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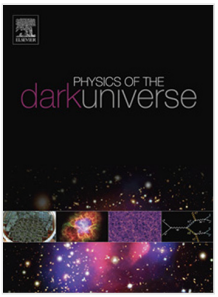

Limits on axion-photon coupling or on local axion density: Dependence on models of the Milky Way's dark halo

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Limits on axion-photon coupling or on local axion density: Dependence on models of the Milky Way's dark halo

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Abstract

The μeV-scale axion is a compelling cold dark matter candidate. The Axion Dark Matter eXperiment (ADMX) searches for axions by stimulating the decay of galactic dark matter halo axions into detectable microwave photons by their conversion in a resonant cavity permeated by a strong, static magnetic field. The signal depends on properties of the Milky Way's dark matter halo; the choice of halo model has significant implications for the sensitivity of direct detection searches, e.g., ADMX. This paper explores the sensitivity of the data taken by ADMX from 2008 to 2010 to various dark matter halo models. New models for the phase-space distribution of local axions are considered; the analysis demonstrates that certain assumptions about the dark matter halo improve limits on axion-photon coupling. In addition, new ADMX data covering 860 – 892 MHz are included in the analysis.

1. Introduction

Experiments and observations have placed limits on axion-photon couplings or on the local axion density. The construction of limits from direct-detection searches requires properties of the Milky Way's dark matter halo. The details of these properties are unknown; therefore, limits are dependent upon the assumption of a halo model. Typically, exclusion limits are generated using the most basic and conservative model: an isothermal distribution. In this paper, models of the Milky Way's dark matter halo with additional structure are used to set limits on axion-photon coupling (or, equivalently on the axion density) using data from the ADMX detector.

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