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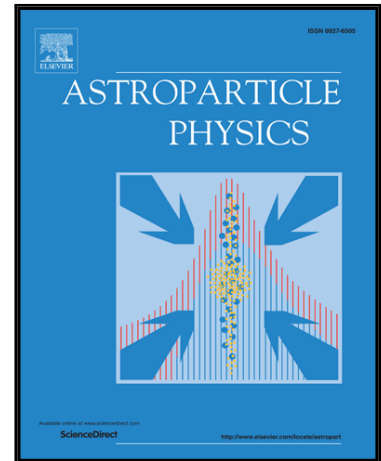
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Active galaxies can make axionic dark energy

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Abstract

AGN jets carry helical magnetic fields, which can affect dark matter if the latter is axionic. This preliminary study shows that, in the presence of strong helical magnetic fields, the nature of the axionic condensate may change and become dark energy. Such dark energy may affect galaxy formation and galactic dynamics, so this possibility should not be ignored when considering axionic dark matter.

Keywords: axion; dark matter; dark energy; helical magnetic field; active galactic nuclei jets

1 Introduction

As supersymmetric particles have not been observed in the LHC yet, interest in axionic dark matter is increasing. Such dark matter has a loop-suppressed interaction with the electromagnetic field, which opens up observational possibilities that aim to exploit the photon-axion conversion in astrophysical magnetic fields. Many authors have considered the electromagnetic interaction of axion particles [1]. However, the effect of this interaction to the axionic condensate itself has been largely ignored, assuming that it is negligible. In this paper we investigate the effect of an helical magnetic field on an axionic condensate. We find that, if the magnetic field is strong enough, axionic dark matter is modified to lead to the violation of the strong energy condition and behave as dark energy.¹ Then we apply our findings to the helical magnetic fields in the jets of Active Galactic Nuclei (AGN). We find that the magnetic fields near the central supermassive black hole may be strong enough

¹Axionic dark energy has been proposed before, see for example Ref. [2].

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