Constraints to dark-matter properties from asteroseismic analysis of KIC 2009504

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Abstract

Asteroseismology is an unique tool to provide us with valuable information about the interior of stars. In the golden era of the CoRoT and the Kepler space telescopes, thousands of high precision time series of pulsating stars were obtained and further analysed using asteroseismology. From Kepler data, Silva-Aguirre et al. (2013) were able to detect for the first time the presence of a convective core in a main-sequence solar-like pulsator. This star, KIC 2009504 (also known as Dushera) was found by the authors to have a mass of 1.15+-0.04 MSun and an age of 3.80+-0.37 Gyr. Casanellas & Lopes (2013) showed that asteroseismology can be used to constrain some properties of dark-matter (DM) particles. They argued that a fraction of weakly interacting DM candidates with an intrinsic matter-anti matter asymmetry (ADM) do not annihilate after being gravitationally captured by stars and, thus, influence their internal structure. One outcome of this interaction is the suppression of the convective core expected to be present in main-sequence stars with masses between 1.1 and 1.3MSun in a dark-matter free scenario. In this work we show the results of modelling Dushera when including a dark-matter scenario. We present some constraints on the properties of ADM in order to allow the presence of the convective core in this star.

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