — Dahlem Center for Complex Quantum Systems, Freie Universität Berlin, 14195 Berlin, Germany

In finite dimensions, controllability of bilinear quantum control systems can be decided quite easily in terms of the "Lie algebra rank condition" (LARC), such that only the system Lie algebra has to be determined from a set of generators. In this paper we study how this idea can be lifted to infinite dimensions. To this end we look at control systems on an infinite dimensional Hilbert space, which are given by an unbounded drift Hamiltonian H_0 and bounded control Hamiltonians $H_1, \ldots, H_N$. The drift H_0 is assumed to have empty continuous spectrum. We use recurrence methods and the theory of Abelian von Neumann algebras to develop a scheme, which allows to use an approximate version of LARC in order to check approximate controllability of the control system in question. Its power is demonstrated by looking at some examples. We recover in particular previous genericity results with a much easier proof. Finally several possible generalizations are outlined.

MP 8.5 Mi 15:50 HS 23

Entanglement properties of USp⊗USp symmetric states — •Zoltán Zimborás[1], Michael Keyl[2], Thomas Schulte-Herbrüggen[3], and Robert Zeier[4] — [1]Wigner Research Centre for Physics, H-1021 Budapest, Hungary — [2]Dahlem Center for Complex Quantum Systems, Freie Universität Berlin, 14195 Berlin, Germany — [3]Technical University Munich, Department of Chemistry, Lichtenbergstrasse 4, 85747 Garching, Germany — [4]Adlzreiterstrasse 23, 80337 Munich, Germany

It is notoriously hard to calculate entanglement measures for generic states. From the beginning of entanglement theory, it has been therefore useful to consider examples of entangled states that are highly symmetric, since representation theoretic methods can then be used to greatly simplify the computations of the measures and the characterization of entanglement properties. In the present work, we continue this program by studying $\mathrm{USp}(2n)\otimes\mathrm{USp}(2n)$ symmetric states. This symmetry defines a two-parameter family of states in any $2n \times 2n$ dimensional bipartite Hilbert-space. The two free parameters are related by partial transposition in much the same way as isotropic and Werner states, but unlike those states the studied family also contains a region with bound entangled states. Using group theoretical methods, we calculate the one-distillability and two-shareability regions for this set of states, and discuss how these might shed new light on some old conjectures.

MP 9: Quantengravitation (joint session MP/GR)

Zeit: Mittwoch 17:00–19:10 Raum: HS 4

Hauptvortrag MP 9.1 Mi 17:00 HS 4

Geodesic Incomplete but Quantum Complete Spacetimes — •Stefan Hofmann — Arnold Sommerfeld Center for Theoretical Physics at LMU Munich, Germany

Important spacetimes such as black holes and Friedmann cosmologies border on space-like singularities. In the vicinity of these geodesic borders, the evolution of quantum fields is described by semigroups. Semigroups allow for a complete quantum evolution if the probabilistic measure for quantum fields to populate the geodesic border becomes zero, and if the norm of quantum states is monotonously decreasing towards the geodesic border.

It is shown that black holes are quantum complete albeit geodesic incomplete. The relation to Hawking's hidden surface is discussed. Furthermore, a quantum complete prelude to inflation is presented. The apparent clash of completeness cultures is discussed and resolved.

MP 9.2 Mi 17:40 HS 4

Towards Gaussian states for the holonomy-flux Weyl algebra — •Robert Seeger — Institut für Quantengravitation, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)

An important challenge in loop quantum gravity is to find semiclassical states. This is difficult because states in the Hilbert space are excitations over a vacuum in which geometry is highly degenerate. Additionally, fluctuations are distributed very unevenly between configuration and momentum variables in this state. Coherent states that have been proposed to balance the uncertainties more evenly can, up to now, only do this for finitely many degrees of freedom. Our work is motivated by the desire to obtain Gaussian states that encompass all degrees of freedom. To implement this idea mathematically we reformulate the U(1) holonomy-flux algebra in any dimension as a Weyl algebra, and discuss generalisations to SU(2). We then define and investigate a new class of states on these algebras which behave like quasifree states on momentum variables.

10 Minuten Pause

MP 9.3 Mi 18:10 HS 4

Quantum Gravity Phenomenology: Modified dispersion relations on curved spacetimes - circular orbits and time delays — •Christian Pfeifer — University of Tartu, Tartu, Estonia

The Hamiltonian formulation of modified dispersion relations allows for their implementation on generic curved spacetimes, and thus enables us to derive effective quantum gravity corrections to the behaviour of probe particles.

In this talk I will consider general first order perturbation of the general relativistic dispersion relation on Schwarzschild and Friedmann-Lemaitre-Robertson-Walker spacetime. For the Schwarzschild case I present the correction to the innermost circular photon orbits; for the FLRW case general I discuss corrections to the cosmological redshift, and the emerging time delay in the time of arrival of simultaneously emitted photons. These results extend existing analyses which consider particularly chosen modified dispersion relations and usually neglect curved spacetime effects. Compared to the predictions of general relativity, the dependence of the observables on the four momentum of the particle is increased. This signature is in principle detectable in observations with instruments of sufficient sensitivity, for example in the shadows of black holes and the time of arrival measurements of high energetic photons from gamma ray bursts.

MP 9.4 Mi 18:30 HS 4

Canonical cosmological perturbation theory with geometrical clocks — •Kristina Giesel[1], Adrian Herzog[1], and Parampreet Singh[2] — [1]FAU Erlangen-Nuernberg, Institut fuer Theoretische Physik III, 91058 Erlangen — [2]Louisiana State University, Baton Rouge, Louisiana, USA

We apply the extended ADM-phase space formulation originally introduced by Pons et al to canonical cosmological perturbation theory and analyze the relationship between various gauge choices made in this framework and the choice of geometrical clocks in the relational formalism. We show that various gauge invariant variables obtained in the conventional analysis of cosmological perturbation theory correspond to Dirac observables tied to a specific choice of geometrical clocks. As examples, we show that the Bardeen potentials and the Mukhanov-Sasaki variable emerge naturally in our analysis as observables when gauge fixing conditions are determined via clocks in the Hamiltonian framework. Furthermore, we will show that the extended ADM phase space provides a framework in which the relation between conventional and canonical cosmological perturbation theory can be naturally analyzed and how existing results in the canonical approach can be generalized.

MP 9.5 Mi 18:50 HS 4

Hamiltonian Renormalization — •Thorsten Lang, Klaus Liegener, and Thomas Thiemann — FAU Erlangen-Nürnberg

We propose a renormalization procedure in the Hamiltonian formalism with applications in canonical quantum gravity. The procedure is motivated from path integral renormalization by applying the Osterwalder-Schrader reconstruction.

MP 10: Gravitation, Felder und Schwarze Löcher

Zeit: Donnerstag 11:00–12:20 Raum: HS 23

MP 10.1 Do 11:00 HS 23

Temperature of quantum matter near spherically symmetric apparent horizons — •Felix Kurpicz[1,2], Nicola Pinamonti[3,4], and Rainer Verch[2] — [1]Max-Planck-Institute for Mathematics in the Sciences (Leipzig) — [2]Institute for Theoretical Physics, University of Leipzig — [3]Dipartimento di Matematica, Università di Genova — [4]Istituto Nazionale di Fisica Nucleare (Genova)

In this talk, we discuss the form taken by quantum matter fields in the proximity of the apparent horizon which is formed during a spherically symmetric gravitational collapse and/or black hole evaporation. Our analysis is performed by discussing the form of the two-point function of a Klein-Gordon field in an arbitrary Hadamard state. We present a suitable scaling procedure that leads to a thermal distribution along integral lines of the Kodama vector field, which prescribes a preferred time direction on spherically symmetric spacetimes.

The temperature of the thermal distribution depends on the point of the apparent horizon that is tested, thus allowing an analysis of kinematical temperature changes along the horizon. The effect is universal in the sense that it does not depend on any particular matter model or a specific Hadamard state. The thermal nature of the two-point function can also be related to the tunneling probabilitiy of particles (defined with respect to the Kodama field) across the horizon.

MP 10.2 Do 11:20 HS 23

A Bound on Relativistic Correlators at Large Spacelike Momenta — •Souvik Banerjee[1], Kyriakos Papadodimas[2], Suvrat Raju[3], Prashant Samantray[4], and Pushkal Shrivastava[3] — [1]Uppsala University, Uppsala, Sweden — [2]ICTP, Trieste, Italy — [3]ICTS, Bengaluru, India — [4]BITS, Hyderabad, India

In this work we study Wightman functions in a relativistic quantum field theory, in the limit where the momenta of the insertions are spacelike and large. We show that this correlator must die off at least as fast as Exp[R] where R is the radius of the smallest sphere that contains the polygon formed by the momenta. We show that holographic correlators at large-N have a characteristic behaviour in this limit that does not saturate the bound. A q-point holographic correlator saturates the bound at order q in 1/N perturbation theory through bulk loop diagrams. Perturbative quantum field theories have a different characteristic behaviour, and also saturate the bound through suitably high-order loops. We conclude with some comments on the behaviour of generic relativistic field theories. This work has direct connection to the understanding of evanescent modes arising in the case of black holes in AdS. This is also deeply related to the understanding of reconstruction of bulk AdS spacetime using CFT data in the light of AdS/CFT correspondence and more specifically the subregion duality.

MP 10.3 Do 11:40 HS 23

Quantum theory of charged black hole horizons — •Konstantin Eder — Lehrstuhl für Theoretische Physik III/Quantengravitation, FAU Erlangen-Nürnberg

We describe the quantum theory of isolated horizons with electromagnetic or non-Abelian gauge charges in the framework of Loop Quantum Gravity. We consider the distorted case, and its spherically symmetric limit. We show that the gravitational horizon d.o.f. give rise to the Bekenstein-Hawking relation, with lower-order terms giving some corrections for small black holes. Furthermore, we demonstrate that one can include matter d.o.f. in the state counting. We show that one can expect (potentially divergent) contributions proportional to the area, as well as logarithmic corrections proportional to the horizon charge. This is qualitatively similar to results on matter contributions obtained with other methods in the literature.

MP 10.4 Do 12:00 HS 23

Poisson brackets for Einstein gravity with Kalb-Ramond field and dilaton — •Eugenia Boffo and Peter Schupp — Jacobs University, Bremen, Germany

We formulate Einstein gravity with the field strength of an antisymmetric 2-form, conformally coupled to a scalar field ϕ with its own kinetic term, as the mechanics of a graded Poisson structure with some Hamiltonian Θ.

A relevant feature of our formulation is that we allow the extended graded phase space to have a connection which is curvatureless. The setup admits also an elegant description in terms of an algebroid on the sections of $TM \oplus T^*M$, and hence a subsequent connection inherited from the one we start with. The derived curvature scalar, projected to the standard tangent space, will then automatically include all the relevant fields (metric, Kalb-Ramond and dilaton) in the right way.

We expect that some slightly different Poisson brackets will account for the non-geometric flux of the open strings metrics.

MP 11: Teilchen und ihr Wechselwirkungen

Zeit: Donnerstag 14:00–14:40 Raum: HS 23

MP 11.1 Do 14:00 HS 23

Phase Spaces, Parity Operators, and the Born-Jordan Distribution — Bálint Koczor[1], Frederik vom Ende[1], Maurice de Gosson[2], Steffen J. Glaser[1], and •Robert Zeier[3] — [1]Technische Universität München, Department Chemie, Lichtenbergstrasse 4, 85747 Garching, Germany — [2]Faculty of Mathematics (NuHAG), University of Vienna, Oskar-Morgenstern-Platz 1, 1090 Wien, Austria — [3]Adlzreiterstrasse 23, 80337 München, Germany

Phase spaces as given by the Wigner distribution function provide a natural description of infinite-dimensional quantum systems. They are an important tool in quantum optics and have been widely applied in the context of time-frequency analysis and pseudo-differential operators. Phase-space distribution functions are usually specified via integral transformations or convolutions which can be averted and subsumed by (displaced) parity operators proposed in this work. Building on earlier work by Grossmann for Wigner distribution functions, parity operators are used to define phase-space distribution functions as quantum-mechanical expectation values. These distribution functions are related to the so-called Cohen class and to various quantization schemes. Our approach is also applied to the Born-Jordan distribution which originates from the Born-Jordan quantization. The corresponding parity operator is written as a weighted average of both displacements and squeezing operators and we determine its generalized spectral decomposition. This leads to an efficient computation of the Born-Jordan parity operator and example quantum states reveal unique features of the Born-Jordan distribution. Refer to arxiv:1811.05872.

MP 11.2 Do 14:20 HS 23

Developments in scattering amplitudes for three-jet production at NNLO — •Simone Zoia — Max-Planck Institute for Physics, Munich

The increasing experimental precision at hadron colliders challenges theoretical physicists to keep up with the accuracy of the corresponding theoretical predictions. Many of the perturbative calculations appearing in the latest Les Houches “wish list" involve yet unknown $2 \to 3$ scattering amplitudes.

We review the recent developments in the calculation of the virtual two-loop corrections for five-particle processes. In particular, we present the analytic calculation of all master integrals of the last missing non-planar integral family for five-particle massless scattering at two loops in any 4D gauge theory. We employ the cutting-edge mathematical techniques for calculating multi-loop Feynman integrals: the method of differential equations, the study of leading singularities to put them in the canonical form, and the symbol alphabet that identifies the space of functions.

With the results here presented, together with the ones already given in the literature, we now know the analytic expressions of all master integrals needed e.g. for the virtual two-loop corrections to three-jet production at NNLO.

MP 12: Superheavy bosons

Zeit: Donnerstag 14:50–15:50 Raum: HS 23

MP 12.1 Do 14:50 HS 23

superheavy boson and first step of fission — genevieve mouze[1] and •Jean-Francois Comanducci[2] — [1]universite de nice,06108 Nice cedex 2, france — [2]LE- AIEA 4 Quai Antoine Premier, 98000 Monaco

In the fission of 258Fm, the pair 132Sn- 126Sn proves that the 50 Ar cluster has interacted with the bare 82- proton phase of the 208Pb core, after having excited the four- phonon level of the oscillator present in the core. But how can two tin nuclei be formed, if 100 u-quarks are not changed into 100 d-quarks, and then 100 d-quarks are not changed into the 50 u-quarks of the two tin nuclei ? This proves not only that a W+ and a W- intervene, but also that a new heavy boson has created the W-boson pair. Clearly, this boson must have charge 0 and mass at least 160.9 GeV/c2. Its lifetime, 0.17 yoctosecond, can be deduced from the width of the mass distribution of the unique product formed at the highest total kinetic energy in asymmetric cold fission. Important is the four - phonon level, now proved thanks to a reinterpretation of the alpha-neutron coincidences of H. Han et al. of 1988.

MP 12.2 Do 15:05 HS 23

superheavy boson and prompt- neutron emission — Genevieve Mouze[1] and •Jean-Francois Comanducci[2] — [1]Universite de Nice,06108 Nice cedex 2, France — [2]LE- AIEA 4 Quai Antoine Premier, 98000 Monaco

Terrels law of 1957 on prompt-neutron emission shows that the distribution of the number of emitted neutrons has a width of 2.438 neutrons at half-maximum, as if a gauge boson having a lifetime of 0.17 yoctosecond had intervened in the fission reaction: this lifetime, shorter than that of the W and Z bosons, is pointing to a very heavy mass. But in 1962 Terrell discovered that prompt neutrons are emitted only by products of mass greater than A= 82 and A=126: it means that during 0.17 ys the fissioning nucleus consists only of neutrons, and consequently that W+ and W- bosons, created by the superheavy boson, necessarily intervened. Thus the new boson has charge zero and mass at least 160.9 Gev/c2. Coincidence experiments made by Durell in 1996 have shown that formation of a product requires the emission of a number positive or nil of neutrons. Clearly, neutron emission results from the uncertainty law and not from evaporation.

MP 12.3 Do 15:20 HS 23

superheavy boson and third step of fission — genevieve mouze[1] and •jean-francois Comanducci[2] — [1]universite de nice,06108 Nice cedex 2, france — [2]LE- AIEA 4 Quai Antoine Premier, 98000 Monaco

The separation of the two nuclei present in a pair occurs only if their Coulomb barrier can be overcome. The barrier, similar to that involved in the alpha particle emission, has to be corrected for the sphericity of the products. We have shown that only two pairs of 258Fm have a fission energy greater than their barrier [1]; all the others are confined. A nucleus can fission symmetrically only if the mass of its light product becomes equal to 126. It may be asked why 252Cf fissions asymmetrically, although a light product of mass 126 could be formed in the interaction of its 44S cluster with the bare 82-proton phase: the reason is that 126In - 126In is still confined. We propose a rational definition of the fission barrier; it is the difference between barrier Bc and fission energy Q. With our discovery of the superheavy boson, we have confirmed that fission is really a cataclysmic rearrangement. [1] G. Mouze, Bormio Intern.Winter Meeting, Università di Milano, 2005.

MP 12.4 Do 15:35 HS 23

mass and superheavy boson — Christian Ythier[1] and •Daniel Cvikevic[2] — [1]Universite de Nice, 06108 Nice cedex 2, France — [2]Bismarckstrasse 73, 70197 Stuttgart, Germany

Newtons experiment with a vessel shows that inertia is coming from the rotational motion of electrons and quarks. According to Zisman and to Feynman, this rotational motion of a charge happens essentially in the future and in the past of the ordinary 3 -D space. This future and this past are real but orthogonal to the present 3 - D space, so that the motion of a quark can be quantified in a real space rather than in a space of colour. The rotational energy of a charge is a form of energy and can be converted into kinetic energy in 3- D space. In the high-energy reaction p + p leads to pion + X, one observes a transversal impulse of 330 MeV, corresponding to the destruction of the pion, since 330 MeV/c2 is the mass of a quark. A superheavy boson having charge zero, spin maybe 2 and lifetime 0.17 yoctosecond shows itself in fission and transfer reactions, where it creates a W+, W- pair; so its mass is at least 160.9 GeV/c2.

MP 13: Grundlegende Probleme und Alternative Ansätze

Zeit: Donnerstag 16:20–18:00 Raum: HS 23

MP 13.1 Do 16:20 HS 23

Entfernte Partikel haben einen starken und schnellen Einfluss auf das Molekülverhalten — •Andreas Pfennig — Chemical Engineering, University of Liège, Liège, Belgium

Molekulare Systeme zeigen Lyapunov-Instabilität, d.h. deterministisches Chaos. Für flüssiges Wasser erhöht sich eine Störung um den Faktor 10 alle 0,23ps, wie aus MD-Simulationen hervorgeht. In der Chaostheorie wird die Konsequenz typischerweise so angegeben, dass eine Vorhersage über eine mittlerer Zeitskala hinaus praktisch unmöglich ist, da die Startbedingungen für jede 0,23ps weiter in die Zukunft um eine weitere Dezimalstelle bekannt sein müssten.

Die Wechselwirkung eines fernen Teilchens beeinflusst jedes beobachtete Molekül minimal, was aufgrund der Lyapunov-Instabilität zu einer erkennbaren Verschiebung des molekularen Verhaltens innerhalb von maximal 33ps führt, auch von Teilchen, die sich am Ende des beobachtbaren Universums befinden. Entferntere Partikel haben keinen geringeren Einfluss, sondern die Zeit, bis die Auswirkung der Interaktion eine bestimmte Größe erreicht, ist länger. Die Geschwindigkeit, mit der sich die Interaktion ausbreitet, muss berücksichtigt werden, was das Ergebnis im Prinzip nicht verändert.

Dieser Effekt beschreibt Wechselwirkungen zwischen Teilchen und ihre Wirkung in der Realität, er bezieht sich nicht nur auf Vorhersagbarkeit wie die Chaos-Theorie. Wenn sich ein Teilchen an einer etwas anderen Stelle befände, verhielte sich das beobachtete System nach nur wenigen ps anders. So entsteht ein hochvernetztes Netzwerk von Wechselwirkungen zwischen allen Teilchen im Universum.

MP 13.2 Do 16:35 HS 23

On a contextual model refuting Bells Theorem — •Eugen Muchowski — Primelstr. 10, 85591 Vaterstetten

It is shown that there is no need for remote action in order to explain polarization measurements at photons in singlet state. A contextual model is presented able to explain the measurement results. It is not ruled out by the Kochen-Specker Theorem. Instead it refutes Bells Theorem. The model is extended to spin one half particles. Consequences for the feasibility of quantum computers will be discussed.

MP 13.3 Do 16:50 HS 23

Phenomenology of orbital angular momentum in relativistic multi-particle systems — •Walter Smilga — Geretsried, Germany

An isolated system of N independent particles can be described quantum mechanically by a simultaneous eigenstate of the total linear and angular momenta. An essential constituent of the angular momentum is the orbital angular momentum. Its eigenstates give an isolated multi-particle system an internal quantum mechanical structure. For N = 2, this structure defines an interaction with the strength of the electromagnetic interaction; for large N, an approximation for large quantum numbers leads to a theory of gravity that does not require dark matter.

10 Minuten Pause

MP 13.4 Do 17:15 HS 23

Relativitätstheorie als mathematische Herausforderung — •Albrecht Giese — Taxusweg 15, 22605 Hamburg

Die Relativitätstheorie Einsteins zu verwenden, gilt als eine besondere mathematische Herausforderung. Selbst gut befähigte Physiker sehen sich meistens von diesem Thema überfordert. Sowohl der Formalismus der Riemannschen Geometrie als auch die Imagination eines gekrümmten 4-dimensionalen Raumes sind für das menschliche Gehirn schwer verdaulich.

Es war Einsteins Forderung, dass die Lichtgeschwindigkeit konstant sei in jedem System (linear bewegt wie auch beschleunigt), welche die 4-Dimensionalität erforderlich machte.

Im Kontrast dazu hatte bereits lange vor Einstein Hendrik Lorentz begonnen, relativistische Phänomene mit klassischen Annahmen zu erklären. Allerdings war das Verständnis der Materie zu jener Zeit so wenig entwickelt, dass seine Ansätze sehr spekulativ erschienen. Vor dem Hintergrund der heutigen Physik jedoch sind sie vollständig bestätigt.

Die mathematische Konsequenz des lorentzianischen Ansatzes ist, dass herkömmliche Mathematik, vor allem euklidische Geometrie, ausreicht, relativistische Phänomene korrekt zu beschreiben. Wir werden den Weg in Ansätzen erläutern und dazu ein Beispiel aus der Allgemeinen Relativitätstheorie vorstellen, in welchem die drastische Vereinfachung der verbundenen Mathematik sehr anschaulich sichtbar wird bei Ergebnissen, die identisch sind zu denen Einsteins.

Weitere Info: www.ag-physics.org

MP 13.5 Do 17:30 HS 23

Neurophilosophie und Physik — •Helmut Hille — Fritz-Haber-Straße 34, 74081 Heilbronn

"Wer nur Chemie versteht, versteht auch die nicht recht" schrieb Georg Christoph Lichtenberg (1742-1799). Das gilt natürlich auch für die Physik. Man muss als theoretischer Physiker auch einiges von Philosophie verstehen. Darum gibt es in der DPG die Arbeitsgruppe Philosophie der Physik. Aber wer nur Philosophie versteht, versteht auch die nicht recht. Man sollte auch wissen, wie das Gehirn funktioniert. Erst die Verbindung von Ergebnissen der Hirnforschung mit philosophischen Fragestellungen, die Neurophilosophie, schafft Einsicht in die Bedeutung der verwendeten Begriffe. Es gilt z.B. zu fragen, wodurch wir von Zeit und Bewegung wissen. Beides sind Impressionen, die uns durch das Gedächtnis geschenkt werden und nur dort existieren! Erst die Verbindung von nacheinander im Hirn eintreffenden Sinneseindrücken erzeugt alle Erlebnisse zeitlicher Art. Ohne die Leistungen des Gedächtnisses wüssten wir aber nicht nur nichts vom zeitlichen Geschehen in der Welt, sondern gäbe es auch keine Sprache und keine Melodien, was unser Menschsein ausmacht, sondern nur unverbundene sinnlose Einzeleindrücke. Wer sein Gedächtnis verliert, verliert auch alles spezifisch Menschliche, weshalb die Leistung des Gedächtnisses und damit die des Beobachters nicht überschätzt werden kann.

MP 13.6 Do 17:45 HS 23

Emission & Regeneration - Unified Field Theory. — •Osvaldo Domann — Stephanstr. 42, D- 85077 Manching

The SM defines for each force a different field resulting the electric, magnetic, weak, strong and gravitation fields. A theory is presented based on a space-like representation of Subatomic Particles (SPs) as Focal Points of rays of Fundamental Particles (FPs) that extend over the whole space. The FPs store the energy of the SPs as rotations defining angular momenta, allowing the description of the interactions between SPs as the interactions between the angular momenta of their FPs. All SPs interact permanently so that the local physical laws are determined by the large-scale structure of the universe according to Ernst March's principle. The main finding of the approach is that many concepts introduced by the SM like gluons, gravitons, dark mater, dark energy, expansion of the universe, equivalence principle, etc. are the product of the inadequate representation of SPs. The approach derives all four known forces as electromagnetic interactions and is compatible with Quantum Mechanics. Another important finding is the interaction of light with the measuring instruments, which together with the emission of light with speed 'c' relative to its source and absolute time and space, leads to Galilean relativity multiplied with the gamma factor. No unphysical concepts like time dilation and length contraction are required. More at www.odomann.com

MP 14: Posters (Montag - Donnerstag)

Zeit: Freitag 9:00–9:00 Raum: HS 23

MP 14.1 Fr 9:00 HS 23

Holographic Schwinger Effect of Dynamic Fields — Chen Lan[1], •Yi-Fan Wang[2], Huifang Geng[1], and Alexander Andreev[1,3] — [1]ELI-ALPS, ELI-Hu NKft, Dugonics tér 13, H-6720 Szeged, Ungarn — [2]Institut für Theoretische Physik, Universität zu Köln, Zülpicher Straße 77, D-50937 Köln, Deutschland — [3]Saint-Petersburg State University, Ulyanovskaya str. 1, Petrodvorets, Saint-Petersburg 198504, Russland

At strong coupling, the scalar Schwinger effect is studied by the field-theoretical method of worldline instantons for dynamic fields of single-pulse and sinusoidal types. By examining the Wilson loop along the closed instanton path, corrections to the results at weak coupling are discovered. They show that: a) since the additional terms depend on strength of the background field, the Wilson loop becomes non-negligible even in the extreme weak-field limit; and b) a breaking of weak-field condition similar to constant field also happens beyond the critical field. In other words, considerations at strong coupling turn out to be indispensable for strongly dynamic field. Therefore, following Semenoff and Zarembo's proposal, the Schwinger effect at strong coupling is studied with an $\mathcal{N} = 4$ supersymmetric Yang–Mills theory in the Coulomb phase. With the help of the gauge/gravity duality, the vacuum decay rate is evaluated by the string action with instanton worldline as boundary, which is located on a probe D3–brane. The corresponding classical worldsheets are estimated by perturbing the integrable case of a constant field.

MP 14.2 Fr 9:00 HS 23

Semigroup Approach to the Sign Problem in Quantum Monte Carlo Simulations — •Zhongchao Wei — University of Cologne, Cologne 50937, Germany

We propose a new framework based on the concept of semigroup to understand the fermion sign problem. By using properties of contraction semigroups, we obtain new sufficient conditions for quantum lattice fermion models to be sign-problem-free. Many previous results can be considered as special cases of our new results. As a direct application of our new results, we construct a new class of sign-problem-free fermion lattice models, which cannot be understood by previous frameworks. This framework also provides an interesting aspect to understanding related quantum many-body systems. We establish a series of inequalities for all the sign-problem-free fermion lattice models that satisfy our sufficient conditions.

MP 14.3 Fr 9:00 HS 23

Emission & Regeneration - Unified Field Theory. — •Osvaldo

Domann — Stephanstr. 42, D- 85077 Manching

The SM defines for each force a different field resulting the electric, magnetic, weak, strong and gravitation fields. A theory is presented based on a space-like representation of Subatomic Particles (SPs) as Focal Points of rays of Fundamental Particles (FPs) that extend over the whole space. The FPs store the energy of the SPs as rotations defining angular momenta, allowing the description of the interactions between SPs as the interactions between the angular momenta of their FPs. All SPs interact permanently so that the local physical laws are determined by the large-scale structure of the universe according to Ernst March's principle. The main finding of the approach is that many concepts introduced by the SM like gluons, gravitons, dark mater, dark energy, expansion of the universe, equivalence principle, etc. are the product of the inadequate representation of SPs. The approach derives all four known forces as electromagnetic interactions and is compatible with Quantum Mechanics. Another important finding is the interaction of light with the measuring instruments, which together with the emission of light with speed 'c' relative to its source and absolute time and space, leads to Galilean relativity multiplied with the gamma factor. No unphysical concepts like time dilation and length contraction are required. More at www.odomann.com

MP 14.4 Fr 9:00 HS 23

On a fractional differential problem of Lane Emden type — •Zoubir DAHMANI[1] and Yasmina BAHOUS[2] — [1]Laboratory LMPA, UMAB Mostaganem — [2]Department of Math-Info, UMAB

In this presentation, using fractional calculus, we present recent results on a problem of differential equations of Lane Emden type. Some existence and uniqueness results are obtained. Some recent stability phenomena of the considered problem are aslo studied. At the end, an illustrative example is discussed.

MP 14.5 Fr 9:00 HS 23

Decoherence of quantum registers — •Javeria Khan[1], Imran Ahmed Siddiqui[2], and Piero Nicolini[3] — [1]Goethe-Universität Frankfurt am Main. — [2]University of Karachi, Pakistan — [3]Goethe-Universität Frankfurt am Main, Germany

This study is motivated by the observation (widely believed but unproven) that classical systems cannot simulate highly entangled quantum systems efficiently, and we hope to hasten the day when well controlled quantum systems can perform tasks surpassing what can be done in the classical world. To operate a large scale quantum computer reliably we will need to overcome the debilitating effects of decoherence, Starting from the dynamical evolution of a quantum register of arbitrary length coupled to an environment of arbitrary coherence length is predicted within a relevant model of decoherence. We have revisited a model of decoherence based upon the one previously studied by Leggett in connection with tunneling problem in the presence of dissipation. The results are reported for both independent decoherence and collective decoherence, for both cases explicit decoherence functions are derived and it is shown that the decay of the coherences of the register is strongly depend on the input state. Our results lead to the identification of decoherence free states in the collective decoherence limit. Only by challenging the entanglement frontier and by tackling decoherence we will learn whether Nature provides extravagant resources far beyond what the classical world would allow. Keywords: decoherence, entangled, evolution, states.