

Physik-Combo



Report of Contributions

Contribution ID: 1

Type: **not specified**

Welcome address

Monday 27 September 2021 10:55 (5 minutes)

Contribution ID: 3

Type: **not specified**

An introduction to tensor networks for describing strongly correlated quantum many-body systems I

Monday 27 September 2021 11:00 (1 hour)

Presenter: Prof. VERSTRAETE, Frank (Ghent University)

Contribution ID: 4

Type: **not specified**

Charged quantum fields inside black holes

Monday 27 September 2021 13:45 (30 minutes)

The strong cosmic censorship conjecture states that black hole spacetimes cannot be continued beyond their inner horizon due to the divergence of local observables, such as the stress-energy tensor of a classical or quantum scalar field, at that horizon. In the case of a spherically symmetric, charged black hole, numerical and analytical studies indicate, that this conjecture is violated classically, even for charged scalar fields, but that the conjecture can be restored by quantum effects in the real scalar case. Here, we present a study on the behaviour of quantum charged scalar fields in a charged, non-rotating black hole. Apart from an extension of the results for real quantum fields, we focus on the charge current induced by this field. We derive an expression for the renormalized current in the Unruh vacuum. In addition, we demonstrate numerically, that the quantum scalar field can charge, instead of discharge, the black hole near the inner horizon.

Presenter: KLEIN, Christiane (ITP Leipzig)

Contribution ID: 5

Type: **not specified**

Quantum energy inequalities and integrable quantum field theories

Monday 27 September 2021 14:15 (30 minutes)

Many results in general relativity rely crucially on classical energy conditions inflicted on the stress-energy tensor. Quantum matter, however, violates these conditions since its energy density can become arbitrarily negative at a point. Nonetheless quantum matter should have some reminiscent notion of stability, which can be captured by the so-called quantum (weak) energy inequalities (QEIs), lower bounds of the smeared quantum-stress-energy tensor. QEIs could be proven in many free quantum field theory (QFT) models on both flat and curved spacetimes. In interacting theories only few results exist. We are here presenting numerical and analytical results on QEIs in interacting integrable QFT models in 1+1 dimension, in particular the $O(N)$ -nonlinear-sigma and sinh-Gordon model at 1- and 2-particle level.

Presenter: MANDRYSCH, Jan (ITP Leipzig)

Contribution ID: 6

Type: **not specified**

An introduction to tensor networks for describing strongly correlated quantum many-body systems II

Monday 27 September 2021 15:30 (1 hour)

Presenter: Prof. VERSTRAETE, Frank (Ghent University)

Contribution ID: 8

Type: **not specified**

A rigorous derivation of the functional renormalisation group equation

Tuesday 28 September 2021 09:15 (30 minutes)

The functional renormalisation group equation is derived in a mathematically rigorous fashion in a framework suitable for the Osterwalder-Schrader formulation of quantum field theory. To this end, we devise a very general regularisation scheme and give precise conditions for the involved regulators guaranteeing physical boundary conditions. Furthermore, it is shown how the classical limit is altered by the regularisation process leading to an inevitable breaking of translation invariance. We also give precise conditions for the convergence of the obtained theories upon removal of the regularisation.

Presenter: ZIEBELL, Jobst (TPI Jena)

Contribution ID: 9

Type: **not specified**

Asymptotically safe Einstein Palatini gravity

Tuesday 28 September 2021 09:45 (30 minutes)

The Einstein-Palatini formulation of gravity treats the metric and the connection as independent degrees of freedom. The most general extension on the level of the Einstein-Hilbert action equips the connection with a U(1)-symmetric vector field as an addition to the conventional Levi-Cevita connection. Making a scale-dependant analysis within the Asymptotic Safety scenario of quantum gravity by employing the Functional Renormalization Group equation, we find a Reuter-like UV-attractive fixed point that is supportive of the weak gravity bound.

Presenter: Mr SALEK, Abdol Sabor (TPI Jena)

Contribution ID: 11

Type: **not specified**

An introduction to tensor networks for describing strongly correlated quantum many-body systems III

Tuesday 28 September 2021 11:00 (1 hour)

Presenter: Prof. VERSTRAETE, Frank (Ghent University)

Contribution ID: 12

Type: **not specified**

Inti Sodemann

Tuesday 28 September 2021 13:45 (1 hour)

Contribution ID: 13

Type: **not specified**

Gravitational Waves from Black hole - Neutron Stars

Tuesday 28 September 2021 15:30 (30 minutes)

Since the first observation of a GW from a binary black hole in 2015, many more have been observed in recent years. GW astronomy provides us with a powerful tool to do science through the information we can get from their detection in interferometers. Most recently, GWs from black hole - neutron star mergers have been observed for the first time. These coalescences are promising candidates to be the source of Kilonova and GRBs. Their detection could also provide us with information about the neutron star's structure. To achieve this, one needs waveform models to successfully detect these peculiar binary systems.

Presenter: GONZALEZ, Alejandra

Contribution ID: 15

Type: **not specified**

Constraints on nuclear equations of state from binary neutron star mergers

Tuesday 28 September 2021 16:00 (30 minutes)

Multi-messenger observations of binary neutron star mergers can provide essential information on the properties of the nuclear equation of state of these compact objects. We perform Bayesian inference on GW170817 and its kilonova counterpart AT2017gfo, constraining the radius of a neutron star of $1.4 M_{\odot}$ to 12.2 ± 0.5 km (1σ level). Furthermore, we show how post-merger gravitational-waves can inform us on the high-density regimes: such observation would constrain the maximum central density of a non-rotating neutron star with an error of the order of $\sim 15\%$ at the 90% confidence level.

Presenter: BRESCHI, Matteo (FSU Jena)

Contribution ID: 17

Type: **not specified**

Dualities in one and two-dimensional quantum systems

Wednesday 29 September 2021 09:00 (1h 30m)

Presenter: Prof. MROSS, David (Weizmann Institute)

Contribution ID: 18

Type: **not specified**

Core collapse in scalar-tensor theory with massive fields

Wednesday 29 September 2021 11:15 (45 minutes)

Though General Relativity has been successfully tested so far, concepts such as dark energy and string theory suggest the need of modifying it. Scalar-tensor theory is one of the most popular alternatives discussed. The key motivation for looking at the ones with massive fields is that they are far less constrained by binary pulsar observations, in contrast to the massless case. In this talk, I will demonstrate studies in stellar core collapse in spherical symmetry that were performed by adapting the numerical code GR1D to the case of massive scalar-tensor gravity. The addition of a mass term allows, within present constraints, much stronger gravitational wave emission than in the massless case, while the dispersion in the propagation of the scalar leads to a quasi-monochromatic signal, potentially detectable by LIGO /Virgo with existing analysis pipelines.

Presenter: ROSCA-MEAD, Roxana (TPI, University of Jena)

Contribution ID: 20

Type: **not specified**

Topology vs. interaction: the strong, the weak and the fragile

Wednesday 29 September 2021 15:30 (1 hour)

Topological systems of non-interacting electrons may be forced by their topological nature to have a gapless spectrum. As two examples, Integer quantum Hall states and topological insulators must carry gapless edge states, which allow them to carry current. Whether interaction between the electrons may turn a gapless conductor into a fully gapped insulator depends on the case at hand, with a negative answer for the first example and a positive for the second.

In this talk I will review these two examples, and then discuss bands of fragile topology. I will explain what fragile topology is as well as how and when it forbids a gapped spectrum at the non-interacting level. Then, I will show that in this case interactions may be powerful enough to overcome the decree issued by topology, and explain how they do that. Finally, I will discuss relevance to twisted bi-layers of graphene.

Presenter: Prof. STERN, Ady (Weizmann Institute)

Contribution ID: 23

Type: **not specified**

Student & PI Meeting

Wednesday 29 September 2021 13:45 (1 hour)

Contribution ID: 24

Type: **not specified**

Prompt Collapse in Binary Neutron Star Mergers: The Effect of the Mass Ratio

Tuesday 28 September 2021 16:30 (30 minutes)

The outcome of a binary neutron star merger dominantly depends on the total mass of the system and the equation of state describing the matter. However, the mass ratio also influences the postmerger evolution, in particular, whether there is a prompt or delayed collapse. Furthermore, the mass ratio influences which fraction of the initial baryonic mass ends up in a disc around a so formed black hole, and the mass of the latter. We investigate the prompt collapse threshold with a new set of general relativistic simulations covering seven mass ratios, and three equations of state. We propose a fitting formula for the dependence of the threshold mass on the mass ratio.

Presenter: KÖLSCH, Maximilian (TPI Jena)