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Classification of Cosmological Wormhole Solutions in the Framework of General Relativity

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Abstract : We explore the effect of expanding space on the exoticity of the matter supporting a traversable Lorentzian wormhole of zero radial tide whose line element is given by ds2 = dt^2 − a^2(t)[dr^2/(1 − kr2 −b(r)/r)+ r2dΩ^2 in the context of General Relativity. This task is achieved by deriving the Einstein field equations for anisotropic matter field corresponding to the considered cosmological wormhole metric and performing a clas□sification of their solutions on the basis of a variable equations of state (EoS) of the form p = ω(r)ρ. Explicit forms of the shape function b(r) and the scale factor a(t) arising in the classification are utilized to construct the corresponding energy-momentum tensor where the energy conditions for each case is investigated. While the violation of energy conditions is inevitable in case of static wormholes, the classification we performed leads to interesting solutions in which this violation is either reduced or eliminated.

Keywords : general relativity, Einstein field equations, energy conditions, cosmological wormhole
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