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RESEARCH ARTICLE

Charged cosmic strings interacting with gravitational and electromagnetic waves

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Abstract Under a particular choice of the Ernst potential, we solve analytically the Einstein–Maxwell equations to derive *a new exact solution* depending on *five parameters*: the mass, the angular-momentum (per unit mass), α, the electromagnetic-field strength, k, the parameter-p and the Kerr-NUT parameter, l. This (Petrov Type D) solution is cylindrically symmetric and represents the curved background around a charged, rotating cosmic string, surrounded by gravitational and electromagnetic waves, under the influence of the Kerr-NUT parameter. A C-energy study in the radiation zone suggests that both the incoming and the outgoing radiation is gravitational, strongly focused around the null direction and preserving its profile. In this case, the absence of the k-parameter from the C-energy implies that, away from the linear defect the electromagnetic field is too weak to contribute to the energy-content of the cylindrically symmetric space-time under consideration. In order to explain this result, we have evaluated the Weyl and the Maxwell scalars near the axis of the linear defect and at the spatial infinity. Accordingly, we have found that the electromagnetic field is concentrated (mainly) in the vicinity of the axis, while falling-off prominently at large radial distances. However, as long as $k \neq 1$, the non-zero Kerr-NUT parameter

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