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Thin layer axion dynamo

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We study interacting classical magnetic and pseudoscalar fields in frames of the axion electrodynamics. A large scale pseudoscalar field can be the coherent superposition of axions or axion like particles. We consider the evolution of these fields inside a spherical clump. Decomposing the magnetic field into the poloidal and toroidal components, we take into account their symmetry properties. Within a spherical clump, we use a thin layer approximation in the induction and Klein-Gordon equations, where the dependence of the fields on the latitude is accounted for. Then, we derive the dynamo equations in the low mode approximation. The non-linear evolution equations for the harmonics of the magnetic and pseudoscalar fields are solved numerically. As an application, we consider a dense axion star embedded in solar plasma. The behavior of the harmonics and their typical oscillations frequencies are obtained. We suggest that such small size axionic objects, containing oscillating magnetic fields, can cause electromagnetic flashes, recently observed in the solar corona, contributing to the corona heating.

References

M. Dvornikov, Thin layer axion dynamo, to be published in Eur. Phys. J. C, arxiv:2401.03185.

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