5 Física Matemática

1. **Expositor:** Luis Guajardo.
Afiliación: Universidad de Talca.
Título: Black string spectrum of Shift-Symmetric Horndeski Theories.
Resumen: We study four dimensional black strings in the shift-symmetric sector of Horndeski theory. We impose that the scalar field profile only depends on the string-generator coordinate. This relaxation allows to find asymptotically $AdS_3 \times \mathbb{R}$ black strings, dressed with an effective cosmological constant even in the absence of the minimally coupling, extending previous results [1]. We argue that in the full spectrum of shift-symmetric Horndeski theories with Einstein limit, the scalar charge needs to be fixed in terms of the parameter space. We illustrate our results in particular scenarios, and compute their conserved charges through the Euclidean method. We also show that these novel AdS strings are locally and globally stable under thermal fluctuations [2].

References

[1] Cisterna, Adolfo; Oliva, Julio, *Exact black strings and p-branes in general relativity*, Class. Quantum Grav. 35 035012 (2018).

[2] Guajardo, Luis, *Black string spectrum of Shift-Symmetric Horndeski Theories*, work in progress.

2. **Expositor:** Evelyn Rodríguez.
Afiliación: Universidad Católica de la Santísima Concepción.
Título: Non-relativistic gravity theory in four spacetime dimensions.
Resumen: We present a non-relativistic gravity theory defined in four spacetime dimensions using the MacDowell-Mansouri geometrical formulation. We obtain a Newtonian gravity action which is constructed from the curvature of a Newton-Hooke version of the so-called Newtonian algebra. We show that the non-relativistic gravity theory presented here contains the Poisson equation in presence of a cosmological constant. Moreover we make contact with the Modified Newtonian Dynamics (MOND) approach for gravity by considering a particular ansatz for a given gauge field.

References

[1] Patrick Concha, Evelyn Rodríguez, Gustavo Rubio, Non-relativistic gravity theories in four spacetime dimensions, JHEP 02, (2023) 191.

3. **Expositor:** Patrick Concha.
Afiliación: Universidad Católica de la Santísima Concepción.
Título: Non-Lorentzian symmetries and Lie algebra expansions.

Resumen: The derivation of a new Lie algebra has been of great interest in Mathematics and Physics. It is well known that the non- and ultra-relativistic counterpart of a relativistic Lie algebra is obtained through a contraction process. More recently, it has been shown in [1–3] that the Lie algebra expansion method results useful to derive known and new Galilean and Carrollian symmetries. Of particular interest, is the expansion method based on semigroup (S-expansion) [4] which allows us to define generalized non- and ultra-relativistic symmetries from a relativistic one. The S-expansion method turn out to be usefull to construct well-defined non-Lorenzian (super)gravity theories [5, 6]. The non-Lorentzian expansion procedure along few comments about its application in gravity context is considered here.

References

[1] Concha, Patrick; Rodríguez, Evelyn, Non-relativistic gravity theory based on an elargement of the extended Bargmann algebra, JHEP 07, (2019) 085.

[2] de Azcárraga, José; Gútiez, Diego; Izquierdo, José, Extended $D = 3$ Bargmann supergravity from a Lie algebra expansion, Nucl. Phys. B 946, (2019) 114706.

[3] Concha, Patrick; Ipinza, Marcelo; Ravera, Lucrezia; Rodríguez, Evelyn, Non relativistic three-dimensional supergravity theories and semigroup expansion method, JHEP 02, (2021) 094.

[4] Izaurieta, Fernando; Rodríguez, Eduardo; Salgado, Patricio, Expanding Lie (super) algebras through Abelian semigroups, J. Math. Phys. 47, (2006) 123512.

[5] Concha, Patrick; Ravera, Lucrezia; Rodríguez, Evelyn, Three-dimensional exotic Newtonian supergravity theory with cosmological constant, Eur. Phys. J. C 81, (2021) 646. JHEP 02, (2023) 191.

[6] Bergshoeff, Eric; Rosseel, Jan, Non-Lorentzian Supergravity, arXiv:2211.02604 [hep-th].

4. **Expositor:** Fernando Izaurieta.
Afiliación: Universidad San Sebastián.
Título: Principal Bundles, Wave Operators, and Weitzenböck Identities.
Resumen: We show generalized versions of the Lichnerowicz-de Rham and the Beltrami wave operators, and the Weitzenböck identity relating them. The construction applies to any Principal Bundle with a Lie (super) group containing a special ortogonal subgroup. Its practical use in physics as a tool to study gravitational waves on Riemann-Cartan geometries is presented.

References

[1] Barrientos, F. Izaurieta, E. Rodríguez, and O. Valdivia, Wave operators, torsion, and Weitzenböck identities, General Relativity and Gravitation 54, (2022) 26.

5. **Expositor:** York Schröder.
Afiliación: Universidad del Bío-Bío.
Título: From sum-integrals to continuum integrals and back.
Resumen: We investigate the structure of a particular class of massive vacuum Feynman integrals at two loops. This class enjoys a linear relation between its three propagator masses, corresponding to zeros of the associated Källén function. We prove a closed-form solution for these integrals, showing that they can always be factorized into products of one-loop cases, for all integer-valued propagator powers [1]. As a phenomenologically relevant application [2] within Thermal Field Theory, we extend the factorization proof to massless bosonic two-loop sum-integrals [3].

References

[1] A. I. Davydychev and Y. Schröder, Recursion-free solution for two-loop vacuum integrals with "collinear" masses, JHEP 12 (2022), 047 [arXiv:2210.10593].

[2] P. Navarrete and Y. Schröder, Tackling the infamous g^6 term of the QCD pressure, PoS LL2022 (2022), 014 [arXiv:2207.10151].

[3] A. I. Davydychev, P. Navarrete and Y. Schröder, Factorizing two-loop vacuum sum-integrals, in preparation.

6. **Expositor:** Javier Rosales.
Afiliación: Universidad de Antofagasta.
Título: On S-expansions and other transformations of Lie algebras.
Resumen: The aim of this work is to study the relation between S-expansions and other transformations of Lie algebras. In particular, we prove that contractions, deformations and central extensions of Lie algebras are preserved by S-expansions. We also provide several examples and give conditions so transformations of reduced subalgebras of S-expanded algebras are preserved by the S-expansion procedure.

References

[1] M. A. Alvarez and J. Rosales-Gomez, "On $S-$expansions and other transformations of Lie algebras", [Preprint].

7. **Expositor:** Andrés Anabalón.
   Afiliación: Universidad Adolfo Ibáñez.
   Título: Spin Structures and Supersymmetry.
   Resumen: We consider soliton solutions in AdS_4 with a flat slicing and Wilson loops around one cycle. We study the phase structure and find the ground state and identify supersymmetric solutions as a function of the Wilson loops. We work in the context of a scalar field truncation of gauged $N = 8$ supergravity, where all the dilatons are equal and all the axions vanish in the STU model. In this theory, we construct new soliton solutions parameterized by two Wilson lines. We find that there is a degeneracy of supersymmetric solutions. We also show that, for alternate boundary conditions, there exists a non-supersymmetric soliton solution with energy lower than the supersymmetric one.

8. **Expositor:** Julio Oliva.
   Afiliación: Universidad de Concepción.
   Título: The asymptotic structure of Thurston black holes.
   Resumen: Understanding the asymptotic structure of the spacetime is fundamental for many purposes, as for example defining the initial data of initial (boundary-)value problem for fields propagating on such geometries. Even more, the symmetry group of such asymptotic structure plays an important role in holography [1]. In this talk I will present recent progress on the understanding of the asymptotic structure that accommodates five-dimensional black holes in General Relativity with a negative cosmological constant, with horizons modelled by Solv and Nil geometries [2]. We propose a set of asymptotic behavior on each case, which allows including new slowly rotating solutions, and obtain the asymptotic symmetry group. Using the Covariant Phase Space approach, we compute the asymptotic symmetries associated to the large diffeomorphism, and obtain the canonical realization of the asymptotic symmetry algebra for these Thurston black holes.

References

[1] Juan Martin Maldacena, The Large N limit of superconformal field theories and supergravity, Int.J.Theor.Phys. 38 (1999) 1113-1133, Adv.Theor.Math.Phys. 2 (1998) 231-252, e-Print: hep-th/9711200 [hep-th].

[2] C. Cadeau; E. Woolgar New five-dimensional black holes classified by horizon geometry, and a Bianchi VI brane world, Class.Quant.Grav. 18 (2001) 527-542, e-Print: gr-qc/0011029 [gr-qc].