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All-scale cosmological perturbations and screening of gravity in inhomogeneous Universe

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Without exceeding the limits of the concordance cosmological model, all-scale scalar and vector perturbations of the homogeneous background are derived analytically for arbitrarily distributed inhomogeneities (discrete gravitating masses) as their nonrelativistic sources. The obtained expressions for the metric corrections converge everywhere in voids, have zero average values, and conform to Minkowski background limit and Newtonian cosmological approximation as particular cases. Moreover, the uniform matter distribution limit as one more crucial test is easily passed as well. It is rigorously proven that gravitational attraction between inhomogeneities is governed by Yukawa law, covering the whole space and coming up to take place of Newtonian gravitation, which is restricted exclusively to sub-horizon distances. The finite time-dependent screening length (amounting to 3.7 Gpc at present) is determined by the average rest mass density of nonrelativistic matter and provides natural estimates of the homogeneity scale, the upper limit of the cosmic structure dimension, and the bound to a spatial domain of probable structure development.

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Summary

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