Ph.D. Thesis

Indirect study of electroweakly interacting particles at 100 TeV hadron colliders

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Abstract

(♣ To be written ♣)

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Contents

Section 1

Introduction

(♣ Definition of "SM" ♣)
(♣ Definition of "WIMP" ♣)

Section 2

Weakly interacting massive particle

2.1 WIMPs as a dark matter candidate

One of the most important evidences of the beyond SM is the existence of dark matter (DM) [1]. DM is an unknown object that occupies a non-negligible ratio of the total energy of our Universe, but has not yet been directly observed because of its weak interaction with the SM particles.[♮1] In spite of its invisibility, the existence of DM is confirmed by several astrophysical observations such as the mass measurement using the gravitational lensing effect caused by galaxies and clusters [2, 3], the flatness of galactic rotation curves further the optical radius [4, 5], the measurement of the power spectrum of the cosmic microwave background (CMB), and so on. In particular, the observation of CMB allows us to determine various cosmological parameters [6, 7] including the density of the non-relativistic matter and baryon, which is currently determined as [8]

$$\Omega_m h^2 = 0.1430 \pm 0.0011, \tag{2.1}$$
$$\Omega_b h^2 = 0.02237 \pm 0.00015, \tag{2.2}$$

where $h \sim \mathcal{O}(1)$ is the Hubble constant in units of $100\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$. The difference between $\Omega_m h^2$ and $\Omega_b h^2$ implies the existence of DM and its abundance $\Omega_c h^2 \simeq 0.12$.

[♮1] At worst DM interacts with the SM particles through the gravity, which is considerably weaker than all the other known interactions. (♣ Mention to Ema paper?? ♣)

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