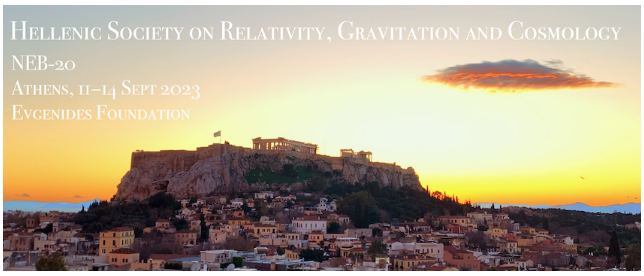

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Ehlers Transformations as a Tool for Constructing Accelerating NUT Black Holes

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This paper investigates the integrability properties of Einstein's theory of gravity in the context of accelerating NUT spacetimes by utilizing Ernst's description of stationary and axially symmetric electro-vacuum solutions. We employ Ehlers transformations, Lie point symmetries of the Einstein field equations, to efficiently endorse accelerating metrics with a nontrivial NUT charge. Under this context, we begin by re-deriving the known C-metric NUT spacetime described by Chng, Mann, and Stelea in a straightforward manner, and in the new form of the solution introduced by Podolský and Vrátný. Next, we construct for the first time an accelerating NUT black hole dressed with a conformally coupled scalar field. These solutions belong to the general class of type I spacetimes, therefore cannot be obtained from any limit of the Plebański-Demiański family whatsoever and their integration needs to be carried out independently. Including Maxwell fields is certainly permitted, however, the use of Ehlers transformations is subtle and requires further modifications. Ehlers transformations do not only partially rotate the mass parameter such that its magnetic component appears, but also rotate the corresponding gauge fields. Notwithstanding, the alignment of the electromagnetic potentials can be successfully performed via a duality transformation, hence providing a novel Reissner-Nordström-C-metric NUT black hole that correctly reproduces the Reissner-Nordström-C-metric and Reissner-Nordström-NUT configurations in the corresponding limiting cases. We describe the main geometric features of these solutions and discuss possible embeddings of our geometries in external electromagnetic and rotating backgrounds.

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