INDIRECT SEARCHES FOR DARK MATTER WITH AMS-02*

Pierre Brun

Laboratoire d'Annecy-le-vieux de Physique des Particules, Université de Savoie
CNRS/IN2P3, 74941 Annecy-le-vieux, France

(Received October 29, 2007)

AMS-02 is a multi-purpose spectrometer with superconducting magnet, designed for 3 years of data taking aboard the International Space Station. Its high performance regarding particle identification and energy measurement will allow performing indirect searches for dark matter (DM) in different channel simultaneously: gamma rays, positrons, antiprotons and hopefully antideuterons. A new spectrum generator, based on the public package micrOMEGAs, is used to determine the AMS-02 sensitivity to new physics. This note shows the example of the positron signal.

PACS numbers: 95.55.Vj, 95.35.+d

1. Introduction

Combinations of different cosmological probes indicate the presence of non baryonic dark matter (DM), at the level of 84% of the total matter density [1]. In an independent way, several models beyond the Standard Model of particle physics (with supersymmetry or extra spacetime dimensions) predict the existence of neutral, weakly-interacting massive particles. Those could fill the Universe up to the observed matter density provided that their co-moving density is regulated by primordial self-annihilations.

Nowadays, these annihilations could take place in the center of massive structures containing DM, like *e.g.* the center of our Galaxy or in Galactic clumps of DM. If efficient enough, annihilations of DM particles can become observable sources of primary cosmic rays. Due to a reduced background, anti-particles (e^+, $\bar{p}$, $\bar{D}$) are amongst the most promising channels.

2. Prospects for the AMS-02 space spectrometer

AMS-02 is a particle physics detector designed for 3 years of data taking. The core of the instrument is a Silicon tracker, surrounded by a supercon-

* Presented at the Symposium "Physics in Collision", Annecy, France, June 26–29, 2007.

ducting magnet. Two scintillator planes allow to measure the time of flight with a 120 ps precision, and an imaging Čerenkov counter determines the charge and velocity. Proton rejection is performed with a transition radiation detector and an electromagnetic calorimeter, which also measures the energy of electromagnetic particles with a few percent precision [2].

The example given here is a comparison between the positron signals [3] in case of two 150 GeV candidates (supersymmetric and extra-dimensions (LZP) [4]). Those mainly differ by the positron yield in the annihilation (more peaked spectrum for the LZP). Fig. 1 shows the expected results of AMS-02 in both cases after 3 years of data taking, under the assumption that the so-called positron excess is due to a DM signal. We show in particular that the models can be distinguished with AMS-02.

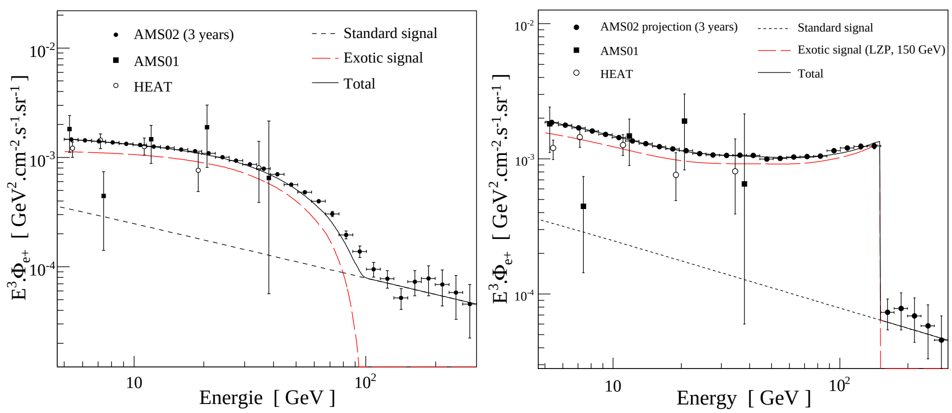

Fig. 1. Expected measurements of the e^+ flux for SUSY DM (a *bino*, left) and a Kaluza–Klein candidate (LZP, right).

3. Conclusions

AMS-02 will allow efficient searches for DM signals. Its high capabilities of background rejection and precise energy measurement could allow to discriminate between annihilation final states and thus probe the underlying new physics model.

REFERENCES

[1] G. Bertone, D. Hooper, J. Silk, *Phys. Rep.* **405**, 279 (2005).

[2] `http://ams.cern.ch`

[3] P. Brun, S. Rosier-Lees, G. Bélanger, F. Boudjema, A. Pukhov, in preparation.

[4] K. Agashe, G. Servant, *Phys. Rev. Lett.* **93**, 231805 (2004).