

**Delgado Gaspar, I.; Pérez Martínez, A.; Piccinelli, G.; Sussman, Roberto A.**  
**A non-perturbative study of the evolution of cosmic magnetised sources.** (English)

Zbl 1332.83108

Gen. Relativ. Gravitation 48, No. 1, Paper No. 7, 26 p. (2016).

**Summary:** We undertake a hydrodynamical study of a mixture of tightly coupled primordial radiation, neutrinos, baryons, electrons and positrons, together with a gas of already decoupled dark matter WIMPS and an already existing “frozen” magnetic field in the infinite conductivity regime. Considering this cosmic fluid as the source of a homogeneous but anisotropic Bianchi I model, we describe its interaction with the magnetic field by means of suitable equations of state that are appropriate for the particle species of the mixture between the end of the leptonic era and the beginning of the radiation-dominated epoch. Fulfilment of observational bounds on the magnetic field intensity yields a “near FLRW” (but strictly non-perturbative) evolution of the geometric, kinematic and thermodynamical variables. This evolution is roughly comparable to the weak field approximation in linear perturbations on a spatially flat FLRW background of sources in which the frozen magnetic fields are coherent over very large supra-horizon scales. Our approach and results may provide interesting guidelines in potential situations in which non-perturbative methods are required to study the interaction between magnetic fields and the cosmic fluid.

**MSC:**

- 83F05 Cosmology
- 85A30 Hydrodynamic and hydromagnetic problems in astronomy and astrophysics
- 76W05 Magnetohydrodynamics and electrohydrodynamics
- 83C55 Macroscopic interaction of the gravitational field with matter (hydrodynamics, etc.)
- 80A10 Classical and relativistic thermodynamics
- 83C25 Approximation procedures, weak fields in general relativity and gravitational theory

**Keywords:**

cosmology; classical general relativity; self-gravitating systems; fermion systems and electron gas

**Full Text:** [DOI](#) [arXiv](#)

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