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Noether symmetrical gravity Lagrangian as a fourth order polynomial in Ricci and Gauss-Bonnet scalars not involving a cosmological constant or dark matter

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An extension of the action of the General Relativity in a form of Noether symmetrical fourth order polynomial in the Riemann curvature tensor is suggested and discussed as a possible fundamental theory of gravity in 4-dimensional space-time in direct analogy with the standard fundamental theory of the particle physics with the Lagrangian being polynomial in fundamental fields as well. The geometrical part of the suggested gravity Lagrangian is derived to be $L = (1/2k)R(1 + G/Gp) + G^2/(GpHi^4)$. Here R is the Ricci scalar, G - the Gauss-Bonnet topological invariant, $k = 8\pi GN/c^4$ is the Einstein constant, c - the speed of light, GN - the Newton constant of gravitational attraction, Gp – a new constant of the gravitational repulsion which is indicated by the observed late-time accelerated expansion of the Universe, and Hi is a constant introduced in respect with the cosmological inflation at the initial stage of Universe evolution. In this theory there is no need for contributions of the very problematic dark energy (cosmological constant) or dark matter. The best fit to the SN Ia supernova data for the luminosity distances with respective red shifts (z) or to data for the baryon acoustic oscillations makes possible to estimate values of the Hubble constant H0, deceleration constant q0 and the values of two parameters of this gravity Lagrangian: Gp, and Hi. In addition, the mean square weighted deviation from these data for the suggested theory of gravity is found to be about 3 times smaller than for the standard cosmological (ΛCDM) model. Some predictions made by this theory of gravity for a possible evolution of the Universe are also discussed.

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