

A spin correction to Coulomb interaction based on Kerr-Newmann solution

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The complex shift introduced by Appell and used by Sommerfeld and Synge in introducing a nontrivial electromagnetic field with a ring singularity from the Coulomb field has an intimate relation to the Newman-Janis transformation in the context of exact solutions of GR. Such a constructed electromagnetic field, called the magic field by Lynden-Bell, coincides with the electromagnetic sector of the Kerr-Newman solution of Einstein-Maxwell theory. The Riemann surface of the analytic continuation of the magic field matches the analytic extension of massless Kerr or zero-G limit of Kerr-Newman. This field is also referred to as the square root of Kerr in more recent works on double-copy formalism. After briefly reviewing some of these points in this talk, I will report the results of calculating the interaction Lagrangian of two magic fields in a static situation, which will correct the Coulomb interaction with respect to the spin of the fields.

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