On the square root model and its cosmological solutions

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Many significant gravitational phenomena have been predicted and discovered by General Relativity (GR), despite of all the successes and many nice theoretical properties, GR is not complete theory of gravity. We consider non-local modification of GR in framework of the pseudo-Riemannian geometry, with the non-local term of 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 $\mathcal{F}(\Box) = \sum_{n=0}^{\infty} f_n \Box^n$ where f_n are 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 calculus of variations of the action induced by the metric tensor $g_{\mu\nu}$, we derived the corresponding equations of motion. In the first part of lecture, we consider several models of the above mentioned type, as well as the case when the scalar curvature is constant. Specially, we are paid our attention to the case where $\mathcal{H}(R) = \mathcal{G}(R) = \sqrt{R - 2\,\Lambda}$, with scaling factor of the form $a(t) = At^{\frac{2}{3}}\, e^{\frac{\Lambda}{14}\, t^2}$, and find some new cosmological solutions and we test validity of obtained solutions with experimental data.

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