The 8th Conference of the Polish Society on Relativity

Report of Contributions

https://events.ncbj.gov.pl/e/152

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

Gravitational Wave Astronomy – Avant le De'luge

Monday, 19 September 2022 09:00 (60)

The era of gravitational-wave (GW) astronomy is now well under way, with nearly 100 compact binary coalescences (CBCs) confidently detected in the first three observing runs of LIGO and Virgo. With the fourth observing run of LIGO, Virgo and KAGRA starting in early 2023, it is timely to review what has been learned so far, both from the CBC events and from the absence of other types of GW detections, including continuous and stochastic radiation. Prospects for making such new discoveries soon will be discussed, along with the potential insights to be gained from the deluge of CBC events expected in the coming years and decades.

Presenter(s) : RILES, Keith (University of Michigan)

Track Classification : Astrophysics

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

Strong lensing of gravitational waves - new opportunity of multimessenger astronomy

Monday, 19 September 2022 10:00 (30)

We have entered the era of gravitational wave (GW) astronomy with routine detections of GW signals by LIGO-Virgo-KAGRA interferometric detectors. Future perspectives are bright with new generations of GW detectors: Earth based - Einstein Telescope and Cosmic Explorer or space borne - LISA, DECIGO, BBO. Gravitaional waves traveling along null geodesics can undergo strong gravitational lensing like the electromagnetic waves do. Hence, strong lensing of GW is becoming a popular research topic. In my talk I will review the state of the art in this subject, including contributions of our group. I will also present new opportunities opening for the multimessenger astronomy from detections of lensed GW signals.

Presenter(s) : BIESIADA, Marek (National Centre for Nuclear Research)

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

BLACK HOLES BINARIES FROM GLOBULAR CLUSTERS as sources of gravitational waves

Monday, 19 September 2022 11:00 (30)

We analyze about a thousand globular cluster (GC) models simulated using the MOCCA Monte Carlo code for star cluster evolution to study black hole - black hole interactions in these dense stellar sys- tems that can lead to gravitational wave emission. We extracted information for all coalescing binary black holes (BBHs) that merge via gravitational ra- diation from these GC models and for those BHs that collide due to 2-body, 3-body and 4-body dy- namical interactions. By obtaining results from a substantial number of realistic star clusters evolu- tion models, that cover different initial parameters (masses, metallicities, densities etc) we have an ex- tremely large statistical sample of two black holes which merge or collide within a Hubble time. We found that creation of an Intermediate Mass Black Hole (IMBH, defined as a BH with mass above 100 M) in a GC's center has large influence on merger and collision rates.

Presenter(s) : ROSINSKA, Dorota (OA, University of Warsaw)

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

Searching for gravitational-wave emission due to r-modes from the pulsar PSR J0537−6910 in LIGO O3 data.

Monday, 19 September 2022 11:30 (20)

I shall present results of the search for gravitational wave emission due to r-modes for the pulsar PSR J0537-6910 using data from the LIGO and Virgo ground based detectors in the O3 observing run. PSR J0537-6910 is a young X-ray pulsar and is currently the most frequent glitcher known. Its inter-glitch braking index suggests that gravitational wave emission due to r-modes may play an important role in the spindown of this pulsar. The times of the glitches during the O3 run were known from the timing ephemeris obtained from the NICER mission data. We searched for gravitational wave signals due to r-modes in the epochs between glitches. We do not detect any signals in the theoretically allowed band of 86-97 Hz, and report upper limits on the amplitude of the gravitational waves. Our upper limits place stringent constraints on theoretical models for r-mode driven spin-down in PSR J0537−6910.

Presenter(s) : DOROSH, Orest (NCBJ)

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

Gravitational waves on Riemann-Cartan geometries

Monday, 19 September 2022 11:50 (20)

We offer a mathematical toolkit for the study of waves propagating on a background manifold with nonvanishing torsion. As an example, we briefly analyze the amplitude propagation of gravitational waves in an Einstein-Cartan-Sciamma-Kibble (ECSK) assuming a dark matter spin tensor sourcing for spacetime torsion at cosmological scales and assess whether a future detection by LISA is possible.

Presenter(s) : IZAURIETA, Fernando (Department of Physics, University of Concepcion)

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

Searches for Gravitational Waves from Known Pulsars at Two Harmonics in the Second and Third LIGO-Virgo Observing Runs

Monday, 19 September 2022 12:10 (20)

I shall present the results of the recent LIGO-Virgo-KAGRA paper on the targeted search from 236 pulsars. When the angular momentum of the pulsar is not perfectly aligned with its symmetry axis, the gravitational wave (GW) signal can originate at both once and twice the spin frequency of the pulsar due to the time-varying quadrupole moment. There has also been a quest to search for the dipole radiation at once the spin frequency predicted by Brans- Dicke (BD) theory. The methods implemented to search for the signals are Bayesian analysis, 5n-vector method and F/G/D-statistics.

Presenter(s) : VERMA, Paritosh (NCBJ)

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

Effective banks of templates in detection of almost monochromatic gravitational waves

Monday, 19 September 2022 14:00 (20)

Problem of finding effective banks of templates is very important in match filtering method used in detection of almost monochromatic gravitational waves coming from single rotating neutron stars located in our Galaxy. Construction of effective banks of templates requires finding optimal grid coverings in the space spanned by unknown parameters of the gravitational-wave signal we are looking for. Such coverings can be generated by the software ''Grids Generator" devised by me. In my talk, I will show some results produced by this software and explain in more detail one of the algorithms used to generate effective grid coverings.

Presenter(s) : PISARSKI, Andrzej (University of Bialystok)

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

Lensing of gravitational waves in Palatini f(R) gravity

Monday, 19 September 2022 14:20 (20)

Presenter(s) : HARIKUMAR, Sreekanth (NCBJ)

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

Canonical structure of f(T) and f(Q) gravity

Monday, 19 September 2022 14:40 (30)

Presenter(s) : GUZMAN, Maria Jose (University of Tartu)

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

Cosmography in f(Q) gravity

Presenter(s) : MANDAL, Sanjay (BITS-Pilani, Hyderabad Campus)

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

Effective equation of state in modified gravity and observational constraints

Presenter(s) : ARORA, Simran (Birla Institute of Technology and Science-Pilani, Hyderabad Campus)

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

The most massive galaxy clusters

Monday, 19 September 2022 16:10 (20)

Extreme bound objects are important probes of the large-scale Universe. The abundance and certain parameters of the most massive (super-) clusters of galaxies put constraints on the cosmological parameters and the background evolution. In my talk I will present two approaches, one [1] based on the exact solution to Einstein's equations and a complementary one [2], based on the relativistic, Lagrangian perturbation theory. Both allow to derive an observationally-verifiable predictions regarding the biggest, gravitationally bounded structures. Comparison with observations will be summarized and put into perspective.

References

[1] Bolejko K., Ostrowski J. J., The environment-dependence of the growth of the most massive objects in the Universe, Phys. Rev. D 99, 124036 (2019) [arXiv:1805.11047]

[2] Ostrowski J.J., Delgado Gaspar I., On the maximum volume of collapsing structures, JCAP, 4, 59 (2022) [arXiv:2112.05245]

Presenter(s) : OSTROWSKI, Jan (NCBJ)

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

Newtonian regime and topology: consequence for the role of spatial curvature in cosmology

Monday, 19 September 2022 16:30 (20)

The standard model of cosmology currently allows for three types of geometries (or topologies) for our Universe (Euclidean, spherical or hyperbolic), each of these types corresponding to a set of different (multiconnected)-topologies. Among these geometries, Newton's theory of gravity is only defined on the Euclidean one. Still, extending the validity of this theory to the other two cases (called a non-Euclidean Newtonian theory), with the aim that this should constitute the limit of a relativistic theory of gravity, could provide a strong theoretical tool to probe large scale effects of global topology. We will see that Einstein's equation is actually incompatible with such a theory. Therefore this equation must be modified in the hypothesis where we require the relativistic theory describing our Universe to be compatible with the presence of a Newtonian regime in any topology. I will present such a modification which is based on Rosen's bi-metric theory. Its main consequence is that the expansion law of a homogeneous and isotropic solution no longer features the spatial curvature (i.e. $\Omega = 1,\ \forall \Omega_k$), asking for a reevaluation of that curvature from cosmological data.

Presenter(s) : VIGNERON, Quentin (Copernicus University, Torun)

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

A new generic and structurally stable cosmological model without singularity

Monday, 19 September 2022 16:50 (20)

Dynamical systems methods are used to investigate a cosmological model with non-minimally coupled scalar field and asymptotically quadratic potential function. We found that for values of the non-minimal coupling constant parameter $\frac{3}{16} < \xi < \frac{1}{4}$ there exists an unstable asymptotic de Sitter state giving rise to non-singular beginning of universe. The energy density associated with this state depends on value of the non-minimal coupling constant and can be much smaller than the Planck energy density. For $\xi = \frac{1}{4}$ we found that the initial state is in form of the static Einstein universe. Proposed evolutional model, contrary to the seminal Starobinsky's model, do not depend on the specific choice of initial conditions in phase space, moreover, a small change in the model parameters do not change the evolution thus the model is generic and structurally stable. The values of the non-minimal coupling constant can indicate for a new fundamental symmetry in the gravitational theory. We show that Jordan frame and Einstein frame formulation of the theory are physically nonequivalent.

Presenter(s) : HRYCYNA, Orest (NCBJ)

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

Matter bounce and dynamical aspects in nonmetricity gravity

Monday, 19 September 2022 15:10 (30)

In the context of the late time cosmic acceleration phenomenon, many geometrically modified theories of gravity have been proposed in recent times. In this paper, we have investigated the role of a recently proposed extension of symmetric teleparallel gravity dubbed as $f(Q,T)$ gravity in getting viable cosmological models, where Q and T respectively denote the non-metricity and the trace of energy momentum tensor. We stress upon the mathematical simplification of the formalism in the $f(Q,T)$ gravity and derived the dynamical parameters in more general form in terms of the Hubble parameter. We considered two different cosmological models mimicking non-singular matter bounce scenario. Since energy conditions play a vital role in providing bouncing scenario, we have analyzed different possible energy conditions to show that strong energy condition and null energy condition be violated in this theory. The models considered in the work are validated through certain cosmographic tests and stability analysis.

Presenter(s) : MISHRA, Bivudutta (BITS-Pilani, Hyderabad Campus)

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

The general relativistic two-body problem at 5PN

Tuesday, 20 September 2022 10:00 (60)

The talk will deliver insight into the general relativistic conservative binary dynamics through the fifth post-Newonian (5PN) order. Through the 4PN order, the well established methods and results get summarized. At the 5PN order, a recently completed computation is presented including comparisons with the literature. Partial results through the 6PN order get reported.

Presenter(s) : SCHAEFER, Gerhard (Friedrich Schiller University Jena, Institute of Theoretical Physics)

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

Recovery schemes in numerical GR MHD simulation of the post-merger system with a composition-dependent equation of state

Tuesday, 20 September 2022 14:00 (30)

The code HARM_COOL, a conservative scheme for relativistic magnetohydrodynamics, is being developed in our group and works with a tabulated equation of state of dense matter. This EOS can be chosen and used during dynamical simulation, instead of the simple ideal gas one. In this case, the inversion scheme between the conserved and primitive variables is not a trivial task. In principle, the code needs to solve numerically five coupled non-linear equations at every time-step. The 5-D recovery schemes were originally implemented in HARM and worked accurately for a simple polytropic EOS which has an analytic form. Our current simulations support the composition-dependent EOS, formulated in terms of rest-mass density, temperature and electron fraction. I will discuss and compare several recovery schemes that have been included in our code. I will present and discuss their convergence tests. I will also show some preliminary results of a numerical simulation, addressed to the post-merger system formed after the coalescence of binary neutron stars.

Presenter(s) : JANIUK, Agnieszka (Center for Theoretical Physics PAS)

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

CANCELLED! New perspectives onto the Universe in the era of multi-messenger astronomy

Tuesday, 20 September 2022 09:00 (60)

Presenter(s) : NISSANKE, Samaya

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

Event Horizon Telescope Imaging of Sagittarius A* and M87 black holes in unpolarized and polarized light

Tuesday, 20 September 2022 11:30 (60)

I will talk about images of black holes in Saggittarius A* and M87 obtained with the Event Horizon Telescope. Both images have a ring-like morphologies consisstent with predictions of magneto-hydrodynamical simulations of gas dynamics in Kerr metric. EHT results provide new window for future tests of gravitational physics and unique way to observe physics of accretion and jet formation around supermassive black holes.

Presenter(s) : MOSCIBRODZKA, Monika (Radboud University)

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

Studying Post-merger Outflows from Magnetized Neutrino-cooled Accretion Disk Simulations

Tuesday, 20 September 2022 14:30 (20)

Neutrino-cooled accretion flow around a spinning black hole, produced by a compact binary merger is a promising scenario for jet formation and launching magnetically and neutrino-driven outflows. Based on GW170817 gravitational wave detection by LIGO and Virgo observatories followed by electromagnetic counterparts, this model can explain the central engine of the short duration gamma ray bursts (GRB) and kilonova radiations. Using the open-source GRMHD HARM_COOL code, we evolved several 2D magnetized accretion disk-black hole models with realistic equation of state in the fixed curved space-time background. The disk and black hole's initial parameters are chosen in a way to represent different possible post-merger scenarios of the merging compact objects. Our simulations show a strong correlation between black hole's spin and ejected mass. Generally, mergers producing massive disks and rapidly spinning black holes launch more wind outflows. We applied particle tracer technique to measure the properties of the outflows, and Skynet r-process nucleosynthesis code to measure the abundances for the ejected matter. We observed our models generate winds with moderate velocity (v/c ~ 0.1-2.0), and broad range of electron fraction. We use these results to estimate the luminosity and light curves of possible radioactively powered transients emitted by such systems. We found the luminosity peaks within the range of 10^40-10^41 erg/s which agrees with previous studies for disk wind outflows.

Presenter(s) : HOSSEIN-NOURI , Fatemeh (CFT PAN)

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

Observational properties of bosonic stars at the galactic centre

Tuesday, 20 September 2022 14:50 (20)

Pushed by a number of advances, electromagnetic observatories have now reached the horizon scale of supermassive black holes. The existence and properties of horizons in our universe is one of the outstanding fundamental issues that can now be addressed. Here we investigate the ability to discriminate between black holes and compact, horizonless objects, focusing on the lensing of hot spots and accretion disks around compact objects. We work in particular with boson and Proca stars as central objects, and show that the absence of a horizon gives rise to a characteristic feature – photons that plough through the central object and produce an extra image. This feature should be universal for central objects made of matter weakly coupled to the standard model.

Presenter(s) : ROSA, João (University of Tartu)

Contribution ID : **22** Type : **not specified**

Stiffness, complexity, cracking and stability of relativistic compacts stars

Tuesday, 20 September 2022 15:10 (20)

Current multi-messenger approach has made it possible to get a much more precise estimation of stellar observables like mass M and radius R of a neutron star which consequently can help us constrain the neutron star equation of state (EOS) like never before. Theoretical stellar models are being refined accordingly. Using Chandrasekhar's variational method, we examine the dynamical stability of a recently proposed modified Tolman VII solution that can accommodate a more realistic neutron star EOS consistent with observational data. We note that the critical value of compactness (M/R) at which instability develops within the configuration decreases with the stiffness increase of the assumed EOS. The critical bound remains below the Buchdahl bound throughout. We further invoke the concepts of 'cracking' and 'complexity' in the stability analysis of an anisotropic stellar configuration. We show that for a static, spherically symmetric, anisotropic distribution of matter with radially decreasing energy density possessing zero 'complexity', the tangential pressure must be greater than the radial pressure at all interior points of a potentially stable stellar configuration.

Presenter(s) : SHARMA, Ranjan (Cooch Behar Panchanan Barma University)

Contribution ID : **23** Type : **not specified**

Optical distance measures in general relativity

Tuesday, 20 September 2022 16:00 (30)

I will discuss the relation between the angular diameter distance and parallax distance in general relativity. This relation involves the curvature tensor along the line of sight and the difference between distance measures can be used to measure the matter content along the line of sight. Moreover, it is also possible to prove that the parallax distance must be not smaller than the angular diameter distance if the null energy condition holds. I will discuss possible astrophysical and cosmological application of these results.

Presenter(s) : KORZYŃSKI , Mikołaj (CFT PAN)

Contribution ID : **24** Type : **not specified**

Early evolution of fully convective stars in scalar-tensor gravity

Tuesday, 20 September 2022 16:30 (20)

Presenter(s) : AGUIAR GOMES , Dèbora

Contribution ID : **25** Type : **not specified**

Jet structure and variability studies of GRBs with 3D GRMHD simulations of magnetically arrested disks

Tuesday, 20 September 2022 16:50 (20)

We study the structure and temporal variabilty properties of the GRB jets considering a magnetically arrested disk as their central engine. We numerically evolve the accretion disk around a Kerr black hole using 3D general relativistic magnetohydrodynamic simulations. We consider two analytical equillibrium disk configurations, the Fishbone-Moncrief and Chakrabarti solutions, as the initial conditions and impose poloidal magnetic fields upon them. The disk starts accreting due to the development of the magnetorotational instability and eventually develops to a magnetically arrested accretion disk state. We consider these models as central engines of short and long-GRBs, based on our initial conditions, and investigate the properties of the jets launched from these models. Our models self-consistently produce structured jets with a hollow core up to ~ 5 degrees. The jets from our simulations have an opening angle up to ~ 11 degrees for the long-GRB model and up to ~ 25 degrees for the short-GRB model. We also do the time variabilty studies of the jets and provide an estimate of their minimum variabilty timescales. Our models can be applied to the GRB jets in the binary neutron star post-merger system or to the ultra-relativistic jets launched from collapsing stars.

Presenter(s) : JAMES, Bestin (Center for Theoretical Physics PAS)

Contribution ID : **26** Type : **not specified**

Stability of differentially rotating compact objects against a prompt collapse

Tuesday, 20 September 2022 17:10 (20)

Numerical simulations have been an important method for studying complex astrophysical scenarios, such as supernova explosions, showing that the remnant of core-collapse supernova rotates differentially at the initial phase of evolution. For neutron stars, differential rotation allows for significantly larger masses than rigid rotation. In our work, we study the stability of those objects and look for the most massive stable neutron stars that can be produced in core-collapse supernova. I will present the results of our studies. For a polytropic equation of state, we have estimated the limit of stability against radial oscillations for a selected sample of configurations. We considered a wide range of parameters and found stable configurations even twice as massive as the most massive non-rotating configuration.

Presenter(s) : SZEWCZYK, Paweł (University of Warsaw, Astronomical Observatory)

Contribution ID : **27** Type : **not specified**

POTOR meeting

Wednesday, 21 September 2022 17:30 (120)

Contribution ID : **28** Type : **not specified**

Coadjoint representation of the BMS group

Wednesday, 21 September 2022 09:00 (60)

The coadjoint representation of the BMS group is worked out from purely group theoretic considerations. It is then identified in the non-radiative gravitational data at null infinity.

Presenter(s) : BARNICH, Glenn (Université libre de Bruxelles)

Contribution ID : **29** Type : **not specified**

Conformal geodesics can not spiral

Wednesday, 21 September 2022 10:00 (30)

We show that conformal geodesics on a Riemannian manifold cannot spiral: there does not exist a conformal geodesic which becomes trapped in every neighbourhood of a point. This settles an outstanding open problem in General Relativity posed by Friedrich. This is joint work with Peter Cameron and Paul Tod.

Presenter(s) : DUNAJSKI, Maciej (University of Cambridge)

Contribution ID : **30** Type : **not specified**

The Einstein equations at space-like infinity

The Bondi-Sachs coordinates are extremely useful in a description of asymptotically flat metrics in the null infinity. They allow to reduce the number of the Einstein equations. The remaining equations can be solved recursively if metric can be expanded into a power series in the inverse of the radial distance r. In the case of the spatial infinity the commonly used coordinates are the Gauss coordinates related to a space-like hypersurface. They allow to write the constraint equations in a convenient way but their solving remains a nontrivial task. In this work we propose another system of coordinates which are more similar to the Bondi-Sachs coordinates concerning reduction of the Einstein equations and expansions in 1/r.

Presenter(s) : TAFEL, Jacek (University of Warsaw)

Contribution ID : **31** Type : **not specified**

Hyperheavenly spaces and their application in para-Kähler geometries

Wednesday, 21 September 2022 11:30 (20)

The talk is devoted to the neutral 4-dimensional spaces. As a basic structure we consider weak, expanding hyperheavenly space, i.e., a space equipped with (at least one) integrable, totally null, 2-dimensional distribution which is not parallely propagated. It is assumed that this distribution is self-dual (SD). If a space is additionally equipped with two anti-self-dual (ASD), parallely propagated distributions, it becomes para-Kähler space. The metric of such a space is analyzed. Some new examples of para-Kähler and Einstein metrics are presented.

Presenter(s) : CHUDECKI, Adam (Center of Mathematics and Physics, Lodz University of Technology)

Contribution ID : **32** Type : **not specified**

Revisiting timelike geodesics in the Schwarzschild spacetime: general expressions in terms of Weierstrass elliptic functions

Wednesday, 21 September 2022 11:50 (20)

The theory of Schwarzschild timelike geodesics is revisited. Based on Weierstrass and Biermann's result, a formula describing all non radial, timelike trajectories in terms of Weierstrass elliptic functions is derived. A single formula works for an entire geodesic trajectory, even if it passes through turning points. Additionally, with this formula's help, expressions for the proper and coordinate time along the geodesic are derived.

Presenter(s) : CIEŚLIK, Adam (Jagiellonian University)

Contribution ID : **33** Type : **not specified**

Evolving black hole with scalar field accretion

Wednesday, 21 September 2022 12:10 (20)

I will present recent results on evolving black holes in general relativity. Approximate analytical solutions are obtained by expanding the Einstein field equations close to the trapping horizon for a dynamical spherically symmetric black hole in the presence of a minimally coupled self-interacting scalar field. This is made possible by a new parametrization of the metric, in which the displacement from the horizon as well as its expansion rate feature explicitly. Our results are valid in a neighbourhood of the horizon and hold for any scalar field potential and spacetime asymptotics. An exact equation for the accretion rate is also obtained, which generalizes the standard Bondi formula. We also develop a dynamical system approach to study near-equilibrium black holes; using this formalism, we focus on a simple model to show that the near-equilibrium dynamics is characterized by simple scaling relations among dynamical variables. Moreover, we show that solutions with purely ingoing energy-momentum flux never reach equilibrium. [based on arXiv:2205.01712]

Presenter(s) : DE CESARE , Marco (University of Naples ”Federico II”)

Contribution ID : **34** Type : **not specified**

Quasinormal modes of extremal black holes

Wednesday, 21 September 2022 11:00 (30)

In this short talk I will discuss the explicitly-solvable toy-model for the problem of waves propagating outside of an extremal black hole. After showing some results regarding quasinormal modes in such setup I will move to the more complicated case of an extremal Reissner-Nordström-anti-de Sitter black hole. This is a joint work with Claude Warnick.

Presenter(s) : FICEK, Filip (Jagiellonian University)

Contribution ID : **35** Type : **not specified**

Resonant enlargements of the Poincaré/AdS (super)algebras

Wednesday, 21 September 2022 14:00 (20)

Using an efficient pattern-based computational method of generating the so-called 'resonating' algebraic structures results in a wide class of the new Lie (super)algebras. They are enlargements of the Poincaré and Anti-de-Sitter (super)algebras, which inherit their base (anti)commutation structure. Obtained superalgebras are rooted in the semigroup expansion method and Maxwell and Soroka-Soroka algebras, spanned by the Lorentz generator J_ab, translations P_a and additional Lorentz-like generator Z_{ab}. Considered configurations include cases up to two fermionic supercharges Q^I_{alpha} and offer interesting modifications to the gauge (super)gravity theories. Presentation is based on arxiv:2108.10304 and arxiv:2205.05921.

Presenter(s) : DURKA, Remigiusz (Institute of Theoretical Physics, University of Wroclaw)

Contribution ID : **36** Type : **not specified**

Critical relaxation in AdS/CFT

Wednesday, 21 September 2022 14:20 (20)

It is not only known that hairy black holes can exist in asymptotically Anti-de Sitter (AdS) spaces, but also that in the context of the Anti-de Sitter/Conformal Field Theory (AdS/CFT) correspondence, such black holes can be interpreted as holographic duals of superfluids. After a perturbation, these black holes usually exhibit an exponentially damped ringing down described by quasi-normal modes, however, I will show that for perturbations around the exact critical point that characterizes the onset of the formation of scalar hair this relaxation will exhibit a power law behaviour at late times. I will also explain how this can be interpreted through the lens of the AdS/CFT correspondence.

Presenter(s) : FLORY, Mario (Jagiellonian University Krakow)

Contribution ID : **37** Type : **not specified**

Equatorial accretion on the Kerr black hole

Wednesday, 21 September 2022 14:40 (20)

We investigate stationary accretion of the collisionless Vlasov gas onto the Kerr black hole, occurring in the equatorial plane. At infinity the gas obeys the Maxwell-Juttner distribution, restricted to the equatorial plane. In the vicinity of the black hole, the motion of the gas is governed by the spacetime geometry. We compute accretion rates of the rest-mass, the energy, and the angular momentum, as well as the particle number surface density, focusing on the dependence of these quantities on the asymptotic temperature of the gas and the black hole spin. The accretion slows down the rotation of the black hole.

Presenter(s) : ODRZYWOLEK, Andrzej (IFT UJ)

Contribution ID : **38** Type : **not specified**

Spherical and Non-spherical collapse of a finite two-layer body

Wednesday, 21 September 2022 15:00 (20)

We study the simplest possible analytical model for spherical collapse that involves density variations, that of a homogeneous core surrounded by a different homogeneous layer, where both are joined using the Darmois matching conditions. The aim is to obtain an analytical expression for whether or not a naked singularity forms, in terms of both mass densities. Although there have been several investigations during the last decade about inhomogeneous collapse models (e.g. Joshi, Bicak), the reason that here we pursue the simplest possible Spherical Model is so that we can then proceed to apply it to Non-spherical collapse by using the Price-Cunningham-Moncrief (1980) slow-rotation framework. This should provide a first indication of how inhomogeneity may lead to the formation of something different to the Kerr Black Hole during a rotating collapse.

Presenter(s) : SARNOBAT, Prakash (East Surrey Gravity Research)

Contribution ID : **39** Type : **not specified**

Existence of potential for linearized Weyl tensor as a generalized Poincare lemma

Wednesday, 21 September 2022 15:20 (20)

Linearized gravity could be treated as a linear theory of a field having symmetries of the Weyl tensor (spin-2 field). To obtain linearized gravity equations in this formulation from a variational formula, it is necessary to have a guarantee of the existence of potential for every spin-2 field. This problem is known as an existence of Lanczos potential, which has been fully solved by F. Bampi and G. Caviglia in 1983. I will show that behind this problem lies the elegant mathematical structure of the N-complex of traceless tensor fields of given Young symmetry (which is a generalization of the de Rham complex of differential forms). The main result presented in the talk will be the fact that existence of potential for spin-2 field is a strict consequence of the generalized Poincare lemma for some N-complex of tensor fields, analogically to classical electrodynamics.

Presenter(s) : WIATR, Marian (University of Warsaw, Faculty of Physics)

Contribution ID : **40** Type : **not specified**

Halilsoy spacetime

Wednesday, 21 September 2022 16:10 (20)

The Halilsoy solution corresponds to cross-polarized standing gravitational waves in cylindrical symmetry. In my talk, I will present recent results on the structure of this spacetime and particles' orbits.

Presenter(s) : SZYBKA, Sebastian (Jagiellonian University)

Contribution ID : **41** Type : **not specified**

Scalarization in Einsteinian Cubic Gravity with General Relativity as a cosmic attractor

Wednesday, 21 September 2022 16:30 (20)

We address the issue of black hole scalarization and its compatibility with cosmic inflation and big bang cosmology from an effective field theory (EFT) point of view. In practice, using a well-defined and healthy toy model which (in part) has been broadly considered in the literature, we consider how higher-order theories of gravity, up to cubic operators in Riemann curvature, fit within this context. Interestingly enough, we find that already at this minimal level, there is a non-trivial interplay between the Wilson coefficients which are otherwise completely independent, constraining the parameter space where scalarization may actually occur. Conclusively, we claim that the EFT does exhibit black hole scalarization, remaining compatible with the inflationary paradigm, and admitting General Relativity as a cosmological attractor.

Presenter(s) : ERICES, Cristian (Universidad Central de Chile)

Contribution ID : **42** Type : **not specified**

Matter fields in loop quantum gravity

Thursday, 22 September 2022 09:40 (20)

The talk concerns the current status of matter fields in the framework of loop quantum gravity, with an emphasis on the recent developments. The presentation will particularly focus on the r-Fock representations and their relation to the standard loop representations, in light of the recent generalization of the construction of r-Fock measures to SU(N) gauge theories, and how one could try bridging the gap between quantum field theory on Minkowski spacetime and the background independent framework of loop quantum gravity.

Presenter(s) : ASSANIOUSSI, Mehdi (Faculty of Physics, University of Warsaw)

Contribution ID : **43** Type : **not specified**

Fermion coupling in Loop Quantum gravity

Thursday, 22 September 2022 10:00 (20)

In the model of a fermion field coupled to loop quantum gravity, we consider the Gauss and the Hamiltonian constraints. According to the explicit solutions to the Gauss constraint, the fermion spins and the gravitational spin networks intertwine with each other so that the fermion spins contribute to the volume of the spin network vertices. For the Hamiltonian constraint, the regularization and quantization procedures are presented in detail. By introducing an adapted vertex Hilbert space to remove the regulator, we propose a diffeomorphism covariant graph-changing Hamiltonian constraint operator of the fermion field. This operator shows how fermions move in the loop quantum gravity spacetime and simultaneously influences the background quantum geometry. Moreover, as an innovation of our work, introducing the vertex Hilbert space also fixes issues so that a densely defined symmetric Hamiltonian constraint operator can be obtained. (Jerzy Lewandowski, Cong Zhang, arXiv:2112.08865)

Presenter(s) : ZHANG, Cong (University of Warsaw)

Contribution ID : **44** Type : **not specified**

Scalar curvature operator for loop quantum gravity on a cubical graph

Thursday, 22 September 2022 10:20 (20)

We introduce a new operator representing the three-dimensional scalar curvature in loop quantum gravity. The classical starting point of our construction is to express the Ricci scalar directly as a function of the Ashtekar variables. The construction does not apply to the entire Hilbert space of loop quantum gravity; instead, the operator is defined on the Hilbert space of a fixed cubical graph. As such, the operator is relevant to approaches such as algebraic quantum gravity, quantum-reduced loop gravity and models of effective dynamics. (Jerzy Lewandowski, Ilkka Mäkinen, arXiv:2110.10667)

Presenter(s) : MAKINEN, Ilkka (University of Warsaw)

Contribution ID : **45** Type : **not specified**

Examining Quasinormal Mode Instability with the Pseudospectrum

Thursday, 22 September 2022 09:00 (20)

Quasinormal modes (QNMs) are the exponentially damped, oscillatory solutions to linearized wave equations that appear in a variety of physical contexts. Most notably, the gravitational waves emitted during the ringdown phase of the merger of two compact objects, such as neutron stars or black holes, are characterized by QNMs. The frequencies of the QNMs encode information about the relic object such as mass and spin, and – in the most energetic cases – are sensitive to higher-curvature corrections to general relativity. The stability of a QNM depends on how its frequency changes in response to perturbations; the pseudospectrum allows us to examine the stability of all the QNMs to a specific perturbation of the background. In this talk, I will review how the pseudospectrum is used to examine the stability of the QNMs of Schwarzschild and Kerr black holes. I will then discuss how these methods can be applied to the stability of QNMs for classical soliton solutions.

Presenter(s) : COWNDEN, Brad (Jagiellonian University)

Contribution ID : **46** Type : **not specified**

Electromagnetic and Gravitational Hopfion-like solutions in de Sitter spacetime

Thursday, 22 September 2022 09:20 (20)

Hopfions are a family of 'solitonary' field solutions which have non-trivial topological structure associated with Hopf fibration. I will present a generalisation of such solutions, based on conformal transformations, to de Sitter spacetime. Two physical applications of Hopfion-like solutions: electromagnetism and linear gravitation will be discussed.

Presenter(s) : SMÓŁKA, Tomasz (University of Warsaw/AEI Max Planck)

Contribution ID : **47** Type : **not specified**

Generalized Uncertainty Principle and Nonextensive Entropies

Thursday, 22 September 2022 11:10 (20)

I will discuss the extensions of Heisenberg Uncertainty Principle onto the gravitational interaction both in small (generalized) and large (extended) scales. Then I will review our results related to the GUP in various nonextensive thermodynamics of black hole and cosmological horizons.

Presenter(s) : DĄBROWSKI, Mariusz P. (University of Szczecin)

Contribution ID : **48** Type : **not specified**

Non-extensive Thermodynamics of Black Holes

Thursday, 22 September 2022 11:30 (20)

Hawking temperature has been widely utilized in the literature as the temperature corresponding to various nonextensive entropies. In this talk, I will talk about the compatibility of Hawking temperature with the nonextensive entropies and demonstrate that, for every nonextensive entropy, one may define an effective temperature by utilizing the equilibrium condition, and that there is always an additive equilibrium entropy associated with this effective temperature.

Presenter(s) : GOHAR, Hussain

Contribution ID : **49** Type : **not specified**

3d gravity, point particles and deformed symmetries

Thursday, 22 September 2022 11:50 (20)

t is well known that gravity in 2+1 dimensions can be recast as the Chern-Simons theory, with the gauge group given by the local isometry group, depending on the metric signature and the cosmological constant. Point particles are added into spacetime as (spinning) conical defects. Then, in principle, one may integrate out the gravitational degrees of freedom to obtain the effective particle action; the most interesting consequence is that the momentum space of a particle turns out to be curved. This is still not completely understood in the case of non-zero cosmological constant. Meanwhile, quantisation of the theory consists in the Hopf-algebraic deformation of the Poisson structure, which is determined by a given classical r-matrix associated with the gauge algebra. All such possible r-matrices have recently been classified. One of the remaining open questions is whether the widely-studied kappa-Poincare algebra (associated with noncommutative kappa-Minkowski space) actually plays a physical role here.

Presenter(s) : TRZEŚNIEWSKI, Tomasz (University of Wroclaw)

Contribution ID : **50** Type : **not specified**

Mixmaster universe: semiclassical dynamics and inflation from bouncing

Thursday, 22 September 2022 12:10 (20)

In this work we explore the quantum Bianchi type IX-model, its semi-classical features, and its relevance in early cosmology to tentatively explain inflation and production of primordial structures. We specially focus on the analytical and numerical exploration of the dynamical system derived from the phase-space portraits. Afterwards we investigate the reliability of our results with regard to inflation and post inflation scenarii commonly accepted nowadays.

Presenter(s) : DE CABO MARTÍN , Jaime (NCBJ)

Contribution ID : **51** Type : **not specified**

Universality and scaling in the collapse of spherical scalar fields in semiclassical loop quantum gravity

Thursday, 22 September 2022 15:50 (60)

We explore the phenomena first described by Choptuik of universality and scaling in the collapse of minimally coupled spherically symmetric scalar fields with the effective semiclassical equations of loop quantum gravity. Contrary to expectations and some previous analyses, we find universality and scaling like those seen in classical general relativity.

Presenter(s) : PULLIN, Jorge

Contribution ID : **52** Type : **not specified**

Quantum dynamics of relativistic systems

Thursday, 22 September 2022 15:00 (20)

The appearance of Hamiltonian constraint in the canonical formalism for general relativity reflects the lack of any preferred notion of time. The dynamics of general relativistic systems can be equivalently expressed with respect to various internal degrees of freedom. However, quantization of general relativistic systems breaks down the diffeomorphism invariance and different time variables generally yield inequivalent quantum dynamics. We investigate the sense in which these inequivalent quantum dynamics could be reconciled. Our result is illustrated with the dynamics of gravitational waves in a quantised universe.

Presenter(s) : MAŁKIEWICZ, Przemysław (NCBJ)

Contribution ID : **53** Type : **not specified**

Quantum Hubble horizon

The talk addresses the possibility of obtaining cosmologically relevant effects from the quantum nature of the Hubble horizon. We show that the Planck scale discreteness of the Hubble horizon naturally leads to a mechanism of condensation in the very early Universe. We argue that this provides a possible resolution of the problem of the initial homogeneity at the onset of inflation. Furthermore, we present an analysis in terms of entropy of the quantum Hubble horizon and show that the ΛCDM model may arise from a linearly corrected Bekenstein-Hawking entropy. Based on this, we justify that the current accelerating expansion can be associated with the entropy decrease in the Hubble volume. The results open new ways to explore the relationship between the Planck scale effects and observationally relevant features of our Universe.

Presenter(s) : MIELCZAREK, Jakub (Jagiellonian University)

Contribution ID : **54** Type : **not specified**

Quantum chaos of the Belinski-Khalatnikov-Lifshitz scenario

Thursday, 22 September 2022 14:00 (20)

We quantize the solution to the Belinski-Khalatnikov-Lifshitz scenario using the affine coherent states quantization method. Quantization smears the gravitational singularity avoiding its localization in the configuration space. Classical chaotic behavior of the BKL scenario becomes enhanced at the quantum level. Our results strongly suggest that the generic singularity of general relativity can be avoided at quantum level.

Presenter(s) : PIECHOCKI, Włodzimierz (NCBJ)

Contribution ID : **55** Type : **not specified**

Integral quantization and quantum time

Thursday, 22 September 2022 14:20 (20)

Quantization of classical models is a non-unique and heuristic procedure. A set of different, in fact non-equivalent approaches is known. In the talk some principles of the integral quantization method is presented. The simplest integral quantization procedure is based on decomposition of unity in the Hilbert state space. More sophisticated way of thinking in this direction is related to the so called Quantum Motion Algebras. One of the unique property of the integral quantization is a possibility to treat physical time on the same footing as the space coordinates. This allows for construction of the covariant quantum spacetime position observable. In this case, instead of the unitary time evolution, other operators, usually projection or POVM operators which map the space of initial states into the space of final states at each step of the evolution can be used. The quantum evolution itself is a stochastic process. This allows to treat time as a quantum observable in a~consistent, observer independent way, which is a very important and required feature to resolve some quantum paradoxes and the time problem in cosmology. Changing ‘’parameter time” into ‘’quantum observable time” seems to be a good step to combine relativity and quantum mechanics.

Presenter(s) : GÓŹDŹ, Andrzej (Institute of Physics UMCS)

Contribution ID : **56** Type : **not specified**

Ascribing quantum system to Schwarzschild spacetime

Thursday, 22 September 2022 14:40 (20)

I will present the quantization the Schwarzschild black hole using the affine coherent states quantization method. The novelty of the approach is quantization of both temporal and spatial coordinates. Quantization smears the gravitational singularity indicated by the Kretschmann invariant avoiding its localization in the configuration space. This way we resolve, to some extent, the singularity problem of considered black hole. The approach relies on using only the metric tensor so that it can be applied to other black holes with the metrics satisfying Einstein's equation.

Presenter(s) : PĘDRAK, Aleksandra (NCBJ)

Contribution ID : **57** Type : **not specified**

κ-deformed complex fields, (discrete) symmetries, and charges

Friday, 23 September 2022 09:00 (20)

It is commonly expected that the usual description of spacetime as a smooth manifold is no longer reliable as we approach the Planck scale when quantum effects of the geometry can no longer be neglected. Noncommutativity of spacetime has been advocated as a possible way to effectively model quantum gravitational effects in regimes of negligible curvature. A widely studied incarnation of this idea suggests that the scale of noncommutativity should be seen as an observer-independent length scale and that, in order to accommodate such a fundamental scale, ordinary relativistic symmetries should be deformed (keeping in mind that they should reproduce the usual Poincaré algebra in the limit of vanishing noncommutativity). The κ-Poincaré algebra is an example of such deformation. In this talk I will briefly describe a construction of a κ-deformed complex scalar field theory, while at the same time shedding light on the behaviour of discrete and continuous symmetries in this formalism. This in turn will open the way to the study of the application of this formalism to actual physical processes. I will then conclude with some comments and prospects for the future.

Presenter(s) : BEVILACQUA, Andrea (NCBJ)

Contribution ID : **58** Type : **not specified**

Quantum simulations of loop quantum gravity

Friday, 23 September 2022 09:20 (20)

One of the possible applications of quantum computers in the near future are simulations of physics. An example are quantum gravitational systems associated with the Planck scale physics. Such systems are expected to be of the many-body type, which justifies utility of quantum computations in the analysis of their complex quantum behaviour. In this talk, simulation of loop quantum gravity on quantum computer are considered. A construction of quantum circuits which generate states of spin networks will be presented. Furthermore, a quantum algorithms which enable projection of states on physical subspace of Hilbert space and determination of amplitudes of transitions between different states of spin network are proposed. Results of implementation of the approach on IBM superconducting quantum computers will be presented. Obtained results provide building blocks for quantum simulations of complex spin networks, which can give insight into the Planck scale physics in the near future.

Presenter(s) : CZELUSTA, Grzegorz (Jagiellonian University)

Contribution ID : **59** Type : **not specified**

The relativistic galaxy bispectrum

Friday, 23 September 2022 10:10 (60)

The galaxy bispectrum will play an important role for future galaxy surveys. On large scales it will be a key probe for measuring primordial non-Gaussianity, and hence help discriminate between different inflationary models and other theories of the early universe. On these scales, a variety of relativistic effects come into play once the galaxy number-count fluctuation is projected onto the past light cone. The Fourier-space galaxy bispectrum is complex, with the imaginary part arising from leading-order relativistic corrections. Detection of the imaginary part is potentially a smoking gun signal of relativistic contributions. We will discuss whether next-generation surveys could make such a detection. Further, We will discuss the decomposition of the bispectrum into invariant multipoles about the observer's line of sight, and examine in detail how the relativistic effects contribute to these.

Presenter(s) : CLARKSON, Chris (University of London)

Contribution ID : **60** Type : **not specified**

Generalized Relativistic Zel'dovich Approximation: A new method for structure formation

We present a new general relativistic method to model the large-scale structure formation in the universe. This method is developed as a simultaneous generalization of the Relativistic Zel'dovich Approximation and Szekeres/LTB exact solutions. The overall approach consists of a deformation field evolving on an inhomogeneous Friedmann-like reference model. As in the original Zel'dovich approach, the dynamics can be interpreted as an extrapolation of the locally one-dimensional exact solution (in terms of the deformation) onto three dimensions. Results of some numerical examples are also shown to illustrate the potential and capability of the approach.

Presenter(s) : DELGADO GASPAR , Ismael (NCBJ)

Contribution ID : **61** Type : **not specified**

Gauge-fixing and spacetime reconstruction in the Hamiltonian theory of cosmological perturbations

Friday, 23 September 2022 11:40 (20)

We will present a general formalism for the Hamiltonian description of any spatially homogeneous spacetime in perturbation theory. We will employ and refine the Dirac method for constrained systems, which is very well-suited to cosmological perturbations. This approach includes a discussion of the gauge-invariant dynamics of perturbations as well as an analysis of gauge transformations, gauge-fixing, partial gauge-fixing and spacetime reconstruction. We will introduce the Kuchař parametrization of the kinematical phase space as a convenient tool for studying the gauge transformations. The key element of this approach is the reconstruction of spacetime based on gauge-fixing conditions. Some examples for selected gauges will be presented.

Presenter(s) : BOLDRIN, Alice (NCBJ)

Contribution ID : **62** Type : **not specified**

Structure forming plane symmetric dust inhomogeneous cosmological model

Friday, 23 September 2022 12:00 (20)

We present a special case of the plane symmetric model from the G_3/S_2-symmetric space-times solving the Einstein equations for a dust source which exhibits a controlled form of the growth of the matter density inhomogeneities.

Presenter(s) : GŁÓD, Krzysztof (Jagiellonian University)

Contribution ID : **63** Type : **not specified**

Cosmological perturbations beyond the linear order

Friday, 23 September 2022 12:20 (20)

In this talk I will present the specific solution to the second-order cosmological perturbation theory. For the background I will consider any Friedmann-Lemaitre-Robertson-Walker model filled with a dust, and a positive cosmological constant. The presented model is a generalization of the previous results obtained with Krzysztof Głód where the background was the Einstein-de Sitter spacetime. Here, I investigate the case of the spatially non-flat background and a positive cosmological constant.

Presenter(s) : SIKORA, Szymon (Jagiellonian University)

Contribution ID : **64** Type : **not specified**

Matter bounce and dynamical aspects in nonmetricity gravity

In the context of the late time cosmic acceleration phenomenon, many geometrically modified theories of gravity have been proposed in recent times. In this paper, we have investigated the role of a recently proposed extension of symmetric teleparallel gravity dubbed as $f(Q,T)$ gravity in getting viable cosmological models, where Q and T respectively denote the non-metricity and the trace of energy momentum tensor. We stress upon the mathematical simplification of the formalism in the $f(Q,T)$ gravity and derived the dynamical parameters in more general form in terms of the Hubble parameter. We considered two different cosmological models mimicking non-singular matter bounce scenario. Since energy conditions play a vital role in providing bouncing scenario, we have analyzed different possible energy conditions to show that strong energy condition and null energy condition be violated in this theory. The models considered in the work are validated through certain cosmographic tests and stability analysis.

Presenter(s) : MISHRA, Bivudutta (BITS-Pilani, Hyderabad Campus)

Contribution ID : **65** Type : **not specified**

Challenging ΛCDM with scalar-tensor f(R,T) gravity and thermodynamics of irreversible matter creation

Friday, 23 September 2022 14:10 (20)

We investigate the possibility of gravitationally generated particle production via the mechanism of non-minimal curvature-matter coupling. An intriguing feature of this theory is that the divergence of the matter energy-momentum tensor does not vanish identically. We explore the physical and cosmological implications of the non-conservation of the energy-momentum tensor by using the formalism of irreversible thermodynamics of open systems in the presence of matter creation/annihilation. The particle creation rates, pressure, temperature evolution and the expression of the comoving entropy are obtained in a covariant formulation and discussed in detail. Applied together with the gravitational field equations, the thermodynamics of open systems lead to a generalization of the standard ΛCDM cosmological paradigm, in which the particle creation rates and pressures are effectively considered as components of the cosmological fluid energy-momentum tensor. We also consider specific models, and we compare the cosmology with a curvature-matter coupling with the ΛCDM scenario, and if it additionally gives rise to particle creation rates, creation pressures, and entropy generation through gravitational matter production in both low and high redshift limits.

Presenter(s) : PINTO, Miguel (Institute of Astrophysics and Space Sciences - University of Lisbon)

Contribution ID : **66** Type : **not specified**

Low scale inflation without (much of) fine-tuning

Friday, 23 September 2022 11:10 (30)

In my talk, I will argue that the GUT scale is the most natural scale for inflation. I will show why we may actually need to go much lower and why this may cause massive fine-tuning. Finally, I will present a possible solution - warm inflation with (almost) arbitrarily low energy scale.

Presenter(s) : ARTYMOWSKI, Michał (UKSW)

Contribution ID : **67** Type : **not specified**

Metric-affine gravity effects on terrestrial (exo)planets' profiles

Friday, 23 September 2022 14:30 (20)

Extended gravity theories modify gravitational phenomena at various scales, ranging from cosmological to the scale of our Solar System. Given the multitude of possible modifications, it is essential to test the models at different energy regimes. Gravity is well-tested here on Earth; any deviations from general relativity (GR) should be miniscule, which imposes some limitations on possible extensions. As it turns out, modified gravity has an influence on the internal structure of spherically-symmetric bodies, such as (exo)planets. In principle, it should be possible to constrain alternatives to GR using, for example, seismicvdata, informing us of the size and composition of layers inside the Earth. In my talk, I will present the way alternative gravity can modify the structure of planets composed of one and two layers, obtaining mass-radius relations of homogeneous and differentiated cold spheres. An additional degeneracy in the (exo)planets' profiles will be discussed together with their properties concluded from our findings in the framework of Palatini f(R) gravity. Possible generalizations will also be discussed.

Presenter(s) : KOZAK, Aleksander (University of Wrocław)

Contribution ID : **68** Type : **not specified**

CANCELLED Compactification of the phase space in the scalar field cosmology with non-minimal coupling

Friday, 23 September 2022 14:50 (20)

We investigate the FLRW cosmological model with a non-minimally coupled scalar field generalized according to the methods given by the nonlinear field space theory. In this approach, one generalizes the phase space of a given field to a topological space (such as symplectic manifold). We consider the compactification of the phase space to a spherical case, corresponding to a spin system, and analyze the evolutionary scenarios of such a model of the universe. Introduction of the non-minimal coupling in the model provides interesting outcome in the dynamics of the late time acceleration.

Presenter(s) : HUMIEJA, Franciszek (Jagiellonian University)

Contribution ID : **69** Type : **not specified**

Scalar-tensor cosmology in a minisuperspace formulation with Chaplygin Gas

Friday, 23 September 2022 15:40 (20)

Scalar tensor theories (STT) of gravity are one of the most fundamental types of modified theories of gravity. By introducing a non-minimally coupled dynamical scalar field, they make it possible to describe gravitational interaction to the extent that the purely tensor general theory of relativity fails, or does not give sufficiently accurate predictions. One of the ideas strongly developed in recent years regarding the attempt to describe the dark sector of the universe is the so-called dark fluid. In its concept, it aims to unify in one physical phenomenon the influence of dark energy and dark matter on the evolution of the universe. One example of such a fluid is the family of models of the so-called Chaplygin gas (CG) [1], which is characterized by a specific equation of state: p(ρ) = − A /ρ^α. By considering particular CG models as sources of matter in the Universe, specific FLRW cosmological models in the minisuperspace (MSS) formalism can be obtained, which can be presented in specific conformal frames, such as the best known Einstein and Jordan frame. Classical mechanical systems in cosmology in the MSS formulation are proved to be extremely effective in studying ST cosmological models [2]. During the talk I will present an analysis on the conservation laws of the energy-momentum tensor in the case of minimal and non-minimal coupling for metric and metric-hybrid STT, as well as a numerical analysis to verify whether the obtained cosmological models can be an extension of the Λ-CDM model. References [1] M. C. Bento, O. Bertolami, and A. A. Sen, Generalized Chaplygin gas, acceler- ated expansion, and dark-energy-matter unification, Phys. Rev. D 66, 043507 (2002). [2] A. Borowiec, A. Kozak, Scalar-tensor cosmologies in a minisuperspace formu- lation: A case study, Phys. Rev. D 105, 4 (2022).

Presenter(s) : POSTOLAK, Marcin (University of Wrocław)

Contribution ID : **70** Type : **not specified**

Rip Cosmological Models in Extended Symmetric Teleparallel Gravity.

Friday, 23 September 2022 16:00 (20)

In this work, we have investigated some rip cosmological models in an extended symmetric teleparallel gravity theory. We consider the form f (Q, T) = aQ^m+bT in the Einstein–Hilbert action and expressed the field equations and the dynamical parameters in terms of the non-metricity Q. Three rip models such as Little Rip, Big Rip, and Pseudo Rip are presented also the energy conditions and the cosmographic parameters are derived and analyzed for all these models.

Presenter(s) : PATI, Laxmipriya (BITS-Pilani, Hyderabad Campus)

Contribution ID : **71** Type : **not specified**

Opening remarks

Monday, 19 September 2022 08:50 (10)