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Cosmic stringlike objects in hybrid metric-Palatini gravity

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We consider static and cylindrically symmetric interior string type solutions in the scalar-tensor representation of the hybrid metric-Palatini modified theory of gravity. As a first step in our study,we obtain the gravitational field equations and further simplify the analysis by imposing Lorentz invariance along the t and z axes, which reduces the number of unknown metric tensor components to a single function $W^2(r)$. In this case, the general solution of the field equations can be obtained,for an arbitrary form of the scalar field potential, in an exact closed parametric form, with the scalar field taken as a parameter. We consider in detail several exact solutions of the field equations, corresponding to a null and constant potential, and to a power-law potential of the form
$V() = V_0{}^{3/4}$, in which the behaviours of the scalar field, of the metric tensor components and of the string tension can be described in a simple mathematical form. We also investigate the string models with exponential and Higgs type scalar field potentials by using numerical methods. In this way we obtain a large class of novel stable string-like solutions in the context of hybrid metric-Palatini gravity, in which the basic parameters, such as the scalar field, metric tensor components, and string tension, depend essentially on the initial values of the scalar field, and of its derivative,on the $r = 0$ circular axis.

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