Tsagas, Christos G.; **Barrow, John D.**

A gauge-invariant analysis of magnetic fields in general-relativistic cosmology. (English)

Zbl 0888.53071
Classical Quantum Gravity 14, No. 9, 2539-2562 (1997).

The gauge-invariant treatment of cosmological perturbations, introduced by G. F. R. Ellis and M. Bruni (1989, 1990) for perfect fluid cosmologies, is extended to the case of electric and magnetic fields in a universe which also contains a perfect fluid. This formalism identifies a combination of gauge-invariant variables which specify the evolution of the perturbations in an invariant manner. It offers several advantages over the gauge-invariant approach of J. M. Bardeen (1980), most notably by virtue of its transparent physical interpretation. The exact nonlinear equations for general relativistic magnetohydrodynamic evolution are derived. Further, the behaviour of small perturbations to Friedmann universes is studied, a comparison is made with earlier Newtonian treatment of cosmological perturbations and some effects of inflationary expansion are examined.

Reviewer: T.Singh (Varanasi)

MSC:

53Z05	Applications of differential geometry to physics
83F05	Relativistic cosmology
83C50	Electromagnetic fields in general relativity and gravitational theory
83C55	Macroscopic interaction of the gravitational field with matter (hydrodynamics, etc.)

Keywords:

primordial magnetic field; cosmological perturbations; inflation

Full Text: DOI arXiv