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Cosmology in delta Gravity: A Classical Analysis and Phenomenology

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We present a model of the gravitational field based on two symmetric tensors, $g_{\mu\nu}$ and $\tilde{g}_{\mu\nu}$. Besides, we have a new matter field given by $\tilde{\phi}_I = \tilde{\delta}\phi_I$, where ϕ_I are the original matter fields. We call them $\tilde{\delta}$ matter fields. This model, called $\tilde{\delta}$ Gravity, has excellent properties at the quantum level. It lives at one loop only, the classical equations of motion of the original fields are preserved and it is a finite quantum theory in vacuum. We find that massive particles do not follow geodesics, while trajectories of massless particles are null geodesics of an effective metric. We analyze some cases to study the effect of the new gravitational field. Firstly, we see the Schwarzschild case, where we get a modified deflection of the light produced by the sun. Secondly, we see the Non-Relativistic case, where we obtain the Post-Newtonian limit. We do a little analysis in the Newtonian limit to interpret $\tilde{\delta}$ matter like a dark matter contribution. Thirdly, we see the Cosmological case, where we get an accelerated expansion of the Universe without dark energy. A Big-Rip is necessary to explain the expansion. Additionally, we obtain a modified age of the universe and when the Big-Rip will happen. Finally, we introduce the effect of $\tilde{\delta}$ Gravity in inflation in a background level.

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