

A Supersymmetric Extension of Axionic Electrodynamics: From Axions and Photons to Axinos and Photinos

In this contribution, we investigate a supersymmetric effective extension of axionic electrodynamics by adopting the superspace/superfield approach. Rather than focusing on UV-complete axion models, our goal is to analyze how supersymmetry modifies the dynamical and propagating sectors of axion electrodynamics at the effective-field-theory level. In terms of component fields, the resulting Lagrangian describes the interactions among the axion, the photon, and their respective supersymmetric partners, the axino, the saxion and the photino. Supersymmetry induces new fermionic self-interactions and a non-polynomial interaction involving the axino, the photino, and the saxion. An interesting aspect to be highlighted is the appearance of fermionic bilinear contributions involving the photino to both the permittivity and permeability tensors of the constitutive relations. We also pay special attention to the dispersion relations in both the bosonic and fermionic sectors, and analyze the effective masses of the different particles in the presence of an external magnetic background, which induces supersymmetry breaking. Finally, with the help of numerical methods, we identify a class of axionic and electromagnetic-field configurations whose profiles resemble magnetic vortex-like configurations.

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