Contribution ID: **50** Type: **Talk**

Black holes, horizons and tetrads in New General Relativity

Monday 30 June 2025 16:55 (25 minutes)

Due to GR's age as a theory, many coordinate systems have been developed for it, each of which is specialized for some particular application. However, extensions of GR often lack these coordinate systems, as the GR ones are not trivially generalizable. In this thesis, we seek to develop such coordinate systems for New General Relativity (NGR), specifically in the context of black hole analysis and taking inspiration from known systems in GR. By making use of such coordinate systems, one may gain better insights into the geometric properties of black holes, such as the properties of horizons. In addition, one may analyze the mathematical properties of the tetrad of the black hole spacetime, which, as the basic dynamical object of NGR, opens up more avenues of research into black holes in NGR. We develop three coordinate systems for 1-parameter NGR, based on the Kruskal-Szekeres, Eddington-Finkelstein and Gullstrand-Painlevé coordinates from GR. We find that the 1PNGR version of the KS metric can be obtained both through a coordinate transformation of a known Schwarzschild-like solution and also from a completely new "KS-like" solution, the tetrad of which is non-singular at the horizon under a certain choice of parameters. However, this same solution is asymptotically complex and therefore the corresponding spacetime cannot be defined on the entire coordinate space. For the EF and GP coordinates, we find that the same is possible, but the new tetrads do not satisfy the field equations, except for zero-mass cases. In addition, the tetrads in these coordinates are inevitably singular at the horizon. Due to the possibility of these coordinate transformations, all systems present a Killing, Cauchy, and apparent horizon at r=2M.

Author: KULL, Paul Martin (University of Tartu)

Presenter: KULL, Paul Martin (University of Tartu)

Session Classification: Monday Parallel 3 - A106

Track Classification: Contributed talks