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Zero mass limit of Kerr spacetime is a wormhole

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Abstract

© 2017 American Physical Society. We show that, contrary to what is usually claimed in the literature, the zero mass limit of Kerr spacetime is not flat Minkowski space but a spacetime whose geometry is only locally flat. This limiting spacetime, as the Kerr spacetime itself, contains two asymptotic regions and hence cannot be topologically trivial. It also contains a curvature singularity, because the power-law singularity of the Weyl tensor vanishes in the limit but there remains a distributional contribution of the Ricci tensor. This spacetime can be interpreted as a wormhole sourced by a negative tension ring. We also extend the discussion to similarly interpret the zero mass limit of the Kerr-(anti-)de Sitter spacetime.

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