

The Astrophobic Axion

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Reliable estimates of the allowed range for axion couplings to photons, nucleons and electrons are of major importance for determining the viable axion mass window as well as to focus experimental axion searches. We show that in a class of generalized DFSZ axion models with generation dependent Peccei-Quinn charges the axion couplings to nucleons and electrons can be simultaneously suppressed. Astrophysical limits from the SN1987A burst duration and from white dwarf cooling can therefore be relaxed, and as a consequence for such an astrophobic axion a mass window up to $O(0.1)$ eV remains open. Since the axion-photon coupling remains sizeable, the proposed IAXO helioscope will become crucial to search for axions of this type.

An unavoidable consequence of astrophobia are flavor off-diagonal axion couplings at tree-level, so that experimental limits on flavor-violating processes can also provide a powerful tool to constrain this scenario. The astrophobic axion can be a viable dark matter candidate in the heavy mass window, and can also account for anomalous energy loss in stars.

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