

Theory: On the nature of Bondi-Metzner-Sachs transformations

Monday, September 4, 2023 3:00 PM (15 minutes)

This work investigates, as a first step, the four branches of BMS transformations, motivated by the classification into elliptic, parabolic, hyperbolic and loxodromic proposed a few years ago in the literature. We first prove that to each normal elliptic transformation of the complex variable z used in the metric for cuts of null infinity, there is a corresponding BMS supertranslation. We then study the conformal factor in the BMS transformation of the u variable as a function of the squared modulus of z . In the loxodromic and hyperbolic cases, this conformal factor is either monotonically increasing or monotonically decreasing as a function of the real variable given by the modulus of z . The Killing vector field of the Bondi metric is also studied in correspondence with the four admissible families of BMS transformations. Eventually, all BMS transformations are re-expressed in the homogeneous coordinates suggested by projective geometry. It is then found that BMS transformations are the restriction to a pair of unit circles of a more general set of transformations. Within this broader framework, the geometry of such transformations is studied by means of its Segre manifold.

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