STELLINGEN

behorende bij het proefschrift

Constraining properties of dark matter particles using astrophysical data

1. All alternatives to the current point of view that about 80% of the total mass in the Universe exists in the form of some mysterious *dark matter* cannot consistently explain the whole variety of existing observational data.

2. The conjecture that dark matter is made of elementary particle implies that the Standard Model of particle physics should be extended.

3. Not much is known about the properties of the conjectured particle that would be responsible for dark matter: for example, its mass, strength of its interaction with the ordinary matter, its lifetime are largely unconstrained.

4. Many studies are based on the assumption that some new physics should appear at the TeV scale (the characteristic scale of electro-weak interactions currently probed by the LHC in CERN), and that dark matter particles should, therefore, be weakly interacting and have its mass in GeV–TeV range. Nevertheless, the possible properties of dark matter particles should be studied and constrained systematically, theoretical bias left aside. The bounds should then be applied to various particle physics models in the search for dark matter candidates.

5. The model-independent lower bound on the mass of fermionic dark matter is $\sim$0.4 keV, and therefore X-ray telescopes hold great potential to discover signatures of dark matter decays in the cosmos.

   This thesis, chapter 2

6. Sterile neutrinos are viable dark matter candidates, allowed by all current bounds.

   This thesis, chapter 2

7. The average central column density of dark-matter haloes (defining, in particular, the expected decay signal) is observed to universally scale with the total halo mass, in agreement with predictions based on ΛCDM.

This thesis, chapter 3

8. The signal from dark matter decays can be unequivocally discriminated from instrumental and astrophysical backgrounds; as a result, the search of radiatively decaying dark matter signal is another type of *direct detection experiment*.

This thesis, chapter 4

9. Compared to observations of individual objects, a combination of many observations of different dark matter-dominated objects allows to increase the sensitivity for searches of narrow faint X-ray lines.

This thesis, chapter 5

10. Drastic improvements in the search for decaying dark matter will become possible with a new generation of X-ray spectrometers, having large field of view and energy resolution at the sub-% level.

This thesis, chapter 6

11. Astrophysics and cosmology are as important for the understanding of fundamental physics as accelerator experiments are.