Astrophysics > High Energy Astrophysical Phenomena

The discovery of geomagnetically trapped cosmic ray antiprotons

O. Adriani, G. C. Barbarino, G. A. Bazilevskaya, R. Bellotti, M. Boezio, E. A. Bogomolov, M. Bongi, V. Bonvicini, S. Borisov, S. Bottai, A. Bruno, F. Cafagna, D. Campana, R. Carbone, P. Carlson, M. Casolino, G. Castellini, L. Consiglio, M. P. De Pascale, C. De Santis, N. De Simone, V. Di Felice, A. M. Galper, W. Gillard, L. Grishantseva, G. Jerse, A. V. Karelin, M. D. Kheymits, S. V. Koldashov, S. Y. Krutkov, A. N. Kvashnin, A. Leonov, V. Malakhov, L. Marcelli, A. G. Mayorov, W. Menn, V. V. Mikhailov, E. Mocchiutti, A. Monaco, N. Mori, N. Nikonov, G. Osteria, F. Palma, P. Papini, M. Pearce, P. Picozza, C. Pizzolotto, M. Ricci, S. B. Ricciarini, L. Rossetto, R. Sarkar, M. Simon, R. Sparvoli, P. Spillantini, Y. I. Stozhkov, A. Vacchi, E. Vannuccini, G. Vasilyev, S. A. Voronov, Y. T. Yurkin, et al. (4 additional authors not shown) You must enabled JavaScript to view entire author list.

(Submitted on 25 Jul 2011)

The existence of a significant flux of antiprotons confined to Earth's magnetosphere has been considered in several theoretical works. These antiparticles are produced in nuclear interactions of energetic cosmic rays with the terrestrial atmosphere and accumulate in the geomagnetic field at altitudes of several hundred kilometers. A contribution from the decay of albedo antineutrons has been hypothesized in analogy to proton production by neutron decay, which constitutes the main source of trapped protons at energies above some tens of MeV. This Letter reports the discovery of an antiproton radiation belt around the Earth. The trapped antiproton energy spectrum in the South Atlantic Anomaly (SAA) region has been measured by the PAMELA experiment for the kinetic energy range 60--750 MeV. A measurement of the atmospheric sub-cutoff antiproton spectrum outside the radiation belts is also reported. PAMELA data show that the magnetospheric antiproton flux in the SAA exceeds the cosmic-ray antiproton flux by three orders of magnitude at the present solar minimum, and exceeds the sub-cutoff antiproton flux outside radiation belts by four orders of magnitude, constituting the most abundant source of antiprotons near the Earth.

Comments:	Accepted for publication in ApJL
Subjects:	**High Energy Astrophysical Phenomena (astro-ph.HE)**; High Energy Physics - Experiment (hep-ex)
Journal reference:	ApJ, 737, L29, 2011
DOI:	10.1088/2041-8205/736/1/L1
Cite as:	**arXiv:1107.4882 [astro-ph.HE]**
	(or **arXiv:1107.4882v1 [astro-ph.HE]** for this version)

Submission history

From: Alessandro Bruno [view email]
[v1] Mon, 25 Jul 2011 10:11:57 GMT (17kb)

Which authors of this paper are endorsers?