A Pictorial Representation of Current Constraints on Condensed Dark Matter

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Abstract

This document provides a graph representing the current constraints on Compact Ultra-Dense Objects (CUDOs)[1;2]. It is intended to be updated as new constraints are published or found. For background to this figure, see[3;4].

Keywords:

1. Acknowledgements

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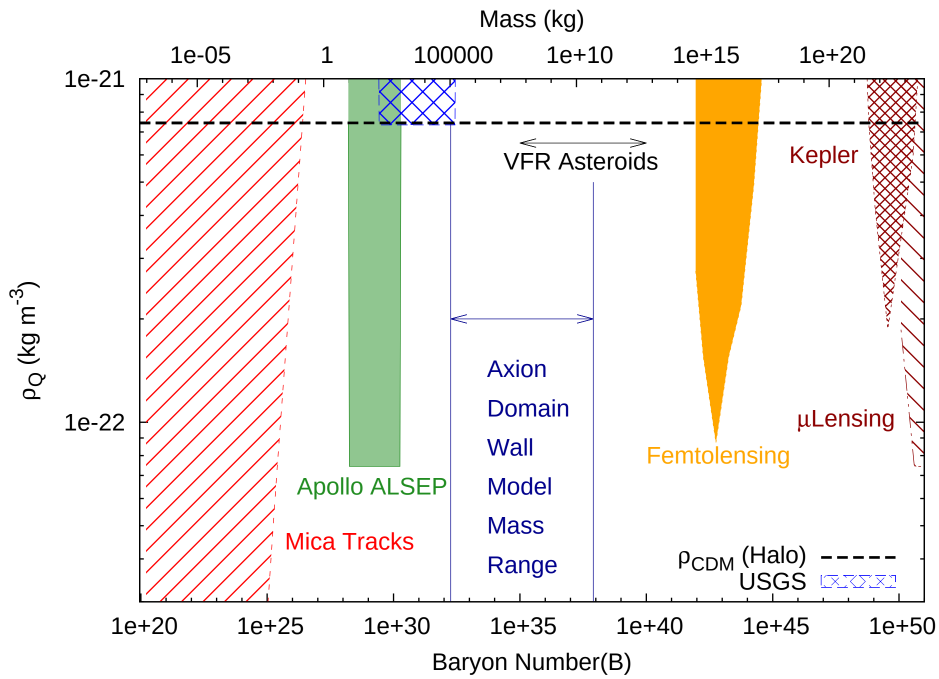

Figure 1: Solar System and Galactic limits on CUDOs as a function of mass, assuming a monochromatic CUDO mass spectrum. ρ_{CDM}(Halo) denotes the Galactic Halo dark matter density, as estimated using stellar kinematics[5]. Shaded regions are the mass ranges excluded by various observational constraints, and theoretically or observationally favored mass ranges are delineated by horizontal arrows. The "Mica Tracks" constraint is based on a failure to find evidence of the passage of CUDOs through crystals of Mica exposed (in rock) for 600 to 900 million years[6;7]. The Mica constraint applies to CUDOs with masses as small as $\sim 10^{-13}$ kg; substantially smaller condensed matter objects are typically called "strangelets" or "nuclearites," and are expected to behave more like microphysical particles; constraints on these objects are described in[8;9]. The lunar Apollo ALSEP and terrestrial USGS constraints are seismological[10], using the entire celestial body as a detector. The femtolensing[11], Kepler microlensing[12] and ground-based microlensing[13;14] constraints apply to condensed objects of any density, the other constraints are most rigorous for objects with densities near the nuclear density. The "VFR asteroid"[4] and "axion domain wall"[15;16] mass ranges suggested by observations and theory, respectively, are not substantially excluded by any of these constraints.

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