

GRAVITATIONAL SINGULARITY IN POINCARÉ GAUGE THEORY

M. Blagojević, D.S. Popović and Dj. ŽivanovićBoris Kidrič Institute, Beograd, Institute of Physics,
Beograd, Faculty of Nat. Sci. and Math., Beograd

The problem of the existence of gravitational singularity in Poincaré gauge theory is studied.

Demanding that the gravitational Lagrangian density \mathcal{L}_G be at most quadratic in gauge field strengths (torsion and curvature) and invariant under space reflection, one finds

$$\mathcal{L}_G = aF + \mathcal{L}_T + \mathcal{L}_F$$

where \mathcal{L}_T contains three terms quadratic in torsion, \mathcal{L}_F contains five independent terms quadratic in curvature. F is scalar curvature and $a = -1/16 \kappa G$ (G is Newton's gravitational constant). The constants are chosen so that all tordions are massive.

We investigate the case of homogenous and isotropic space, with the torsion $C_{10}^1 = C_{20}^2 = C_{30}^3 = C(t)$, the other components being zero; we also assume that the matter spin tensor is zero. The generalized Friedman's cosmological equation for metric scaling factor $R(t)$ is obtained, and two limiting cases of dusty matter ($p=0$) and radiation ($p = \rho/3$) are considered.

When there are no propagating tordions, we found that there exist minimum of the metric scaling function $R(t)$ at $t=0$.

In the general case, corresponding to the existence of one scalar propagating tordion, it is found that the minimum of $R(t)$ at $t=0$ exists if constants in the theory (f, β, D or D' , k) satisfy certain relation. It is possible, at the same time, to have large-scale behaviour of $R(t)$ closely resembling standard GR case.