Black holes and their symmetries

Rapport sur les contributions

https://indico.in2p3.fr/e/36091

ID de Contribution: **1** Type: **Non spécifié**

Third law of black hole mechanics for supersymmetric black holes

mercredi 2 juillet 2025 10:15 (45 minutes)

Orateur: REALL, Harvey

ID de Contribution: **2** Type: **Non spécifié**

Gravitational wave generation beyond General Relativity

jeudi 3 juillet 2025 09:00 (45 minutes)

I will review how non-linearities can allow for screening solar-system scales from non-tensorial gravitational polarizations, focusing on the case of scalar-tensor theories with derivative self-interactions (K-essence). I will then present fully relativistic simulations in these theories in 1+1 dimensions (stellar oscillations and collapse) and 3+1 dimensions (binary neutron stars), showing how to avoid breakdowns of the Cauchy problem that have affected similar attempts in the past. I will show that screening tends to suppress the (subdominant) dipole scalar emission in binary neutron star systems, but that it fails to quench monopole scalar emission in gravitational collapse, and quadrupole scalar emission in binaries.

Orateur: ENRICO, Barausse

ID de Contribution: **3** Type: **Non spécifié**

Free-surface correlations on analogue black-hole water flows

mercredi 2 juillet 2025 16:45 (45 minutes)

Orateur: ROBERTSON, Scott

ID de Contribution: **4** Type: **Non spécifié**

Dynamical formation of regular black holes

vendredi 4 juillet 2025 14:00 (45 minutes)

Orateur: BUENO, Pablo

ID de Contribution: **5** Type: **Non spécifié**

Symmetries and peeling in the extremal Reissner-Nordström spacetime

mercredi 2 juillet 2025 11:00 (45 minutes)

Orateur: GOURGOULHON, Eric

ID de Contribution: **6** Type: **Non spécifié**

Dissipation, boundaries and universality in black hole spacetimes: a hyperboloidal 'non-normal' approach

jeudi 3 juillet 2025 14:45 (45 minutes)

Orateur: JARAMILLO, Jose Luis

ID de Contribution: **7** Type: **Non spécifié**

Equivalence Principle and generalised accelerating black holes from binary systems

vendredi 4 juillet 2025 10:15 (45 minutes)

Orateur: ASTORINO, Marco

ID de Contribution: **8** Type: **Non spécifié**

Deforming black holes and ultracompact objects from the inside and from the outside

mercredi 2 juillet 2025 14:45 (45 minutes)

Orateur: BARCELO SERON, Carlos

ID de Contribution: **9** Type: **Non spécifié**

Hearts of Darkness: the inside-out probing of black holes

jeudi 3 juillet 2025 14:00 (45 minutes)

The standard paradigm of black holes, rooted in Einstein's General Relativity, predicts the existence of singularities. However, the emergence of quantum gravity candidates and new observational technologies have opened the door to exploring regular black holes and black hole mimickers as viable alternatives. These non-singular solutions, which replace the central singularity with a finite-core structure, challenge traditional concepts and offer a path towards understanding gravitational collapse beyond Einstein's framework. In this talk, I will discuss the theoretical foundations of regular black holes and black hole mimickers, and their possible instabilities and phenomenology. I will further explore their observational signatures, ranging from gravitational wave echoes to modifications in black hole images, as a means to distinguish them from classical black holes. In the end I will argue that by leveraging recent advancements in observational astrophysics, we might be at the dawn of a new era for quantum gravity phenomenology.

Orateur: LIBERATI, Stefano

ID de Contribution: **10** Type: **Non spécifié**

Gravitational wave tests of generic EFT-inspired theories of gravity

jeudi 3 juillet 2025 10:15 (45 minutes)

Orateur: BERNARD, Laura

ID de Contribution: **11** Type: **Non spécifié**

Killing horizon data

jeudi 3 juillet 2025 16:00 (45 minutes)

Orateur: MARS, Marc

ID de Contribution: **12** Type: **Non spécifié**

Semiclassical aspects of two-dimensional black holes: singularity resolution via a negative central charge

mercredi 2 juillet 2025 14:00 (45 minutes)

We analyze the semiclassical geometry of two-dimensional (CGHS) black holes in the Boulware vacuum. In this state, the expectation value of the stress-energy tensor is singular at the classical horizon. However, when backreaction effects are taken into account, the resulting geometry becomes horizonless and takes the form of a non-symmetric wormhole, featuring a curvature singularity beyond the throat. Remarkably, reversing the sign of the central charge of the conformal matter eliminates this singularity, yielding a backreacted geometry that is both horizonless and asymptotically flat. We argue that this behavior is largely universal, independent of the specific local counterterm added to the non-local Polyakov action. This result aligns with recent findings obtained in the semiclassical analysis of Schwarzschild geometry within the framework of two-dimensional dilaton gravity. We also discuss the physical significance of negative central charges in conformal anomalies from a four-dimensional perspective.

Orateur: SALAS, Jose Navarro

ID de Contribution: **13** Type: **Non spécifié**

Some unconventional enhanced black hole symmetries with physical implications

vendredi 4 juillet 2025 14:45 (45 minutes)

Exact continuous symmetries play a central role in constraining black hole dynamics. In this talk, I will discuss two examples of non-exact or non-continuous enhanced black hole symmetries that also have physical implications. One is the manifestation of SL(2,R) symmetries within the near-zone region, a region that extends beyond the near-horizon regime and has a non-empty overlap with the far region. This near-zone ("Love") symmetry, albeit approximate in its nature, has the ability to address instances of magic zeroes in the black hole response problem: it outputs the vanishing of the static Love numbers as a selection rule. The other symmetry I will talk about emerges for some asymptotically flat extremal black holes and comes in the form of spatial inversions. First identified by Couch & Torrence, these spatial inversions conformally map the degenerate event horizon onto null infinity, and vice versa. This mapping enforces matching conditions between near-horizon and near–null-infinity data, a direct consequence being the identification between infinite towers of conserved quantities: the near-horizon Aretakis constants and the near–null-infinity Newman-Penrose constants.

Orateur: CHARALAMBOUS, Panagiotis

ID de Contribution: **14** Type: **Non spécifié**

Null infinity as a weakly isolated horizon

vendredi 4 juillet 2025 09:00 (45 minutes)

I will present a common description of null infinity and physical horizons, highlighting the geometric properties they share, and the origin of the radically different physics they describe. The common description offers new perspectives on the different symmetry groups considered at finite distance. I will then show how ambiguities in the construction of charges from Noether's theorem are removed using a prescription due to Wald and Zoupas, for both null infinity and the finite distance case, and how the results match with the method by Ashtekar and Streubel. I will then show how the method of Barnich and Brandt can be also brought in agreement, in particular how the covariance requirement removes any field-dependent 2-cocycle in the realization of the symmetry algebra. Finally, I will summarize the status of the Wald-Zoupas prescription for different enlargements of the BMS symmetry currently under study.

Orateur: SPEZIALE, Simone

ID de Contribution: **15** Type: **Non spécifié**

The memory effect : from numerical to analytic study

vendredi 4 juillet 2025 15:30 (45 minutes)

The displacement of particles hit by a burst of gravitation waves called the Memory Effect, proposed by Braginski, Thorne, Zel'dovich, Polnarev, and others, is studied. The original proposal of Gibbons and Hawking admits only numerical solutions, however ingeneous approximations of the wave profile allow to find analytic solutions.

Orateur: HORVATHY, Peter

ID de Contribution: **16** Type: **Non spécifié**

Exotic properties of strongly interacting matter under acceleration and rotation

vendredi 4 juillet 2025 11:00 (45 minutes)

Recent first-principles lattice simulations of SU(N) Yang-Mills theory in 3+1 dimensions have revealed that the gluon plasma—a precursor to the quark-gluon plasma believed to have existed in the early Universe—exhibits several unexpected equilibrium properties under extreme conditions: (i) a negative moment of inertia within a certain temperature range; (ii) the formation of a thermodynamically stable inhomogeneous mixed phase that does not align with the conventional Tolman–Ehrenfest relation in static gravitational backgrounds; (iii) a rotation-induced enhancement of the critical deconfinement temperature; and (iv) a pronounced softening of the deconfinement transition under linear acceleration. We briefly review these surprising observations and argue that they may share a common origin rooted in the nontrivial coupling of gluonic degrees of freedom to strong gravitational fields, particularly in rotating or accelerated frames.

Orateur: CHERNODUB, Maxim

ID de Contribution: **17** Type: **Non spécifié**

Investigation of Non-Symmetric Black Hole Mimickers

jeudi 3 juillet 2025 16:45 (30 minutes)

This presentation explores the classification of various configurations of non-symmetric black hole mimickers, limited by the conditions of spacetime regularity and geodesic completeness. For physically viable models, test metrics will be presented, and their parameters will be analyzed in light of observational data from black hole shadow experiments. Furthermore, scalar perturbations and the associated quasinormal modes arising in these spacetimes will be discussed.

Orateur: TAGIEV, Vagif

ID de Contribution: **18** Type: **Non spécifié**

Breaking the SYMMETRIES in ANALOG GRAVITY or Why Experiments are DIFFICULT? The Point of View of Interfacial Hydrodynamics

mercredi 2 juillet 2025 16:00 (45 minutes)

Orateur: ROUSSEAUX, Germain

ID de Contribution: **19** Type: **Non spécifié**

TBA

jeudi 3 juillet 2025 11:00 (45 minutes)

Orateur: DIAS, Oscar

ID de Contribution: **20** Type: **Non spécifié**

TBA

jeudi 3 juillet 2025 17:15 (30 minutes)

Orateur: VOLKOV, Mikhael

ID de Contribution: **21** Type: **Non spécifié**

TBA

jeudi 3 juillet 2025 17:45 (30 minutes)

Orateur: GERVALLE, Romain