

# Electromagnetic couplings of axions

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We show that, contrary to assertions in the literature, the main contribution to the axion-photon coupling need not be quantized in the units proportional to  $e^2$ . In particular, we discuss a loophole in the argument for this quantization and then provide explicit counterexamples. Hence, we construct a generic axion-photon effective Lagrangian and find that the axion-photon coupling may be dominated by previously unknown Wilson coefficients. We show that this result implies a significant modification of conventional axion electrodynamics and sets new targets for axion experiments. At the core of our theoretical analysis lies a critical reexamination of the interactions between axions and magnetic monopoles. We show that, contrary to claims in the literature, magnetic monopoles need not give mass to axions. Moreover, we find that a future detection of an axion or axion-like particle with certain parameters can serve as evidence for the existence of magnetically charged matter.

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