

Exact wormhole solutions with nonminimal kinetic coupling

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Abstract

© 2014 American Physical Society. We consider static spherically symmetric solutions in the scalar-tensor theory of gravity with a scalar field possessing the nonminimal kinetic coupling to the curvature. The Lagrangian of the theory contains the term $(g_{\mu\nu} + \eta G_{\mu\nu})\phi_{,\mu}\phi_{,\nu}$ and represents a particular case of the general Horndeski Lagrangian, which leads to second-order equations of motion. We use the Rinaldi approach to construct analytical solutions describing wormholes with nonminimal kinetic coupling. It is shown that wormholes exist only if $\eta = -1$ (phantom case) and $\eta > 0$. The wormhole throat connects two anti-de Sitter spacetimes. The wormhole metric has a coordinate singularity at the throat. However, since all curvature invariants are regular, there is no curvature singularity there.

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