

PERTURBATIONS OF LOCALLY ROTATIONALLY SYMMETRIC COSMOLOGIES

Gauge invariant first order perturbations of homogeneous orthogonal LRS (Locally Rotationally Symmetric) class II cosmologies with cosmological constant are considered in the framework of the 1+1+2 covariant decomposition of spacetime. The perturbations, which are of perfect fluid type, include general scalar, vector and tensor modes.

A harmonic decomposition is performed and the field equations are then reduced to a set of eight evolution equations for eight harmonic coefficients, representing perturbations in density, shear, vorticity and the Weyl tensor, in terms of which all other variables can be expressed algebraically. This system decouples into two sub-systems, one for five and one for three coefficients.

As is well known, vorticity cannot be generated in a perfect fluid with a barotropic equation of state, but an already existing vorticity acts as source terms in the evolution equations for the other quantities. The time development of the vorticity degrees of freedom are to first order completely determined by the background.

In the high frequency approximation the four independent Weyl tensor harmonics evolve as gravitational waves on the anisotropic background.