Prospects for High Energy Light Isotope Measurements on Balloons

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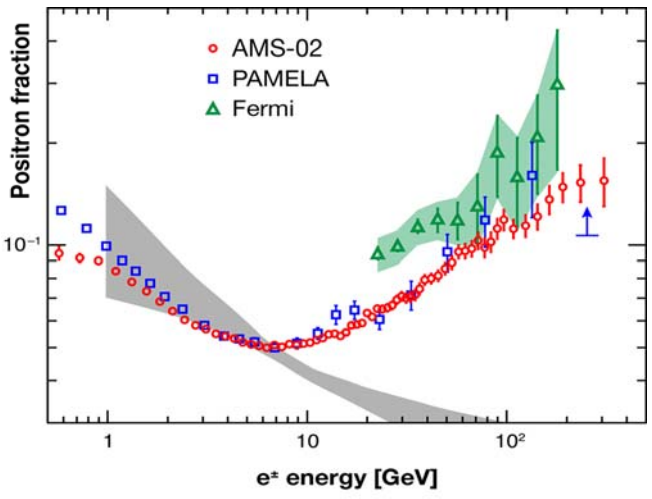
Motivation

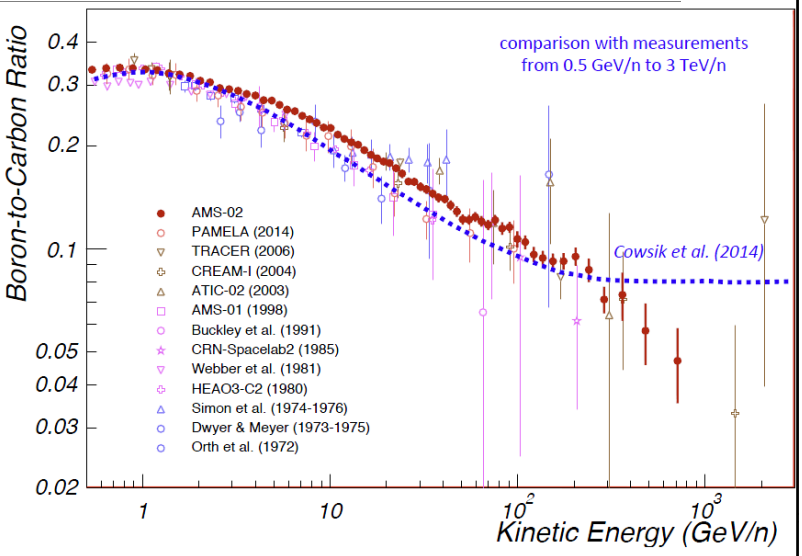
- Surprising data (e.g.):
  - Rising positron fraction
  - Changing p/He ratio
  - Breaks in the light elemental spectra
- Interpretation :
  - Improving propagation models with additional key measurements



AMS02 Collaboration PRL110 (2013)

Elemental Secondary/Primary Ratios

- Sensitive to the amount of matter traversed by the cosmic rays
- Best measured is Boron/Carbon
  - But also sub-Fe/Fe, etc

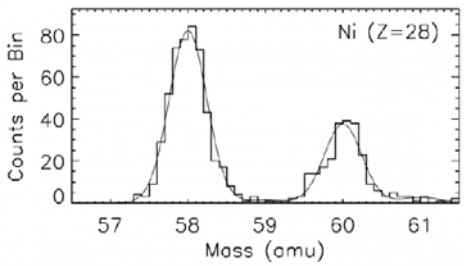


Light Isotopic Ratios

- Stable Isotopes
  - Additional model tests with H, He, Li, Be, B
  - Several examples at this conference:
    - W. Menn (#376) -7Li/6Li, 7Be/(9Be+10Be) to ~1 GeV/nuc with PAMELA
    - W. Menn (#378) - 2H/1H, 3He/4He to ~1 GeV/nuc with PAMELA
    - N. Picot-Clémente (#425) - 2H/1H , 3He/4He to ~2 GeV/nuc with BESS-Polar II

Caution: Cross-section uncertainties

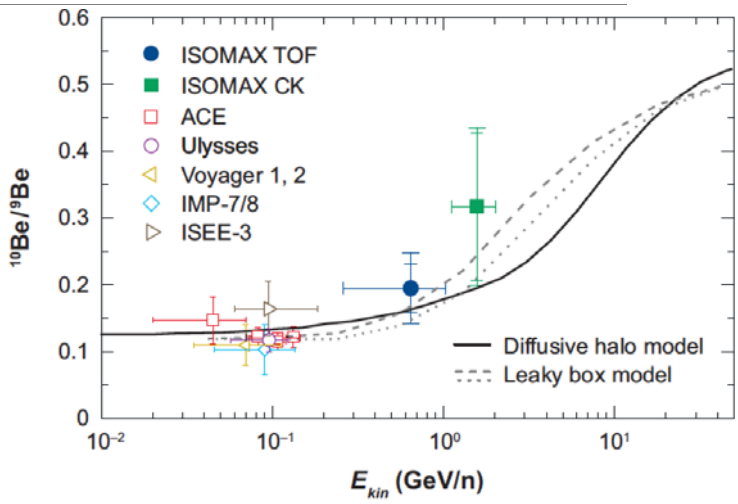
- Radioactive 'clock' isotopes
  - Nucleosynthesis/acceleration timescales
    - 59Ni, 60Fe - M. Israel (#275)
  - Confinement timescales
    - 54Mn, 36Cl, 26Al, **10Be**



Wiedenbeck, et al., *Ap.J.* 523, L61 (1999)

The $^{10}Be/^{9}Be$ Ratio

- Radioactive secondary (10Be) with a 1.4Myr half-life
- Several good measurements at a few hundred MeV/nuc
- Above this, the ISOMAX balloon payload covers up to ~2 GeV/nuc
- Good model discriminating power around 3 GeV/nuc



I. Moskalenko - "AMS02 Days"

Measurements

- High Energy: Magnet Spectrometers
  - Examples on balloons: ISOMAX, IMAX, HEAT, CAPRICE…

$$\left(\frac{\Delta m}{m}\right)^2 = \left(\frac{\Delta R}{R}\right)^2 + \gamma^4 \left(\frac{\Delta \beta}{\beta}\right)^2$$