Physik-Combo

Report of Contributions

https://indico.tpi.uni-jena.de/e/Combo-Spring2022

Contribution ID: **1** Type: **not specified**

Welcome

Tuesday, 29 March 2022 10:50 (10 minutes)

Presenter: GIES, Holger (TPI, FSU Jena)

Contribution ID: **2** Type: **not specified**

Energy conditions and quantum energy inequalities

Tuesday, 29 March 2022 11:00 (1 hour)

Presenter: FEWSTER, Chris

Contribution ID: **3** Type: **not specified**

Q&A

Tuesday, 29 March 2022 12:00 (15 minutes)

Contribution ID: **4** Type: **not specified**

Functional methods for cosmic large-scale structure formation

Tuesday, 29 March 2022 14:30 (1 hour)

Presenter: ERSCHFELD, Alaric

Contribution ID: **5** Type: **not specified**

Phase Transitions in a Yukawa-QCD Model

Tuesday, 29 March 2022 16:00 (30 minutes)

Despite the standard model's great success at describing
particle physics phenomenology at currently accessible energies it is not considered to provide a fundamental description of nature. One problem of the SM is the so-called hierarchy problem.

In our study we employ the functional renormalization group to gain insights on the phase transition in a Yukawa-QCD toy model. We study the parameter-dependence of the second order phase transition, with particular emphasis on the dependence of the separation of Fermi scale
and QCD scale.

Presenter: SCHMIEDEN, Richard

Contribution ID: **6** Type: **not specified**

Background Effective Action with Nonlinear Massive Gauge Fixing

Tuesday, 29 March 2022 16:30 (30 minutes)

Non-Abelian gauge theories constitute fundamental building blocks in the description of elementary particle interactions and exhibit by construction invariance under local gauge transformations.
Quantization entails a breaking of such symmetry, which is generally restored by imposing a constraint equation (e.g. Zinn-Justin equation), as well as a natural emergence of a global symmetry called BRST symmetry.
In our study, we employ the background field method to construct an action which preserves both gauge and BRST invariance manifestly. The construction features BRST invariant mass parameters for the gluon and ghost fields.
In our formalism, we compute the running coupling and examine the implications of such a construction in the form and behavior of the one-loop effective action.

Presenter: GKIATAS, Dimitrios

Contribution ID: **7** Type: **not specified**

Project talk

Contribution ID: **8** Type: **not specified**

Geometry of rotating discs in Einstein-Maxwell theory and the Ehrenfest paradox

Wednesday, 30 March 2022 09:00 (30 minutes)

In 1909 Ehrenfest formulated a famous paradox concerning a rigidly rotating disc (or cylinder originally) within special relativity. It caused a lot of debate and there is no general agreement on its solution. Directly related to the paradox is the question of spatial geometry of rotating discs.
In this talk, I will discuss the charged rotating disc of dust which is a concrete, physically relevant solution of the Einstein-Maxwell equations in terms of a post-Newtonian expansion.
Based on the solution, the spatial geometry of the disc will be examined and a comparison to a standard disc within special relativity (described by Grøn) will be drawn in the Newtonian limit. Furthermore, I will show that new, interesting effects appear near the ultra-relativistic limit and for non-vanishing charge.

Presenter: RUMLER, David

Contribution ID: **9** Type: **not specified**

Singularity theorems

Wednesday, 30 March 2022 09:30 (1 hour)

Presenter: FEWSTER, Chris

Contribution ID: **10** Type: **not specified**

Q&A

Wednesday, 30 March 2022 10:30 (15 minutes)

Contribution ID: **11** Type: **not specified**

Characteristic Hadamard states and semi-classical gravitational collapse

Wednesday, 30 March 2022 11:15 (30 minutes)

To study the influence of quantum fields on the formation of a black hole, we show how locally covariant renormalization schemes for the stress-energy tensor for linear scalar fields can be adapted to a characteristic (i.e. null-cone) treatment of the semi-classical Einstein equations. Key to this approach is understanding the singularities of Hadamard parametrices restricted to null-cones. We show that for conformally coupled fields on spherically symmetric space-times the renormalization freedom of this stress-energy tensor can be reduced by conditions on the required initial data. Furthermore, we show how this approach provides hints that due to local quantum effects during gravitational collapse the (averaged) null energy condition may be violated, potentially implying that formation of a trapped surface (i.e. apparent horizon) need not lead to the formation of a black hole singularity.

Presenter: JANSSEN, Daan

Contribution ID: **12** Type: **not specified**

Wedge-local observables in integrable models with bound states

Wednesday, 30 March 2022 11:45 (30 minutes)

Presenter: SHEDID, Karim

Contribution ID: **13** Type: **not specified**

Black hole spectroscopy and fundamental physics implications of gravitational wave ringdown observations

Wednesday, 30 March 2022 14:30 (1 hour)

Presenter: CARULLO, Gregorio

Contribution ID: **14** Type: **not specified**

GW190521: a dynamical capture of two black holes

Wednesday, 30 March 2022 16:00 (30 minutes)

Gravitational waves (GWs) represent a new channel to study the universe. They can lead to new –and at times unexpected– discoveries about the nature of compact objects, such as black holes and neutron stars. However, our ability to extract the source properties from GW data crucially depends on the waveform models we employ to perform the analysis.
In this talk I will discuss the exemplary case of GW190521, the gravitational wave transient observed by LIGO and Virgo on 21 May 2019, whose astrophysical interpretation is strongly dependent on the model employed. After going over the possible interpretations that have been advanced, I will show that the data supports the first gravitational-wave detection from the dynamical capture of two stellar-mass black holes. This hypothesis is preferred over the more conservative scenario of two black holes coalescing along quasi-circular orbits.

Presenter: GAMBA, Rossella

Contribution ID: **15** Type: **not specified**

Critical gravitational collapse with the code bamps

Wednesday, 30 March 2022 16:30 (30 minutes)

Critical phenomena emerges as we approach the threshold between gravitational collapse and dispersed fields. We study this phenomena associated to the gravitational field alone, in vacuum, by evolving gravitational waves. The axisymmetry of this setup allows us to verify critical phenomena beyond spherical symmetry. More importantly, widening the variety of initial data we can test the universality of these features. Our pseudo-spectral code bamps, with its new adaptive mesh refinement, has allowed us to tune six different one parameter families of initial data with the same resources that previously permitted us to tune one family. We present our results after evolving three prolate and three oblate, including two centred and four off-centred, families of Brill waves up to the threshold of critical collapse.

Presenter: CORS, Daniela

Contribution ID: **16** Type: **not specified**

Symmetry Breaking in Hydrodynamics and Holography

Thursday, 31 March 2022 09:00 (30 minutes)

Symmetries are abundant in physical theories but often broken by Nature. In this talk I will discuss symmetry breaking and how is it incorporated into hydrodynamics – an effective theory for the late time dynamics of conserved quantities. Such hydrodynamic frameworks may in turn be tested by the means of the holographic duality, the principles of which will be presented and some results shown.

Presenter: GRAY, Seán

Contribution ID: **17** Type: **not specified**

Large charge expansion

Thursday, 31 March 2022 09:30 (1 hour)

Presenter: REFFERT, Susanne

Contribution ID: **18** Type: **not specified**

Q&A

Thursday, 31 March 2022 10:30 (15 minutes)

Contribution ID: **19** Type: **not specified**

Chiral symmetry for a gauge theory with one adjoint fermion on the lattice

Thursday, 31 March 2022 11:15 (30 minutes)

In this talk, I will focus on how to implement chiral symmetry on the lattice through the overlap operator. We apply this approach to one flavour adjoint QCD to study whether an infra-red conformal behavior is observed or not. Our simulation shows that, quite deep in the infra-red regime, a natural length appears in terms of the chiral condensate, a strong numerical hint that the theory is not conformal, in contradiction to some previous results.

Presenter: SOLER, Ivan

Contribution ID: **20** Type: **not specified**

One-Particle entanglement for one dimensional spinless fermions after an interaction quantum quench

Thursday, 31 March 2022 11:45 (30 minutes)

Presenter: THAMM, Matthias

Contribution ID: **21** Type: **not specified**

New Evidence for Anyons: Collisions and Braiding

Thursday, 31 March 2022 14:30 (1 hour)

Fermions and bosons are fundamental realizations of quantum statistics, which governs both the symmetry of the wave function under the interchange of particle coordinates and the probability for two particles being close to each other spatially. Anyons in the fractional quantum Hall effect are an example for quantum statistics intermediate between bosons and fermions. Two recent experiments have provided evidence for such exotic anyonic statistics: the collision of anyons in a mesoscopic setup has demonstrated that anyons indeed have a reduced spatial exclusion as compared to fermions, and the symmetry of the quantum mechanical wave function for anyons has been measured directly by braiding anyons around each other in a Fabry-Perot interferometer. I will focus on the theoretical description of anyon collisions, which provides an interesting application of non-equilibrium bosonization.

Presenter: ROSENOW, Bernd