Fast and accurate AMS-02 antiproton likelihoods for global dark matter fits

Sowmiya Balan, Felix Kahlhoefer, Michael Korsmeier, Silvia Manconi, Kathrin Nippel

Balan et al., 2303.07362

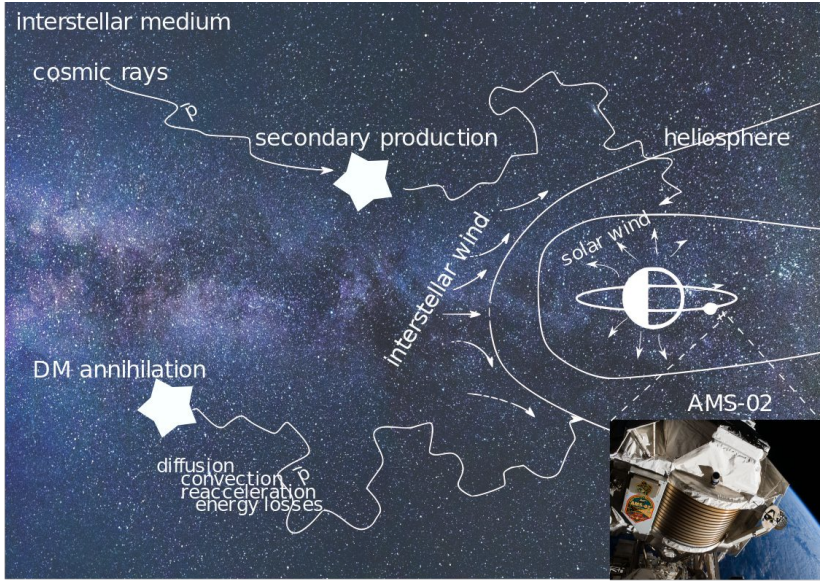
Global Fits

- Combine different experiments

$$\mathcal{L} = \mathcal{L}_{Collider}\ \mathcal{L}_{DD}\ \mathcal{L}_{ID}$$

Indirect dark matter searches with antiprotons

- Antiprotons from dark matter annihilation
- Indirect searches with AMS-02 antiprotons
  - Background + propagation
    → ~10 nuisance parameters
  - Prohibitive in global fits



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Analysis Pipeline

- DarkRayNet v2
  - Recurrent neural network replacing GALPROP
  - Primary and secondary antiproton spectra
- pbarlike
  - State-of-the-art modeling of data correlations
  - Marginalization over nuisance parameters
- GAMBIT 2.4 - global fits!
  - Interface to pbarlike
  - Many likelihoods - direct detection, gamma, neutrino, ...

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Is there an antiproton excess?

- Proper treatment of errors → reduced significance (1σ and $2.2\,\sigma$) for DM annihilating into bottom quarks