The Alpha Magnetic Spectrometer on the International Space Station

S. Ting
AMS: a U.S. DOE sponsored international collaboration

16 Countries, 60 Institutes and 600 Physicists

Strong support from


and DOE (J. Siegrist, M. Salamon, D.Kovar, S. Gonzalez, R. Staffin, J. O’Fallon, …)
New results from the first 2 years of AMS
New results from AMS

1) Proton flux

Scaled by $R^{2.7}$  From 1 GV to 1.8 TV
Proton flux
Comparison with past measurements
PAMELA Measurements of Cosmic-Ray Proton and Helium Spectra

O. Adriani et al.
Science 332, 69 (2011);
DOI: 10.1126/science.1199172

Fig. 4. Proton (left) and helium (right) spectra in the range 10 GV to 1.2 TV. The gray shaded area represents the estimated systematic uncertainty, and the pink shaded area represents the contribution due to tracker alignment. The green lines represent fits with a single power law in the rigidity range 30 to 240 GV. The red curves represent the fit with a rigidity-dependent power law (30 to 240 GV) and with a single power law above 240 GV.
Proton flux

Search for structures

AMS-02 Data

Pamela Data

PAMELA Measurements of Cosmic-Ray Proton and Helium Spectra
O. Adriani et al.
Science 332, 69 (2011);
DOI: 10.1126/science.1199172
New Results from AMS

2) Helium spectrum, 2GV to 3TV

He Flux \( (m^2 \text{ sr sec GV})^{-1} \times \text{Rigidity}^{2.7} \)
Helium flux
Comparison with past measurements

He Flux (m^2 sr sec GV^-1) x R^{2.7}

Rigidity (GV)

AMS-02(2011-2013)
PAMELA(2006-2008)
CREAM-I(2004-2005)
ATIC-02(2003)
BESS-Tev(2002)
BESS-98(1998)
AMS-01(1998)
CAPRICE(1998)
IMAX(1992)
Baloon(1991)
MASS-91(1991)
New results from AMS
3) Electron Spectrum, 1GeV to 500GeV
New results from AMS
4) Positron Spectrum, 1GeV to 350GeV

![Graph showing E^3 Flux vs. Energy for AMS-02 2013 and HEAT 2000]
New results from AMS
5) All Electron Spectrum, 0.5GeV to 700GeV
(Electron plus Positron) Spectrum
(Electron plus Positron) Spectrum comparison with recent measurements
New results from AMS

6) Boron-to-Carbon ratio, 5GV to 500GV

Precise measurement of the energy spectra of B/C provides information on Cosmic Ray Interactions and Propagation

AMS: Multiple Independent Measurements of the Charge (|Z|)

<table>
<thead>
<tr>
<th>Component</th>
<th>Carbon (Z=6) ΔZ (cu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracker Plane 1</td>
<td>0.30</td>
</tr>
<tr>
<td>TRD</td>
<td>0.33</td>
</tr>
<tr>
<td>Upper TOF (1 counter)</td>
<td>0.16</td>
</tr>
<tr>
<td>Tracker Planes 2-8</td>
<td>0.12</td>
</tr>
<tr>
<td>Lower TOF (1 counter)</td>
<td>0.16</td>
</tr>
<tr>
<td>RICH</td>
<td>0.32</td>
</tr>
<tr>
<td>Tracker Plane 9</td>
<td>0.30</td>
</tr>
</tbody>
</table>
Carbon Fragmentation to Boron
$R = 10.6$ GV

$Z_{TRK\_L1} = 6.1$

$Z_{TRD} = 6.0$

$Z_0 = 9.9$

$Z_1 = 5.3$

$Z_{TRK\_IN} = 4.8$

$Z_{TOF\_LOW} = 5.2$

$Z_{RICH} = 5.1$
B/C Ratio

10% of total expected data

Boron-to-Carbon ratio

AMS-02

Orth et al. (1972)
Dwyer & Meyer (1973-1975)
Simon et al. (1974-1976)
HEAO3-C2 (1980)
Webber et al. (1981)
CRN-Spacelab2 (1985)
Buckley et al. (1991)
AMS-01 (1998)
ATIC-02 (2003)
CREAM-I (2004)
TRACER (2006)
Boron-to-Carbon ratio
comparison with recent data

B/C Ratio

AMS-02

10% of total expected data

ATIC-02 (2003)

CREAM-I (2004)

TRACER (2006)

Kinetic Energy (GeV/n)
Boron-to-Carbon ratio

AMS-02

10% of total expected data

Borono-Carbon Ratio

Kinetic Energy (GeV/n)
New results from AMS
7) Positron ratio anisotropy (update)
New results from AMS
ICRC2013: On the origin of excess positrons

If the excess has a particle physics origin, it should be isotropic.

The fluctuations of the positron ratio $e^+/e^-$ are isotropic.
On the origin of excess positrons

Limits on the amplitude of a dipole anisotropy in any axis in galactic coordinates on the positron to electron ratio

δ ≤ 0.030 at the 95% confidence level