Posters - Gravity@Prague 2026

Session 1 (Tuesday 15/09/2026)

1. Simran Arora

Poster title: Constraining Spatial Curvature with Priors from Swampland Conjectures

Abstract: We study a string-motivated theoretical prior on the quintessential dark energy model with exponential potential, allowing for non-zero spatial curvature. First, we formulate the corresponding dynamical system and investigate its cosmological evolution numerically, illustrating the phase-space behaviour and the influence of curvature on the background dynamics. In open universes, it has been suggested that a curvature-related fixed point may support accelerated expansion even for relatively steep potentials compatible with swampland considerations. Next, we explicitly impose swampland-motivated priors on the slope parameter, restricting it to values consistent with the de Sitter conjecture that excludes the (curved) CDM limit. Furthermore, we restrict our considerations to the range of field excursion that is consistent with the swampland distance conjecture. Our primary interest is the possibility that such theoretically-motivated priors may shift values of cosmological parameters inferred by observational data, compared with the standard analysis based on theory-agnostic priors such as a sufficiently wide flat prior. We examine this possibility using a combination of Planck CMB data, DESI BAO measurements, and recent Type Ia supernova samples, performing a Bayesian inference of the model parameters. Our analysis indicates that the swampland-motivated prior mildly shifts the values of Ω_k.

2. Michele Benaco

Poster title: Stochastic Gravitational Waves from Modulated Reheating

Abstract: We investigate scalar-induced stochastic gravitational waves from adiabatic curvature perturbations sourced by a spectator field via the modulated reheating mechanism. We consider a spectator scalar with Higgs-like couplings and inflaton decay via shift symmetric dimension-five operators. The spectator is assumed to be in the de Sitter vacuum and it sources blue-tilted, strongly non-Gaussian curvature perturbations which can dominate the spectrum on small scales $k \gg \mathrm{Mpc}^{-1}$. We find that the setup could generate a gravitational wave signal testable by surveys like BBO and DECIGO but only for large coupling values not expected in low-energy particle physics setups that can be perturbatively extrapolated up to the inflationary scale.

3. Sebastian Brezina

Poster title: Teleparallel gravity and Noether's second theorem

Abstract: We examine the gauge structure and the situation with matter coupling in teleparallel gravity. Using Noether's second theorem, we demonstrate that gauge symmetries are diffeomorphisms and local Lorentz transformations, and that the structure of Noether's identities implies the Levi-Civita coupling.

4. Shouvik Roy Choudhury

Poster title: Cosmology in an extended parameter space: new constraints on dark energy and neutrino masses with DESI BAO

Abstract: Based on arXiv: 2409.13022, arXiv: 2504.15340, and arXiv: 2509.26144 (all three published in the Astrophysical Journal Letters).

We update constraints on cosmological parameters in a 12-parameter model, which extends the standard 6-parameter ΛCDM to include dynamical dark energy and massive neutrinos, along with other new parameters. We use the latest Planck PR4 (2020) likelihoods, DESI DR1 & DR2 BAO, and the latest uncalibrated type Ia Supernovae (SNe) datasets. In this talk, I will discuss the implications for dynamical dark energy in such an extended model, and at the same time, provide robust bounds on neutrino masses which will be useful for the astro- and particle physics communities. I will also discuss the current status of the weak lensing tension and the Hubble tension in this extended cosmology.

5. Büşra Dedeoğlu

Poster title: Rank-3 Jordan Structure and Ultra-Logarithmic Modes in an MMG-Like Gravity Model

Abstract: We investigate the critical structure of the simplest non-trivial member of a Chern–Simons-like family of third-way consistent, three-dimensional MMG-like gravity models. The $N = 2$ theory propagates three massive spin-2 modes in addition to the two massless sectors of AdS_3 gravity. We focus on the degenerate branch of the parameter space, where two massive roots coincide, and examine its intersection with the chiral line. At the special point $(\rho, \gamma) = (5, 6)$, one Brown-Henneaux central charge vanishes and the degeneracy is further enhanced: three eigenvalues of the linearized mass operator coincide. The operator is therefore non-diagonalizable and develops a rank-3 Jordan block. The resulting Jordan chain contains a primary mode and two logarithmic partners, identifying this point as an ultra-logarithmic limit of the theory. The quadratic action further shows that the remaining massive excitation is a ghost. This example demonstrates how higher-rank logarithmic sectors can emerge in extended third-way consistent gravity models.

6. Héloïse Delaporte

Poster title: Odd-parity perturbations in purely-metric Horndeski theories

Abstract: Horndeski scalar-tensor theories pave a promising and tractable avenue to test the Kerr paradigm in strong gravity. New light on a subclass of this family formed by purely-metric Horndeski theories, in which the additional scalar degree of freedom purely derives from (higher-order) curvature invariants, was recently shed. This Horndeski subclass is particularly interesting as higher-order curvature invariants generically appear in both classical Effective Field Theories and quantum modifications of General Relativity (GR). On top of the standard GR branch, a new branch of hairy Black-Hole (BH) solutions was numerically found, for which the BH hair is purely induced by a non-zero Ricci scalar curvature, hence the name "curvaturised BHs". The gravitational dynamics of hairy BHs is altered due to this extra hair, such that GR's isospectrality of Quasi-Normal Modes (QNMs) is expected to be broken, while instabilities of overtones may appear. Using recent findings that the dynamics of odd-parity perturbations of spherically-symmetric BHs in shift-symmetric quadratic DHOST can be recast as the GR perturbations propagating on an effective metric, we show that this is also the case for odd-parity perturbations of curvaturised BHs in purely-metric Horndeski containing non-shift symmetric terms up to cubic order. We provide the form of the effective metric on which GR odd-parity perturbations evolve and sketch the resulting causal structure of the background and the effective metrics.

7. Pietro Farina

Poster title: Gravitational signatures beyond Newton: exploring hierarchical three-body dynamics

Abstract: Hierarchical three-body systems offer a compelling framework to explore the subtle interplay between Newtonian and relativistic gravitational effects in astrophysical environments. In this work, we investigate post-Newtonian corrections to the periastron shift within such systems, focusing on the impact of orbital eccentricity. Modeling the secondary body's influence as a quadrupolar perturbation, we compare Newtonian, Schwarzschild, and post-Newtonian quadrupolar contributions to orbital precession. Our analysis demonstrates that Newtonian quadrupolar effects could be observable, for a long monitoring time, in the orbit of the S87 star around Sagittarius A* if an intermediate-mass black hole is present, under the assumptions of our model. Additionally, post-Newtonian quadrupolar corrections may influence the dynamics of small Solar System bodies in the presence of massive companions. Although the predicted effects are minute and require long monitoring periods to be measurable, our analysis clarifies how relativistic corrections enter the dynamics of the third body and outlines the conditions under which future observations could reveal them. Furthermore, we present a preliminary analysis based on the perturbing acceleration method, highlighting the differences in the secular evolution arising when the nodal precession of the inner and outer orbits is treated independently.

8. Sabatino Fatigati

Poster title: Characterisation of light rings around black holes in Scalar-Tensor-Vector Gravity

Abstract: In this poster, I will present a study of circular photon orbits in plasma-rich environments around black holes in Scalar-Tensor-Vector Gravity, built on a potential-based approach originally developed in General Relativity. This work extends the analysis of light propagation to the strong-field regime of Scalar-Tensor-Vector Gravity and provides a consistent theoretical framework within this context. It also allows one to assess possible deviations from General Relativity or, at least, to place constraints on the parameter that characterises this alternative theory of gravity.

9. Juliana Zanatta Finotti

Poster title: CROSS-CORRELATION OF METRIC AND MONOPOLE PERTURBATIONS FROM HOLOGRAPHIC COSMOLOGY

Abstract: We aim to investigate cosmological non-Gaussianities associated with the magnetic monopole field and metric perturbations. Using the phenomenological approach of holographic cosmology, we map the correlators of a 3D QFT into a cosmological theory. The main expected result is the derivation of the cross-correlation between metric perturbations (scalar and tensor) and the magnetic monopole field in the squeezed limit, where one mode has a much smaller momentum than the others. This is achieved through the 1-loop calculation of the $\langle \mathrm{TJJ} \rangle$ correlator of the dual QFT.

10. Luca Gallerani

Poster title: Towards a causal effective thermodynamics of scalar-tensor gravity

Abstract: Scalar-tensor gravity can be elegantly interpreted through a thermal analogy, mapping its effective fluid to Eckart's irreversible thermodynamics. However, this established framework is inherently non-causal. In this work, we resolve this limitation by extending the thermal analogy to the causal Israel-Stewart model, utilizing a minimal *ansatz* that promotes the heat flux density to a timelike vector.

This approach yields analytically manageable constitutive equations and achieves the first consistent decoupling of the effective temperature ($\mathcal{T}$) and thermal conductivity ($\mathcal{K}$). Crucially, this causal framework preserves the compelling interpretation of General Relativity as an equilibrium state, naturally approached via dynamical relaxation in the vanishing $\mathcal{KT} \to 0$ limit. We validate this new formalism through applications to Bianchi I and FLRW cosmologies, providing a rigorous causal foundation for the attractor-to-GR mechanism.

11. Pietro Isaia

Poster title: A Variational Framework for Linearised Theories

Abstract: The usual approach to perturbation theory presents some mathematical flaws. For instance, when studying gravitational waves (GW) around a Minkowski background, one usually imposes the weak-field limit, requiring the spacetime metric to be the Minkowski metric plus a small perturbation. However, the bundle of Lorentzian metrics is neither linear nor affine; thus, the addition operation is not globally well-defined. Starting from this consideration, we analyse another approach to linearisation and perturbation theory, which is completely variational. This framework presents numerous advantages: it can be applied to any classical field theory (generality), it does not involve any approximation in the computations (exactness), and, most importantly, it allows to study linearisation around all solutions of the theory at the same time (globality). As a first example, we apply the framework to standard General Relativity and we show that linearised Einstein equations are a generalisation of GW equations around a general background, as expected. Finally, we present a few considerations on the existence of solutions and on conservation laws.

12. Zeynep Su Koç

Poster title: Nonlinear Degrees of Freedom of Born-Infeld Gravity in 2+1 Dimensions

Abstract: Born-Infeld extension of New Massive Gravity (NMG) in 2+1 dimensions is an infinite order extension of NMG. It was known that the theory has 2 massive degrees of freedom around it unique maximally symmetric vacuum at the linear level. Here we prove that the theory has only 2 massive degrees of freedom at the non-linear level. Hence there is no Boulware-Deser ghost. The proof has three parts. First, the higher-derivative metric theory is rewritten as a first-order system with twelve phase-space variables per spatial point. Second, diffeomorphism invariance produces three gauge chains. Because the physical lapse is coupled to the normal component of the auxiliary metric, the naive lapse constraint need not be the final first-class generator. The correct normal and tangential generators may differ from the naive ones by auxiliary constraints. Third, the auxiliary scalar sector contains a primary scalar constraint whose self-bracket vanishes. Its preservation produces a secondary scalar constraint, and their bracket has a nonvanishing ultralocal part. On the maximal-rank branch, these two constraints form a second-class pair and remove the unwanted scalar mode. The theory therefore propagates two local degrees of freedom, corresponding to the two polarizations of a massive spin-two field in three dimensions.

13. Andrew Kovachik

Poster title: Black Holes In Lorentz Violating Gravity Are (Almost) Unchanged

Abstract: Lorentz violating theories modify the effective point particle description of black holes through sensitivity parameters that describe their response to motion through a preferred frame. We calculate these sensitivity parameters for Einstein-aether and khrono-metric gravity for both Schwarzschild and Kerr black holes. Despite variations in black hole properties, theories, and parameter regimes, we find that the sensitivity approaches a common, small, limiting behaviour in most of the parameter space. I will also discuss the motivation of Lorentz violating theories, our method for calculating sensitivity, and next steps.

14. Joosep Lember

Poster title: Conformal gauge gravity and linearized particle spectra

Abstract: Shortcomings of GR motivate the study of extended theories of gravity, while other fundamental interactions, successfully formulated as gauge theories, drive the development of a gauge theory of gravity. We will present a gauge-theoretic framework of gravity based on spontaneous symmetry breaking of the conformal group to the Lorentz group. The geometry can be defined from a connection and two vector fields responsible for symmetry breaking. The theoretical setup of the framework is described, along with possible action densities that can be constructed. Applications of the framework are illustrated by the study of linearized theories around a Minkowski background, whose particle spectra can be calculated using the package PSALTer. The results include models with dynamical degrees of freedom equivalent to GR as well as models where additional degrees of freedom are found.

15. Jack Lindner

Poster title: Thermodynamics of STU Planar Black Holes and Solitons

Abstract: The STU model of gauged $N = 8$ supergravity in four dimensions has provided an interesting landscape of study in the low energy limit of M-theory. We investigate the thermodynamics of planar black holes and their corresponding solitons in this model using techniques from black hole chemistry. The STU model provides an interesting landscape for black hole thermodynamics due to the presence of multiple $U(1)$ charges and dilaton fields. Functions for the mass of these objects and the corresponding potentials were computed numerically. The free energies, stability, and phase transitions between black holes and solitons are found along with their relationships with the parameters in the model. It is found that multicritical phase transitions occur featuring multiple solitons and one black hole, sourced in a different way from previously investigated multicriticality in non-linear electrodynamic theories. In this poster, cases involving the varying of two charges will be considered. Extensions to the varying of three or more charges will also be briefly discussed, as well as further discussion and interpretation of the results.

16. Pratul Manna

Poster title: Influence of differential rotation on maximum masses of Neutron stars described by nuclear equation of states

Abstract: Differential rotation plays a significant role in determining the structure and evolution of neutron stars and can influence observable signals such as gravitational waves produced during core-collapse supernovae and binary mergers. A key challenge in modeling these systems is the uncertainty in the equation of state (EoS) of dense nuclear matter. Earlier studies have mainly used simplified polytropic EoS models, which do not accurately represent the complexities of nuclear physics. In this study, we systematically investigate equilibrium solutions using more realistic nuclear EoS models. We find that all four equilibrium solution types previously identified with polytropic models also occur for nuclear EoSs, enabling us to determine the maximum masses of differentially rotating neutron stars. Our results show that differential rotation can raise the maximum mass to approximately 2–3 times that of the corresponding non-rotating star, with the magnitude of this increase depending on the stiffness of the EoS.

17. Andrea De Marco

Poster title: Superconformal index for (large N-)Quiver Quantum Mechanics

Abstract: In this paper, we study the role of the emergent conformal symmetry within D-brane quiver quantum mechanics to better understand the microscopic structure of extremal supersymmetric black holes under AdS_2/CFT_1 duality. While the Coulomb branch description of D-brane bound states eventually develops a scaling symmetry in the asymptotic AdS_2 limit, this symmetry is typically disrupted near the Coulomb–Higgs branch intersection due to quantum corrections. To overcome this limitation, we employ localization techniques to construct a fixed-point expression for the superconformal index of cyclic abelian quivers. We demonstrate that in a specific large-N limit—where N represents the rank of the gauge group—the system's fixed points shift into a regime where these conformal-breaking corrections become negligible, restoring the validity of the superconformal framework. Crucially, this large-N superconformal index reproduces a contribution to the microscopic BPS index coming from scaling solutions (previously identified by Beaujard, Mondal, and Pioline) that standard Coulomb branch analyses fail to detect. These findings offer a clearer connection between conformal quantum mechanics and black hole microstate counting, advancing the development of a string-theoretic realization of AdS_2/CFT_1 holography.

18. Hryhorii Ovcharenko

Poster title: A new class of rotating charged black holes in the external Bertotti-Robinson (electro)magnetic field

Abstract: We present a large family of twisting and expanding solutions to the Einstein-Maxwell equations of algebraic type D, for which the two double principal null directions (PNDs) of the Weyl tensor are not aligned with the null eigendirections of the Faraday tensor. In addition to systematically deriving this new class, we present its various metric forms and convenient parameterizations. We show that in Boyer-Lindquist-type coordinates these solutions depend on 7 parameters, namely the Kerr and NUT (Newman-Unti-Tamburino) twist parameters a and l, mass parameter m, acceleration α, strength of the Maxwell field |c|, and angular parameters β γ that represent two duality rotations of the Faraday tensor, which include the rotation between the electric and magnetic charges generating the aligned part of the Maxwell field. This coordinate parameterization, analogous to the Griffiths-Podolský form of the Plebański-Demiański solutions, allows us to perform various limits, explicitly identify the subcases, and determine the physical interpretation of the new class. Interestingly, by considering the limit with no acceleration ($\alpha \to 0$), one obtains either the famous Kerr-Newman-NUT black holes (if the parameter |c| remains constant) or the novel Kerr-Bertotti-Robinson black holes, announced recently in our work [Phys.Rev.Lett. 135 (2025) 18, 181401] (if α -> 0 while α |c|=const.). We may thus conclude that this new class of spacetimes represents twisting charged accelerating black holes, immersed in an external magnetic (or electric) field. In the non-twisting subcase, we obtain the previously known solution of Van den Bergh-Carminati.

19. Hyo Jung Park

Poster title: A Hunt for the Physical Manifestation of Black Hole Unitarity

Abstract: The black hole information paradox is a fundamental conflict between quantum mechanics and semiclassical gravity: does black hole evaporation via Hawking radiation represent a unitary process or an irreversible thermal one? While many models (e.g., [1,2]) exhibit unitary evaporation, as evidenced by the Page curve behavior of the radiation's entanglement entropy, experimental limitations in measuring entropy and verifying quantum gravity theories have left the paradox unresolved. To address this challenge, we explore an alternative approach to test black hole unitarity without relying on entropy calculation: by employing the Unruh-DeWitt (UDW) particle detector, we search for physical signatures of unitary evaporation in a model that exhibits it, specifically the hybrid Russo–Susskind–Thorlacius (RST) model [2,3], which is 2D dilaton gravity with both physical and non-physical quantum fields. We analyze the transition rates of the UDW detector in three different parameter regimes of the model: classical (no quantum fields), single quantum (physical fields present), and hybrid quantum (both physical and non-physical fields present). Our results suggest that the UDW detector is capable of capturing the model's transition from thermality to non-thermality, agreeing with the behavior of the Page curve.

[1] Hong Zhe Chen, Robert C. Myers, Dominik Neuenfeld, Ignacio A. Reyes, Joshua Sandor. Quantum Extremal Islands Made Easy, Part II: Black Holes on the Brane". `https://doi.org/10.48550/arXiv.2010.00018.`

[2] Yohan Potaux, Sergey N. Solodukhin, and Debajyoti Sarkar. "Spacetime Structure, Asymptotic Radiation, and Information Recovery for a Quantum Hybrid State." Physical Review Letters 130, no. 26 (June 30, 2023): 261501. `https://doi.org/10.1103/PhysRevLett.130.261501.`

[3] Yohan Potaux, Debajyoti Sarkar, and Sergey N. Solodukhin. "Quantum States and Their Back-Reacted Geometries in 2D Dilaton Gravity." Physical Review D 105, no. 2 (January 12, 2022): 025015. `https://doi.org/10.1103/PhysRevD.105.025015.`

Session 2 (Wednesday 16/09/2026)

20. Ayan Kumar Patra

Poster title: Quantum Solitons

Abstract: Semiclassical gravity provides a useful approximation to a fully quantum theory of gravity, but its equations are often difficult to solve. In some cases, holographic duality offers a powerful framework for addressing the semiclassical problem, yielding non-perturbative solutions to the semiclassical equations.

In this poster, I will describe how this formalism can be used to construct three-dimensional asymptotically AdS semiclassical solutions describing the backreaction of a strongly coupled thermal CFT state on a curved, everywhere smooth Lorentzian geometry. These "quantum solitons" are holographically dual to a class of four-dimensional accelerating black hole solutions. I will discuss the construction of these solutions and their semiclassical thermodynamics.

21. Andrea Di Pinto

Poster title: Static Charged or Uncharged Black Holes with External Bertotti-Robinson and Bonnor-Melvin Electromagnetic Fields in General Relativity and Supergravity

Abstract: We examine and generalize the new Ovcharenko-Podolský family of exact solutions of the Einstein-Maxwell equations describing possibly charged and accelerating static black holes embedded in a Bertotti-Robinson universe.

We study the constraints that guarantee supersymmetry in the context of N=2, D=4 supergravity. We show that the extremal subcase is supersymmetric and saturates the BPS bound, and explicitly compute the Killing spinors of the spacetime. We use this result to compute the black hole mass and analyze the thermodynamics of the solution. Moreover, we present a generalization of the extremal solution to include a cosmological constant.

Then we introduce a new parameterization for the uncharged and non-accelerating subfamily. The new spacetime is, in general, different from the original corresponding Ovcharenko-Podolský

subcase, in particular on the branches solving the field equations, for which the original parameterization can lead to black holes with a negative mass, whereas the new one always leads to black holes with a positive mass. Moreover, by introducing additional gauge constants, we remove the various pathologies and ensure consistency with the laws of black hole thermodynamics. We then obtain a new family of Einstein-Maxwell solutions by generalizing this new parameterization, through a Harrison transformation within the Ernst method, to also include an external electromagnetic field of the Bonnor-Melvin type. We again identify the appropriate gauge constants required to remove the possible pathologies and ensure that the resulting solutions satisfy the laws of black hole thermodynamics. Finally, we investigate the vacuum subcase of the new family and establish its relation to previously known metrics.

22. Valentin Pomakov

Poster title: Analog regular black holes and black hole mimickers in a Bose-Einstein condensate

Abstract: With the goal of investigating inner horizon and inner light ring instabilities of static, spherically symmetric regular black holes and black hole mimickers, respectively, we show how to emulate their corresponding spacetime possessing a radius-dependent mass function $m(r)$ in an analog-gravity platform based on a Bose-Einstein condensate (BEC). We compare the sonic and the gravitational line elements and show a correspondence between $m(r)$ and the ratio of radial flow velocity and sonic speed. This allows, in theory, to emulate the entire spacetime in the analog platform, and shows which are the condensate analog quantities for gravitational parameters like the regularization parameter ℓ and the ADM mass M in different areas of the condensate. Resolving this correspondence relation along with the Bernoulli and continuity equation, we show how to experimentally realize the central and the asymptotic region of the gravitational spacetime in the BEC by means of a given profile $U(r)$ of the external potential and interaction strength $g(r)$, tuned by means of the Feshbach resonance with a radially varying magnetic field $B(r)$. We propose a concrete experimental setup and, using experimental values of the relevant quantities from existing BEC experiments, provide a reality-check which demonstrates the viability and realizability of our analog-gravity program.

23. Ansofi Pretorius

Poster title: Two rings to rule them all? Observing double Einstein rings in an exact solution of f(R) gravity

Abstract: Strong gravitational lensing offers an intimate probe into the underlying physical properties of the constituent galaxies of a strongly lensed system. This is often achieved through the means of ray tracing and lens modelling techniques. While modified theories of gravity have gained much prominence in recent years, in some part due to the growing tensions arising in the standard model of cosmology, they have remained under-represented in the context of lens modelling analysis. We present the first implementation of a modified theory of gravity into the source reconstruction and lens modelling formalism of PyAutoLens. We implement a deflection angle that was obtained from the derivation of a general framework for the study of strong lensing in $f(R)$ gravity using the 1+1+2 covariant approach. This deflection angle emerges from an exact spherically symmetric solution of R^n gravity, and uniquely predicts the formation of a double Einstein ring from a single source galaxy. In this work, we illustrate the statistically competitive nature of $f(R)$ gravity in the analysis of galaxy-galaxy strong lensing. Furthermore, we discuss the dependence of the observed magnification of the lensed images to the particular theory of gravity, as well as motivate for the broader introduction of physically-motivated alternative theories of gravity into the lens modelling and source reconstruction analysis of strongly lensed systems.

24. Cynthia Belen Arias Pruna

Poster title: Geometrically preferred conformal to Kerr-NUT-AdS spacetimes

Abstract: It is well known that Kerr–NUT–AdS spacetimes in arbitrary dimensions admit complete towers of hidden and explicit symmetries generated by the principal Killing–Yano tensor. A general construction implies that any conformally related spacetime inherits the corresponding conformal hidden symmetries. We show that, among all spacetimes conformally related to Kerr–NUT–AdS, there exist three distinguished families in even dimensions, characterized by specific conformal factors, for which the tower of explicit symmetries is preserved and can be, at least partially, reconstructed from the conformal hidden symmetries. The resulting metrics (i) recover the original Kerr–NUT–AdS spacetimes in a conformal frame, (ii) provide a natural higher-dimensional generalization of the Plebański–Demiański family of metrics, and (iii) yield an "inverse" higher-dimensional Plebański–Demiański family. By contrast, in odd dimensions no analogous construction exists, leaving the Kerr–NUT–AdS spacetimes as the unique preferred metrics in this class.

25. Máté Pszota

Poster title: Higher-order nonlocal thermodynamic theories of gravity

Abstract: By investigating Newtonian gravity within the framework of nonequilibrium thermodynamics it is possible to use specific energy density with up to 3rd order gradient dependency. Assuming a cross-effect between the mechanical and gravitational terms of the thermodynamic forces and fluxes arising from the specific entropy production rate, a generalised, and via the cross-effect, a modified Poisson's equation is obtained for the gravitational field. The resulting general field equation allows us to compare models with different gravitational energy densities. The resulting nonrelativistic modified gravity may allow the explanation of various astrophysical phenomena, which are usually attributed to Dark Matter, or may help the analysis of Solar-system level tests of the effects of corrections to Newtonian (e.g. by the introduction of Yukawa-like terms).

26. Oscar Ramirez

Poster title: The First Law of Black Hole Thermodynamics for General Gravity and Matter Theories

Abstract: Black hole thermodynamics provides a powerful framework for probing the fundamental structure of gravity. Since the 1990s, a general method for deriving the first law of black hole thermodynamics in diffeomorphism-invariant theories has been developed within the metric formalism. Differential forms, however, offer a natural and efficient language for formulating gravitational theories, particularly in extensions of General Relativity. In this work, we develop a unified prescription for deriving the first law using differential forms defined on spacetime. The framework applies to a broad class of theories, including theories with torsion and generic matter fields, and provides explicit expressions for the corresponding first law.

27. Paolo Rossi

Poster title: Wormholes, Ensembles, and (Non-)Invertible Structure in Three-Dimensional Holography

Abstract: Euclidean wormholes pose a sharp puzzle for holography: while their bulk contributions naturally connect disconnected boundaries, an ordinary quantum field theory is expected to factorize across them. One possible resolution is that the gravitational theory is dual not to a single boundary theory, but to an ensemble of theories.

We explore this idea in a controlled setting based on three-dimensional “exotic” gravity theories, dual to ensembles of two-dimensional rational conformal field theories. In these models, it is possible to analyze multi-boundary amplitudes explicitly. Focusing on two disconnected boundaries, we ask whether “exotic wormhole” contributions are required by the consistency of the ensemble holography interpretation. It turns out that, in exotic gravity, these extra contributions have a precise bulk interpretation in terms of surface defects in a seed 3D TFT, which are known to form a non-invertible symmetry of the bulk theory.

We set up and study consistency conditions arising from ensemble holography with up to two boundary components in a number of exotic toy models. The emerging pattern is that consistency of the wormhole amplitude restricts the possible averaging over ensembles admitting an invertible or "group-like" multiplication structure.

28. Luís Filipe Dias da Silva

Poster title: Black Hole Shadows and Accretion dynamics in black holes with spontaneous Lorentz symmetry breaking

Abstract: We investigate the accretion properties of an electrically charged, static, spherically symmetric black hole in Kalb-Ramond (KR) gravity, where a dimensionless parameter "l" characterizes spontaneous Lorentz symmetry-breaking. We first constraint the free charge and KR parameter space, (Q,l), by comparing the predicted shadow radius of this family of solutions with the bounds inferred from Event Horizon Telescope observations of Sagittarius A*. The inclusion of electric charge introduces a degeneracy between Q and l, enlarging the region compatible with the observed shadow size and yielding the broad constraint $-0.3900 \leq l \leq 0.1898$, with part of the compatible parameter space extending into the naked-singularity sector. We then investigate relativistic accretion disks around the charged KR black hole within the above constraints. For geometrically thin disks, we compute the time averaged energy flux, temperature distribution, emission spectrum, time averaged torque, and mass-to-radiation conversion efficiency, finding that the radiative output increases for higher values of l, while lower values of l suppress it. Furthermore, when coupled with the electric charge this effect is amplified. For geometrically thick, constant-angular momentum tori, Lorentz symmetry-breaking shifts the characteristic orbital radii, compresses the radial extent of equilibrium configurations, narrows the interval supporting finite stable tori, and promotes an earlier transition toward radially unstable and unconfined flows. These results show how charge and spontaneous Lorentz symmetry-breaking jointly affect observational constraints and the structure and emission properties of black hole accretion flows, providing potential signatures of KR gravity in the strong gravity regimes.

29. Andrea Spina

Poster title: Regular black holes in asymptotic safety

Abstract: Asymptotic Safety provides a framework for quantum gravity in which the running of gravitational couplings can modify black hole physics at short distances, potentially resolving the classical singularity while preserving the Schwarzschild geometry at large scales. We investigate the properties and phenomenology of regular black holes arising within this framework, focusing on famous static solutions and new dynamical solutions obtained from the proper-time flow approach.

We address the robustness of the approach by studying their perturbative dynamics through quasinormal modes and investigating complementary observables, including Hawking radiation, and shadows. The quasinormal spectrum shows significant deviations from the Schwarzschild case, with higher overtones providing enhanced sensitivity to the quantum corrected near-horizon geometry. The Hawking flux is strongly suppressed, indicating slower evaporation and relaxed

constraints for primordial black holes, while shadows remain compatible with current constraints.

30. Sankarshana Srinivasan

Poster title: Testing Gravity on Cosmological Scales with Nonlinear Large-Scale Structure

Abstract: As cosmology rapidly approaches the data-dominated phase of stage IV large scale structure surveys, the modelling of nonlinear scales has become a serious challenge that faces the community, particularly when analysing models beyond wCDM. Here, we demonstrate that COmoving Lagrangian Acceleration (COLA) simulations make emulation of the matter power spectrum (and other similar summary statistics) in modified gravity models possible through modelling of the boost factor, i.e., the ratio of the matter power spectrum in MG relative to LCDM cosmology assuming identical initial conditions. We assume a time-varying effective gravitational constant μ and a gravitational slip η that are binned in redshift. Using Gaussian Process emulation, we are able to achieve accuracy $< 1\%$ in the modified gravity boost relative to COLA simulations, up to $k = 1\,h\,\mathrm{Mpc}^{-1}$. The emulator is publicly available at `https://github.com/sankarshana16/mg_binned_boost_emulator`. We sample the joint cosmological and MG parameter using the nested sampler, nautilus, using simulated 3×2pt LSST Y10-like data vector and a 6×2pt LSST Y10 x Simons Observatory cosmic microwave background (CMB) lensing data vector. We recover the characteristic degeneracy between μ and η previously identified in Fisher forecasts and demonstrate that the best-constrained direction corresponds to the combination $\Sigma = \mu(1 + \eta)/2$ which governs the lensing potential. We show that while large scale structure is sensitive to growth of structure at low redshift, CMB lensing extends the sensitivity to a higher redshift range. These results demonstrate that fast emulation of nonlinear modified-gravity effects enables full Bayesian analyses of model-agnostic gravity parameterisations with realistic survey data vectors and astrophysical systematics.

31. Ayushi Srivastava

Poster title: Improved Quantum Null Energy Condition

Abstract: Generalized entropy, defined as the sum of the area of a Cauchy-dividing surface in Planck units and the von Neumann entropy of the fields on one side of the surface, captures a deep connection between entanglement and geometry in semiclassical gravity. It is expected to satisfy fundamental thermodynamical conditions, notably Quantum Focusing Conjecture, which in certain limits reduces to quantum field theory inequalities. One such limit, obtained by restricting to quantum extremal surfaces, leads to the Improved Quantum Null Energy Condition (INEC). The INEC is a statement relating the local energy density and the shape derivative of von Neumann entropy in Minkowski space-time. It is a stronger condition than the quantum null energy condition and includes the possibility of expanding or contracting geodesics. Using the properties of relative entropy and modular Hamiltonian associated with null deformation of the sphere, we show that the INEC holds under an additional assumption relating the stress-energy tensor to the relative entropy.

32. Michal Stano

Poster title: Teleparallel Regularisation of Gravitational Action

Abstract: Classical solutions with a finite action play an important role in the path integral quantization of gravity, black hole thermodynamics, and holography. While the teleparallel action avoids the need for boundary terms, it depends on a non-dynamical spin connection that effectively encodes the regularization. We study different choices of this spin connection, as well as various methods for evaluating the gravitational action. We show that consistent results

require properly accounting for the role of singularities, and we examine the issue of uniqueness, which leads us to identify underlying symmetries of the teleparallel action.

33. Jan Vendelin Tajcovsky

Poster title: Linear Perturbations of Black Hole Geometries in Quadratic Gravity

Abstract: This poster presents a Newman–Penrose analysis of radial black-hole perturbations in modified theory of gravity known in the literature as quadratic gravity. The Schwarzschild linear order perturbation equations reduce to a single master equation, generalizing the Regge–Wheeler–Zerilli problem from 1957. Exact, explicit, local solutions of the master equation are matched to the known, exact Schwarzschild–Bach geometry, which was found in 2018 in Prague. The corresponding reductions for Taub–NUT and Kerr, which generalize the Teukolsky 1973 result, are briefly compared.

34. Aydın Tavlayan

Poster title: Partition function of a volume of space in a higher curvature theory

Abstract: Recently, [Phys. Rev. Lett. 130, 221501 (2023)] Jacobson and Visser calculated the quantum partition function of a fixed, finite volume of a region with the topology of a ball in the saddle point approximation within the context of Einstein's gravity with or without a cosmological constant. The result can be interpreted as the dimension of Hilbert space of the theory. Here we extend their computation to a theory defined in principle with infinitely many powers of curvature in three dimensions. We confirm their result: The partition function of a spatial region in the leading saddle point approximation is given as the exponential of the Bekenstein-Hawking or the Wald entropy of the boundary of the finite spatial region both in the case of zero and finite cosmological constant. In the latter case, the effective Newton's constant appears in the entropy formula. The calculations lend support to the holographic nature of gravity for finite regions of space with a boundary.

35. Roxane Theriault

Poster title: Gravitational waves induced from the symmetry restoration of a Higgs phase of gravity

Abstract: We study the gravitational waves induced by a scalar field undergoing ghost condensation—an analog of the Higgs mechanism in gravity—as it transitions to a canonical scalar field. The presence of this ghost condensate leads to an early matter-dominated era which transforms into a radiation-dominated era when the symmetry is restored. As a result, the production of induced gravitational waves is enhanced significantly for scalar modes inside the horizon at the time of transition, scaling with the duration of the early matter-dominated era. We show that the primordial gravitational wave background can be strengthened by several orders of magnitude, such that it can, in principle, be observed by future detectors.

36. Alessandro Tiano

Poster title: Post-Newtonian test-particle dynamics in f(R)=R+αR^2 gravity

Abstract: The quadratic model $f(R) = R + \alpha R^2$ is the simplest higher-order extension of General Relativity and provides a natural framework to investigate finite-range modifications of gravity through a Yukawa correction in the weak-field limit. While this correction has been extensively studied at the Newtonian and linearized levels, we extend the analysis to a complete first Post-Newtonian (1PN) description, including the non-linear $\mathcal{O}(4)$ sector of the metric. We present its analytic derivation in the extreme-mass-ratio limit of a binary system by solving the fourth-order field equations directly in the metric formulation of the theory and regularizing the singular point-particle self-field contributions through Hadamard's partie finie. From the 1PN metric, we derive the conservative test-particle Lagrangian and equations of motion, and compute the orbital precession through the Gauss perturbation equations, retaining the full eccentricity dependence. In the screened short-range regime, we apply the formalism to Solar-System planets, obtaining bounds on the Yukawa length scale in close agreement with previous linearized analyses, and to the S2 star orbiting Sgr A^*, extending the analysis to a more relativistic system and much larger orbital scales. We also consider the opposite asymptotic long-range regime, where the Yukawa interaction modifies the Newtonian dynamics already at leading order. After calibrating the orbit in terms of the measured Keplerian parameter, the relativistic precession is rescaled by a factor 3/4 with respect to the corresponding general-relativistic prediction, making this branch observationally distinct from General Relativity.

37. Arman Tursunov

Poster title: Energy extraction and particle acceleration by rotating supermassive black holes

Abstract: It is well known that supermassive black holes in the centers of galaxies are capable of accelerating charged particles to very high energies. Rotating black holes provide a unique environment for extracting energy from spacetime rotation through processes occurring inside the ergosphere. We explore the acceleration of charged particles in the combined gravitational and magnetic field around rotating supermassive black holes as a possible sources of cosmic rays with the energy from PeV to ZeV. We derive the energy spectrum for charged particles escaping to infinity, which can serve as injection spectrum for observed high energy cosmic rays.

38. Mauricio Valencia-Villegas

Poster title: Gradient Catastrophes in Biased Domain Walls

Abstract: Thin domain walls remain free of gradient catastrophes (caustics) even with a vacuum bias — the minimal deformation needed to solve the cosmological domain wall problem. However, when curvature corrections are included, the interplay with the bias can generically trigger gradient catastrophes, potentially sourcing intense particle and gravitational wave emission. We discuss the potential implications for stochastic GW backgrounds. Based on 2604.08142 and work in progress.