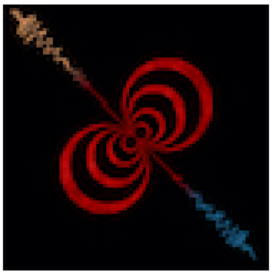

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J. Lemos: Thermodynamics of Schwarzschild-de Sitter and Nariai spaces in the 50 years of Bekenstein's black hole entropy

Monday 19 December 2022 09:15 (15 minutes)

In 1972 Bekenstein put forward the idea that a black has an entropy S proportional to its area A in Planck units. Bekenstein's black hole entropy was published in Nuovo Cimento. Hawking, developing quantum field theory calculations in curved spacetime, soon showed that the constant of proportionality in the entropy formula is one quarter, so that S = A/4, and that indeed a black hole has temperature. With the Bekenstein-Hawking entropy and the Hawking temperature formulas, the discipline of black hole thermodynamics was born. After 50 years of Bekentein's paper, we are still exploring its extraordinary consequences that led to a better understanding of low energy quantum gravity and with it of how general relativity and quantum theory might unite in a full proper quantum gravity. Here, we use the Euclidean path integral approach to quantum gravity to study the statistical mechanics and thermodynamic behavior of the Schwarzschild-de Sitter and Nariai spaces in the canonical ensemble. For both these spaces one can place two types of heat reservoirs that imply two independent physical settings. In one setting there is an outer reservoir that harbors the black hole horizon, in the other setting there is an inner reservoir that discloses the cosmological horizon. In Schwarzschild-de Sitter, the results related to the outer reservoir are much the same as the ones for pure Schwarzschild found by York in 1986, nevertheless there are a few interesting differences due to the existence of the additional scale parameter associated with the cosmological constant, whereas the problem related to the inner reservoir and the corresponding cosmological horizon has not been explicitly formulated before. In Nariai, there are intriguing surprises. These will be the main focus of the talk.
Collaborators: This work is in collaboration with Oleg Zaslavskii.

Session Classification: Session 1