ON SOME MODELS OF NON-LOCAL MODIFIED GRAVITY

Zoran Rakić

ABSTRACT. Despite to all significant gravitational phenomena discovered and predicted by general theory of relativity, it is not a complete theory. One of actual approaches towards more complete theory of gravity is its nonlocal modification.

We consider nonlocal modification of the Einstein theory of gravity in framework of the pseudo-Riemannian geometry. The nonlocal term has the form $\mathcal{H}(R)\mathcal{F}(\Box)\mathcal{G}(R)$, where $\mathcal{H}$ and $\mathcal{G}$ are differentiable functions of the scalar curvature R, and $\mathcal{F}(\Box) = \sum_{n=0}^{\infty} f_n \Box^n$ is an analytic function of the d'Alambert operator $\Box$. Our motivation to modify gravity, in an analytic nonlocal way, comes mainly from string theory, in particular from string field theory and p-adic string theory.

Using the calculus of variations we derived the corresponding equations of motion. The variation of action is induced by variation of the metric tensor $g_{\mu\nu}$. Firstly, we consider several models of the above-mentioned type, as well as the case when the scalar curvature is constant.

Recently, we deal with the cases where: (1) $\mathcal{H}(R) = \mathcal{G}(R) = R - 4\Lambda$, and (2) $\mathcal{H}(R) = \mathcal{G}(R) = \sqrt{R - 2\Lambda}$. Specially, we are paid our attention to the case (2) with scaling factor of the form $a(t) = At^{\frac{2}{3}} e^{\frac{\Lambda}{14} t^2}$, and we find some new cosmological solutions, and we test validity of obtained solutions with experimental data.

References

1. I. Dimitrijevic, B. Dragovich, A. S. Koshelev, Z. Rakic, J. Stankovic, *Cosmological solutions of a nonlocal square root gravity*, Physics Letters B **797** (2019), 134848.
2. I. Dimitrijevic, B. Dragovich, A. S. Koshelev, Z. Rakic, J. Stankovic, *Some cosmological solutions of a new nonlocal gravity model*, Symmetry **12**(6) (2020), 917.
3. I. Dimitrijevic, B. Dragovich, Z. Rakic, J. Stankovic, *New cosmological solutions of a nonlocal gravity model*, Symmetry **14**(1) (2022), 3.

Faculty of Mathematics University of Belgrade, Belgrade, Serbia.