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Killing Symmetries for Chiral Self-Gravitating Models Connected with f(R, (\nabla R)^2, \Box R) Gravity

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Abstract: The modified gravity models with higher derivatives with respect to scalar curvature can be transformed to GR with a few scalar fields using Lagrange multipliers and a conformal transformation from Jordan to Einstein frame. Such resulting models can be presented as Chiral Self-Gravitating Models with fixed functional dependence for a chiral (target) space and the potential energy. In the present contribution, we study Killing symmetries for the chiral spaces corresponding to $f(R, (\nabla R)^2)$, $f(R, \Box R)$ and few versions of $f(R, (\nabla R)^2, \Box R)$ gravity. Special investigation is devoted to the modified $f(R)$ gravity with a kinetic scalar curvature of the form: $f(R, (\nabla R)^2, \Box R) = f_1(R) + X(R) \nabla_\mu R \nabla^\mu R$. We investigate connection of obtained Killing vectors of target space with Killing symmetry of Friedmann-Robertson-Walker and spherically symmetric spacetimes with the aim to find exact solutions of the models under consideration.

Keywords: modified gravity; Killing symmetry; chiral self-gravitating model