

# Enhancing Cosmic-Ray Antinuclei Fluxes from Dark Matter using Baryon Number

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Based on 2603.12314



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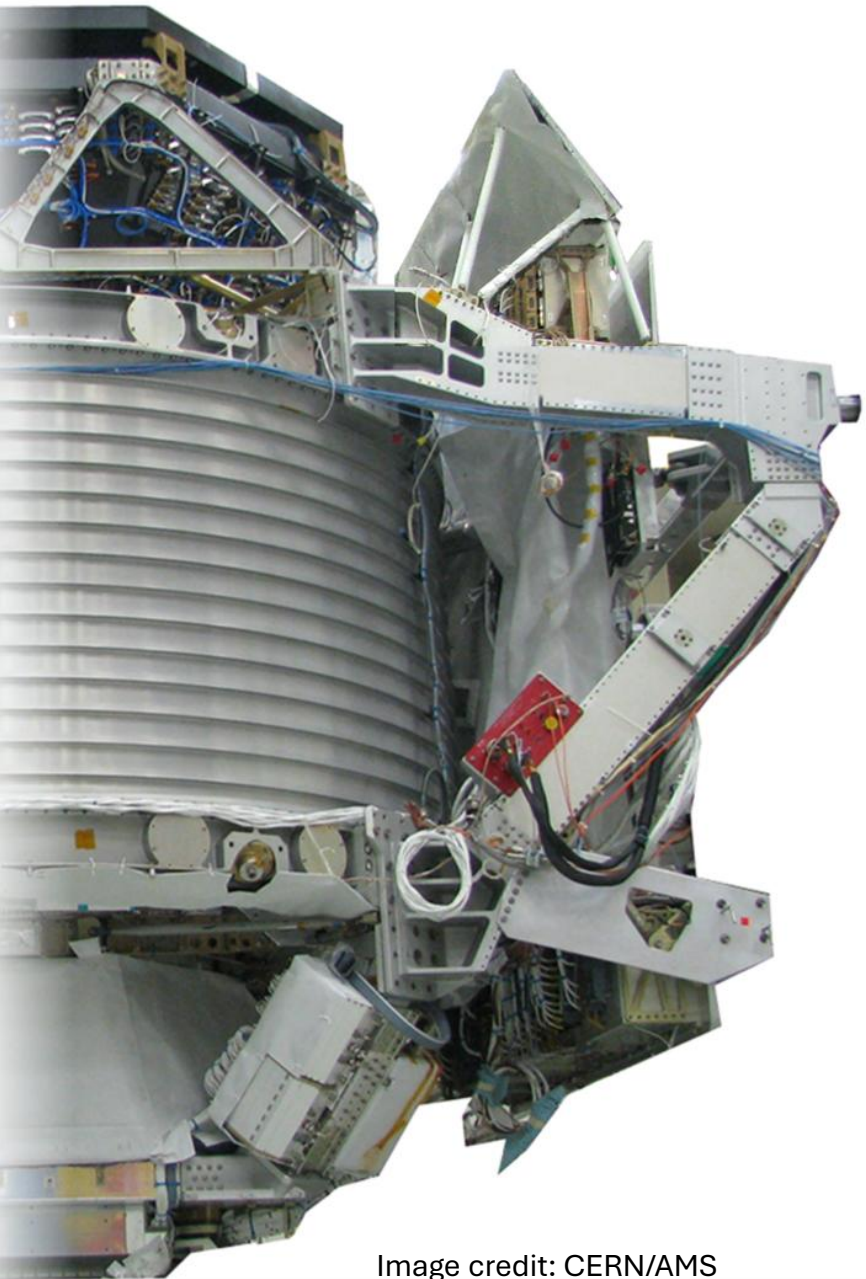
- Dark matter annihilation produces matter and antimatter **equally**
- This makes cosmic-ray antimatter a powerful dark matter probe
- Large efforts to measure the cosmic-ray antinuclei spectrum underway
  - **AMS-02**: modular experiment aboard the International Space Station
  - **GAPS**: high-altitude balloon-borne experiment out of Antarctica

# The observations of AMS-02



Image credit: CERN/AMS

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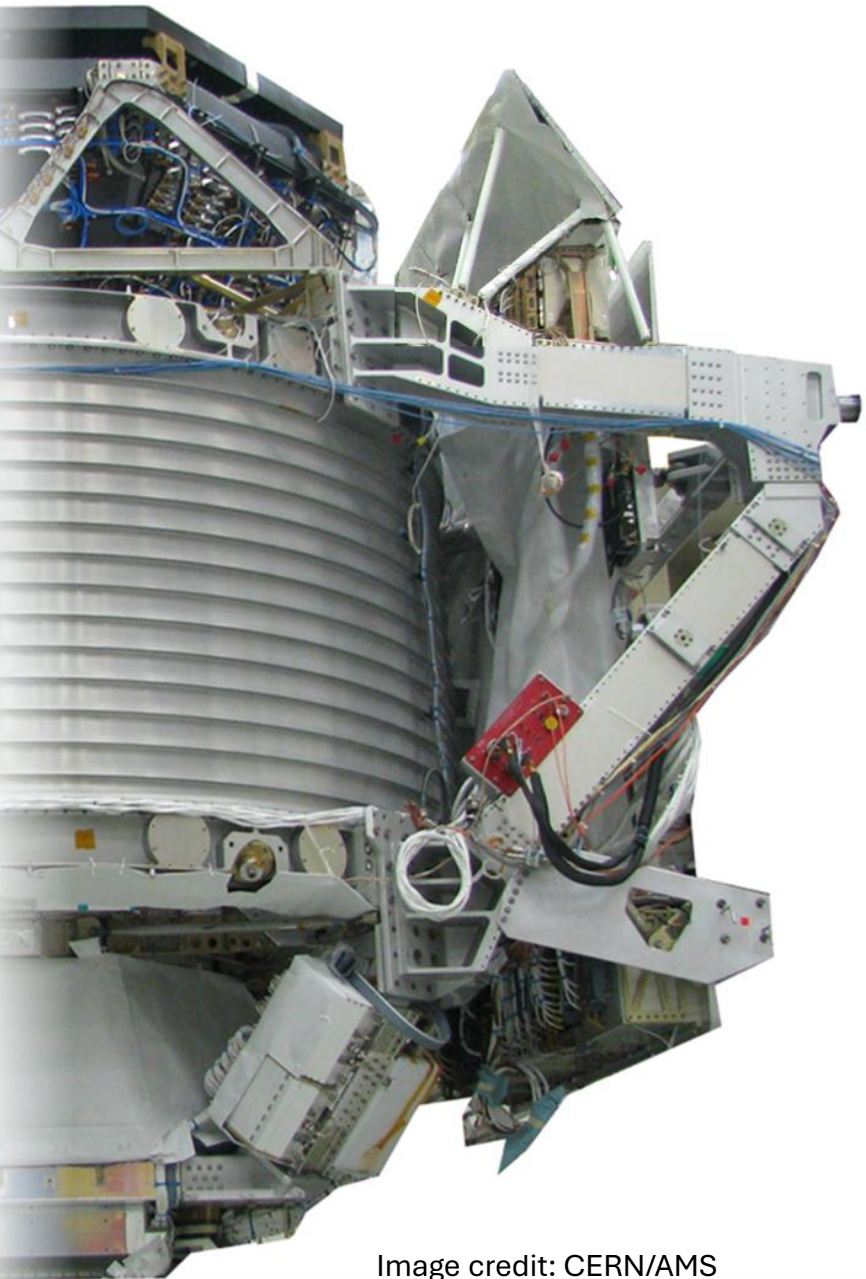


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- Events are largely low-rigidity
- Orders of magnitude above expected standard fluxes\*

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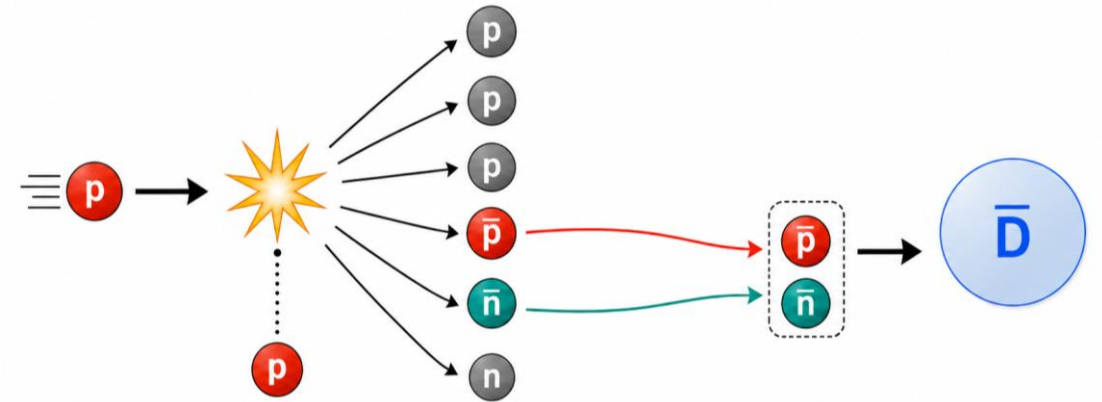
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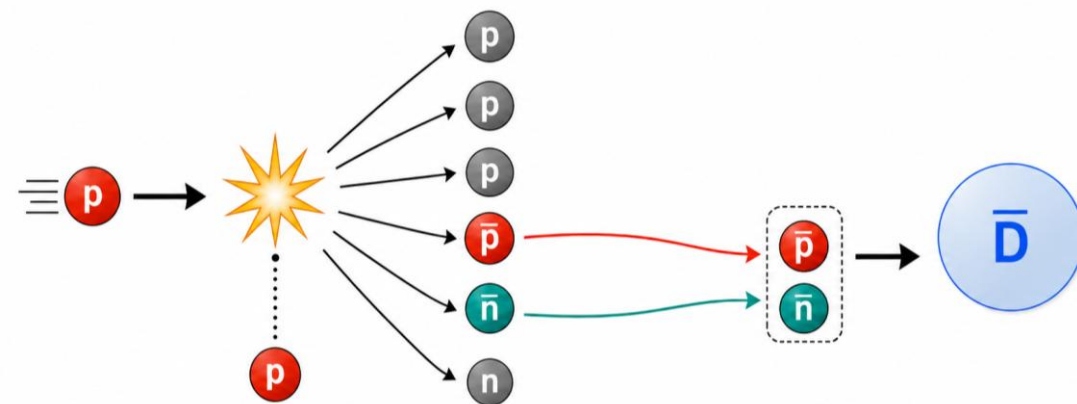
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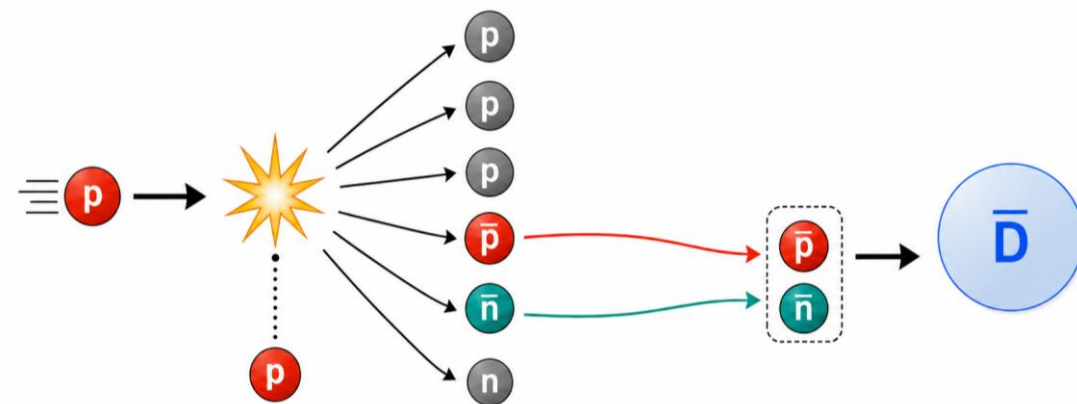
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- Dark matter annihilation through a dark sector or into SUEPs

(See C. Gemmel's talk)

- Other new physics, such as antistars

# Our dark matter annihilation model

- Annihilation into baryon-number-carrying scalars:

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- These particles appear naturally various Standard Model extensions\*

\* E.g., 1309.3970, 2506.06068, 2202.05275

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- Focus on  $B = L = 1$  and  $B = L = 3$  cases:

$$\chi\bar{\chi} \rightarrow \phi_{1,1}\bar{\phi}_{1,1} \rightarrow (udd\nu_e)(\bar{u}\bar{d}\bar{d}\bar{\nu}_e)$$

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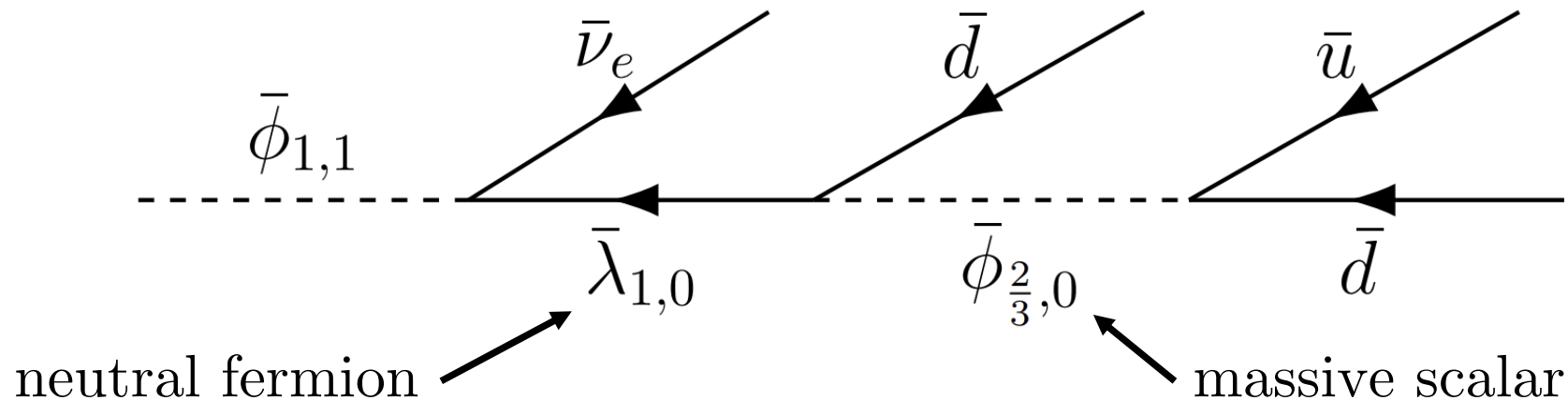
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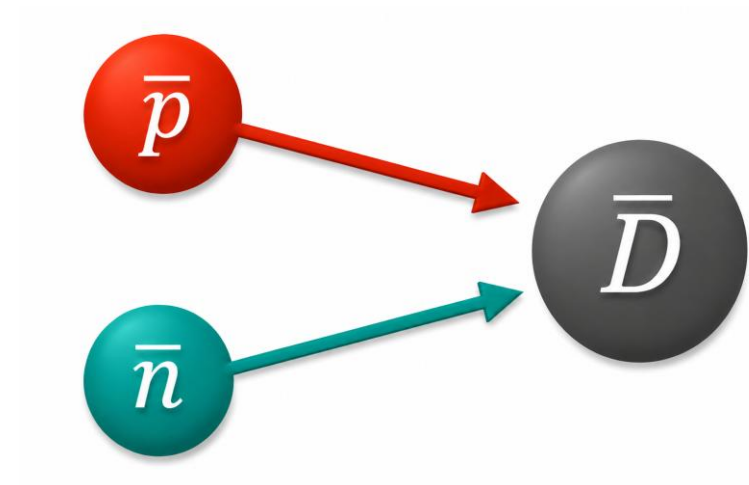
- A possible UV completion:



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Coalescence scheme:

- For every antiproton-antineutron pair:

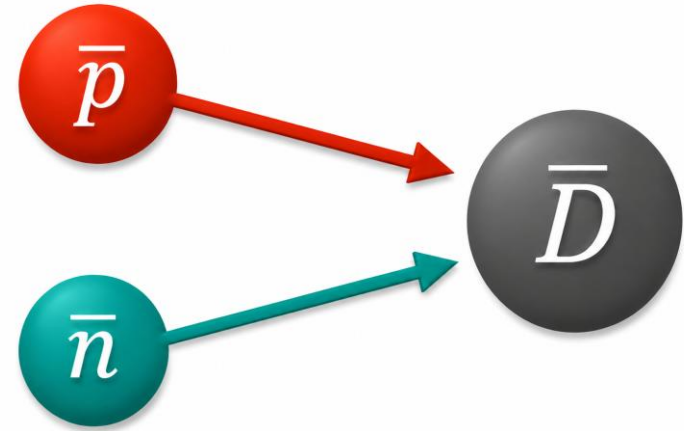


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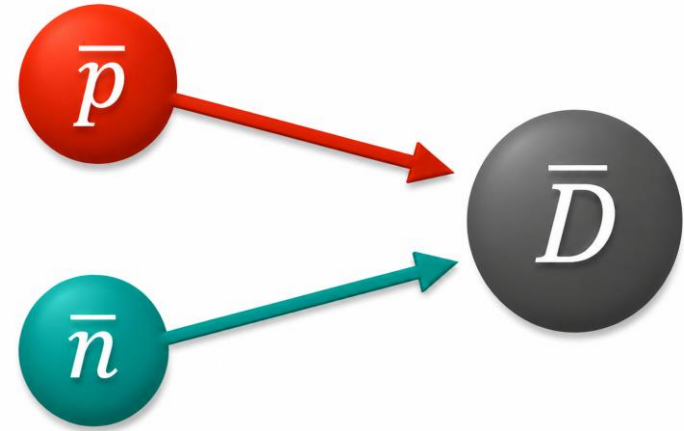
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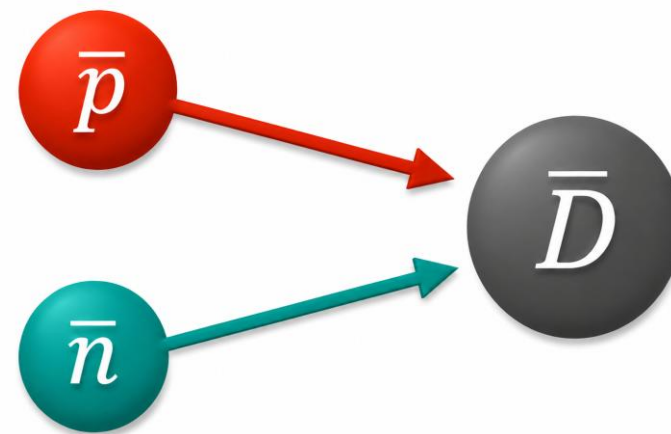


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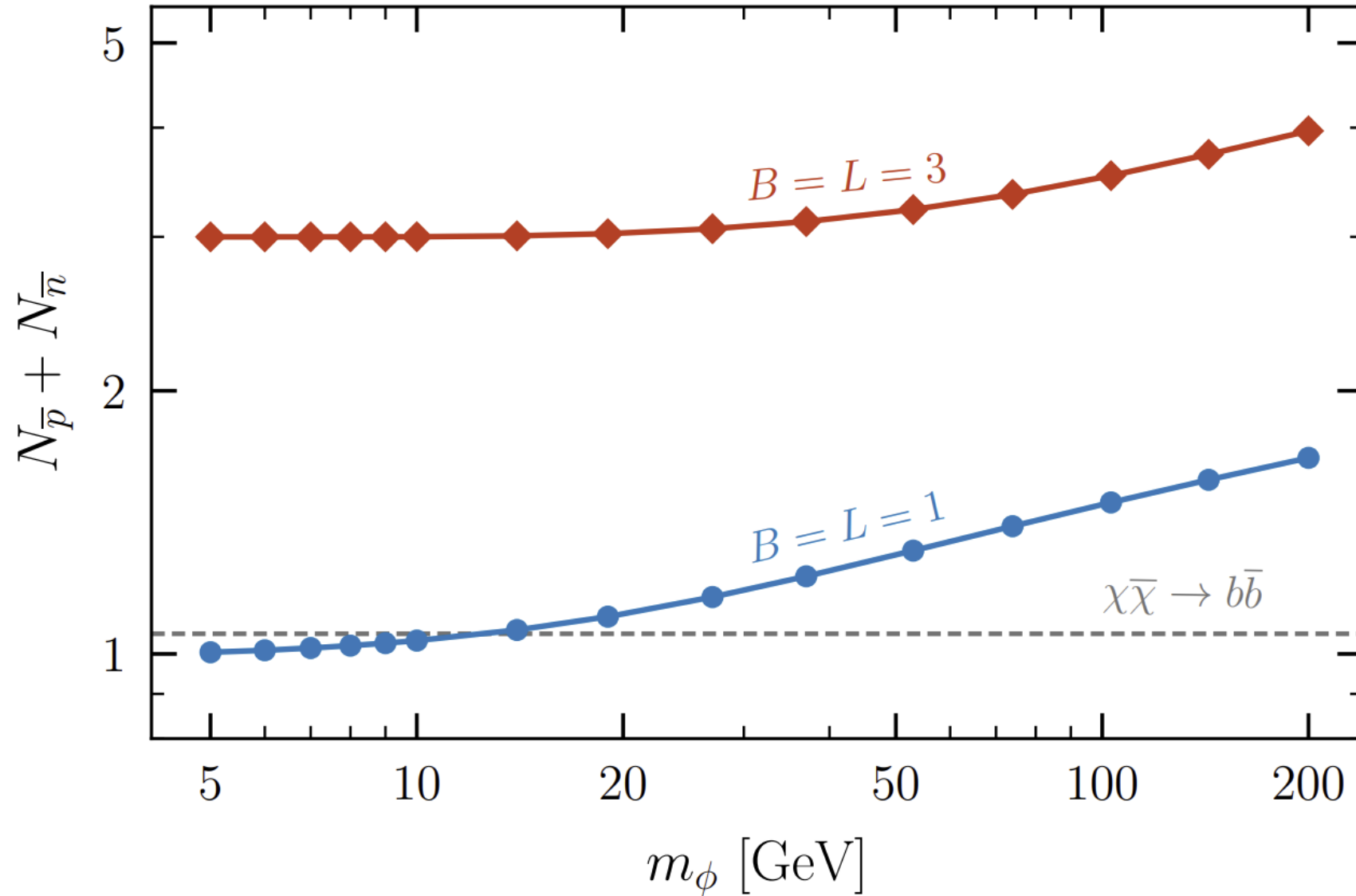
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■ Calibrate  $p_{\text{coal}}$  using experimental data

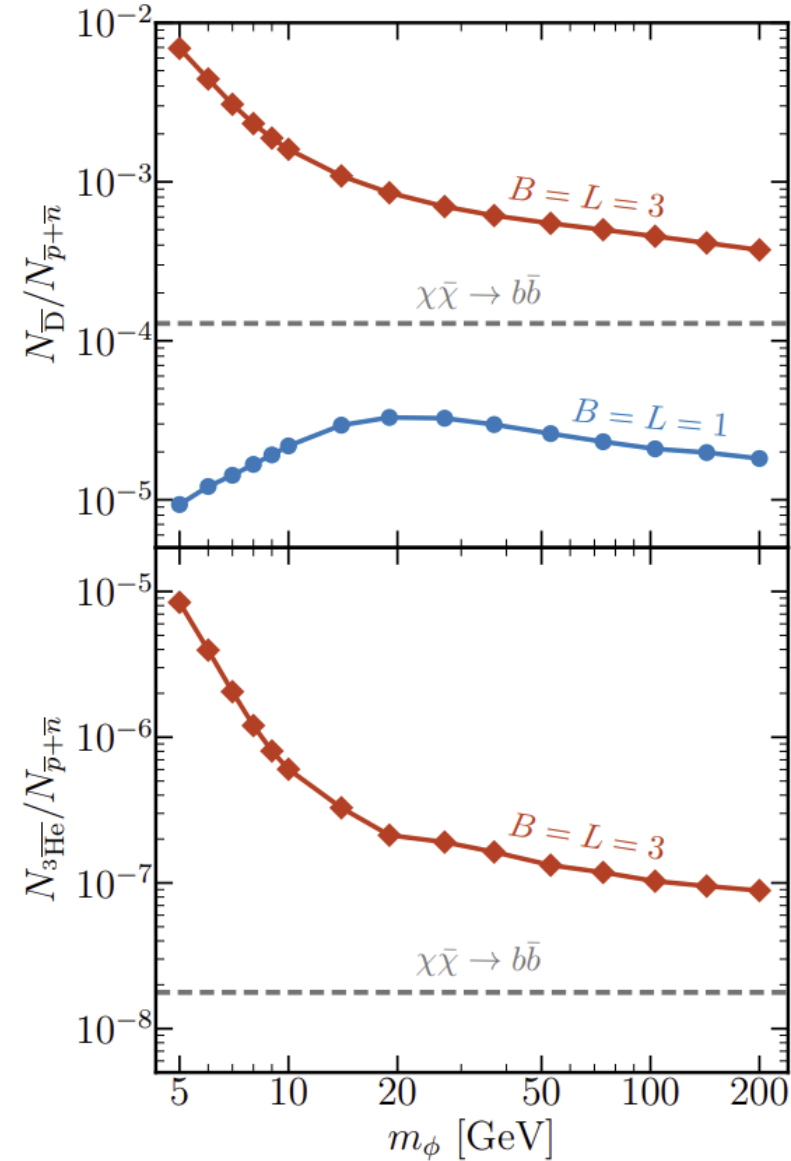
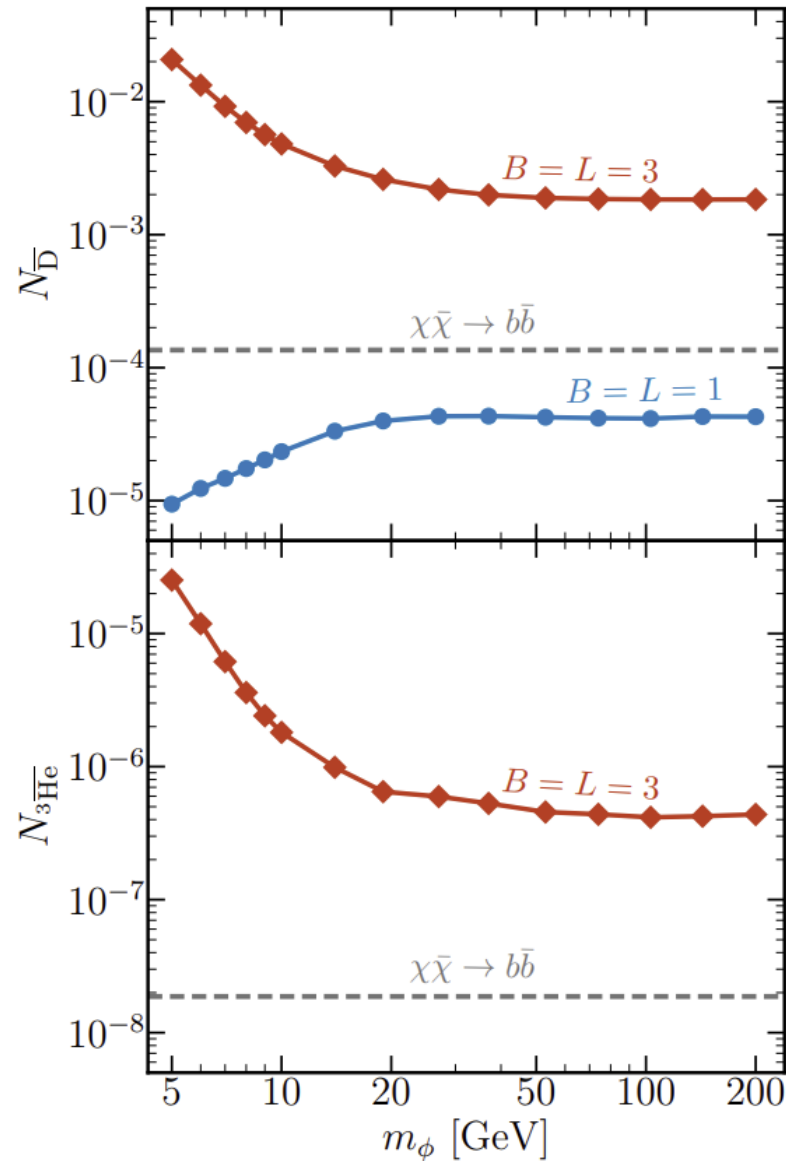
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- Antinucleon enhancement



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- Antideuteron and antihelium enhancement

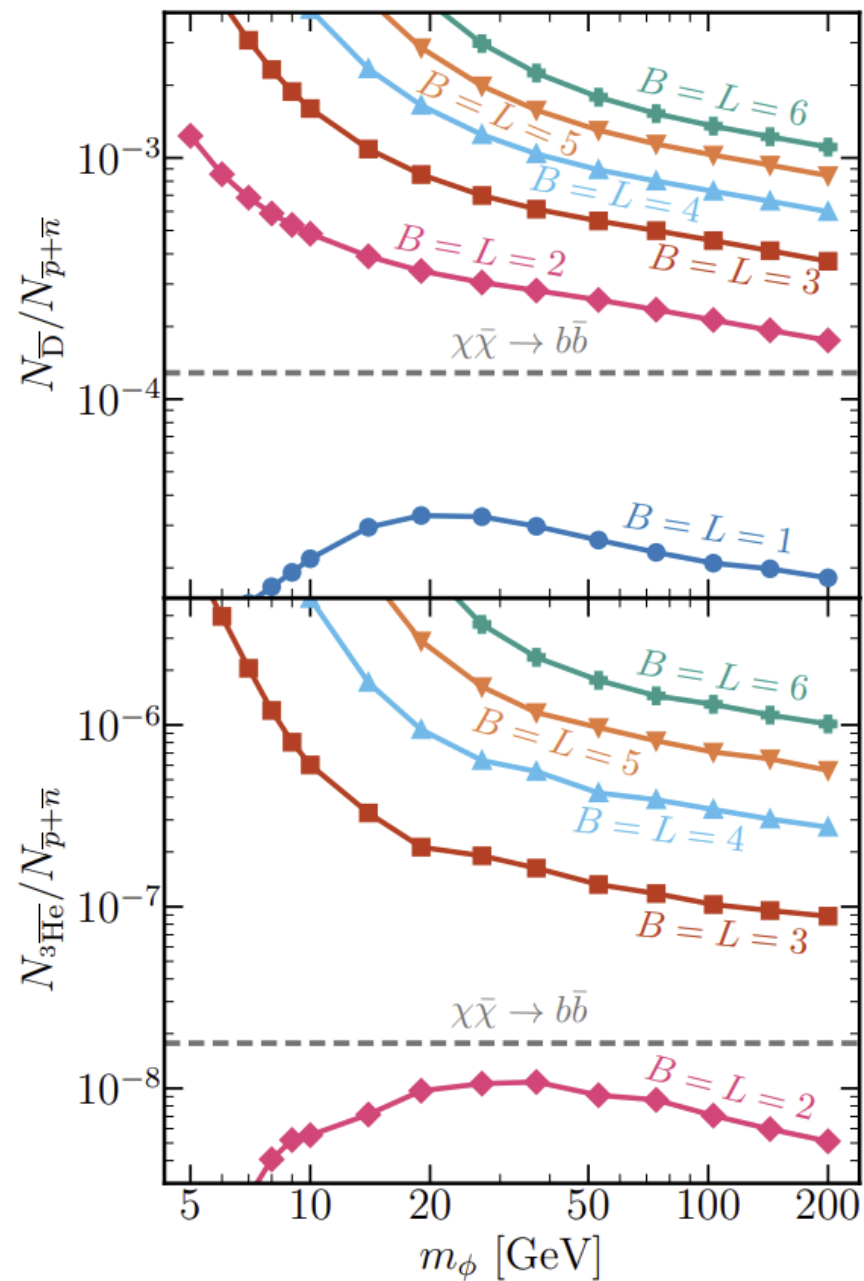
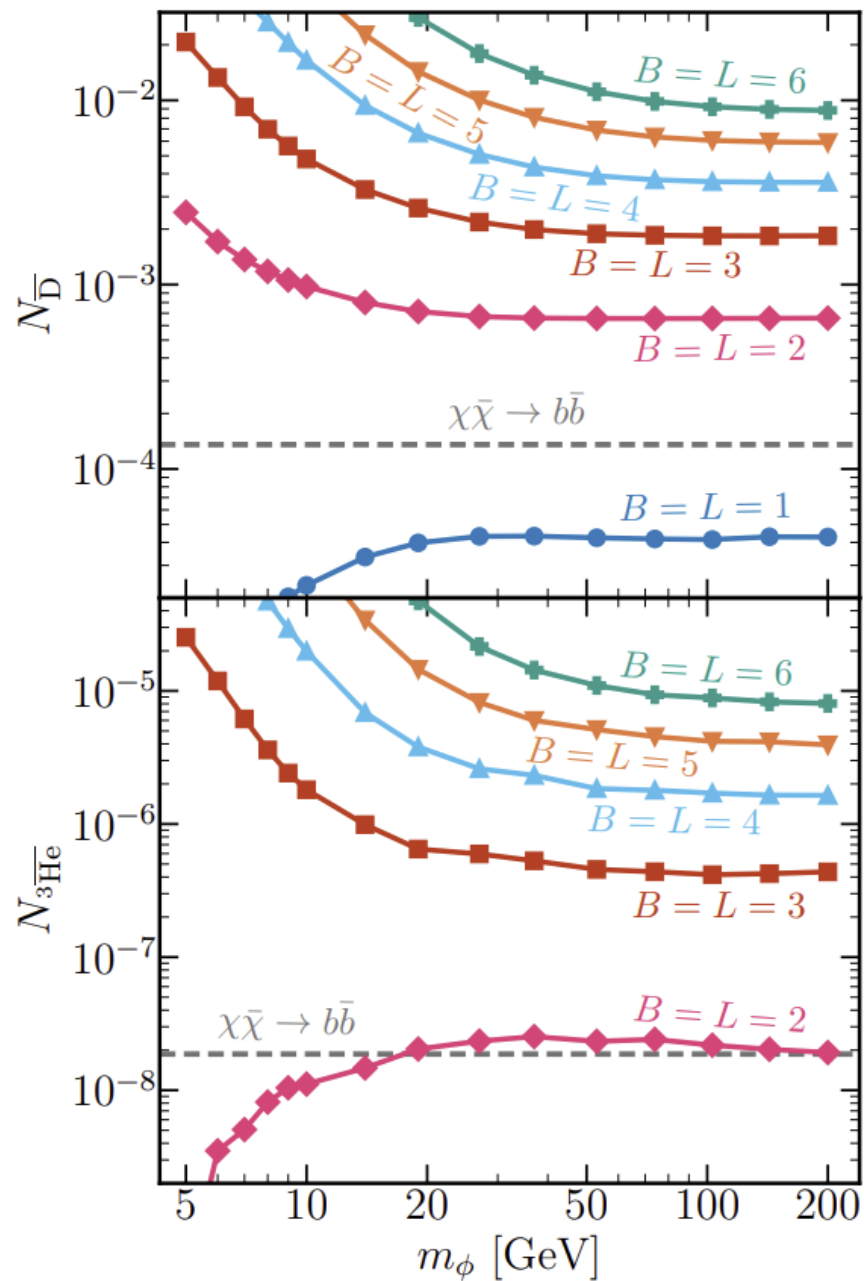


- If confirmed, the AMS-02 observations are likely a smoking-gun signal of new physics
- We propose a mechanism to explain these events via dark matter annihilation to baryon-number-carrying scalars:

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- This produces a  $10\text{--}100\times$  multiplicity enhancement
- We are currently carrying out a detailed galactic propagation study to position our model in relation to existing excesses

# Additional slides: higher $B = L$



# Additional slides: comparison of decay channels

