Contribution ID : **28** Type : **Plenary/section talk**

Cosmological and astrophysical magnetic fields in turbulent matter

Tuesday, 3 October 2017 16:45 (15)

We study the evolution of cosmological and astrophysical magnetic fields driven by the chiral magnetic effect and accounting for the turbulence of background matter. We start with the consideration of the physics concepts underlying the proposed model, such as the chiral magnetic effect (including the case when the electroweak interaction with background matter is present), the relativistic hydrodynamics, the magnetic helicity, and the modified Faraday equation. Then we discuss the model to take into account the turbulent motion of matter in the description of the evolution of the magnetic field. On the basis of this model we derive the new kinetic equations for the spectra of the magnetic energy and the magnetic helicity accounting for the chiral magnetic effect. Out results are compared with the findings of earlier studies.

As one of the applications of this model we discuss the evolution of magnetic fields in the early universe after the electroweak phase transition. For this purpose, the basic kinetic equations rewritten in conformal variables are supplemented by the equation for the evolution of the chiral imbalance. Basing on the solution of the obtained system, we find the dependences of the chiral imbalance, the magnetic field strength, and the magnetic helicity on the temperature of the cooling universe.

Another example illustrating the developed model consists in the description of small-scale magnetic fields generated in quark matter, taking into account the electroweak interaction of quarks. For this purpose, the system of the basic equations is supplemented by the corresponding correction to the chiral magnetic effect. The evolution of magnetic fields described in this model is applied to explain the bursts of highly magnetized compact stars known as magnetars.

References

1. M. Dvornikov, V.B. Semikoz, The influence of the turbulent motion on the chiral magnetic effect in the early universe, Phys. Rev. D 95, 043538 (2017), arXiv:1612.05897.
2. M. Dvornikov, Magnetic fields in turbulent quark matter and magnetar bursts, arXiv:1612.06540.

Primary author(s) : Dr. DVORNIKOV, Maxim (Institute of Terrestrial Magnetism, Ionosphere and Radiowave Propagation (IZMIRAN))

Presenter(s) : Dr. DVORNIKOV, Maxim (Institute of Terrestrial Magnetism, Ionosphere and Radiowave Propagation (IZMIRAN))

Session Classification : Gravitation and Cosmology - 2

Track Classification : Gravitation and cosmology