Supersymmetric Resonant Dark Matter

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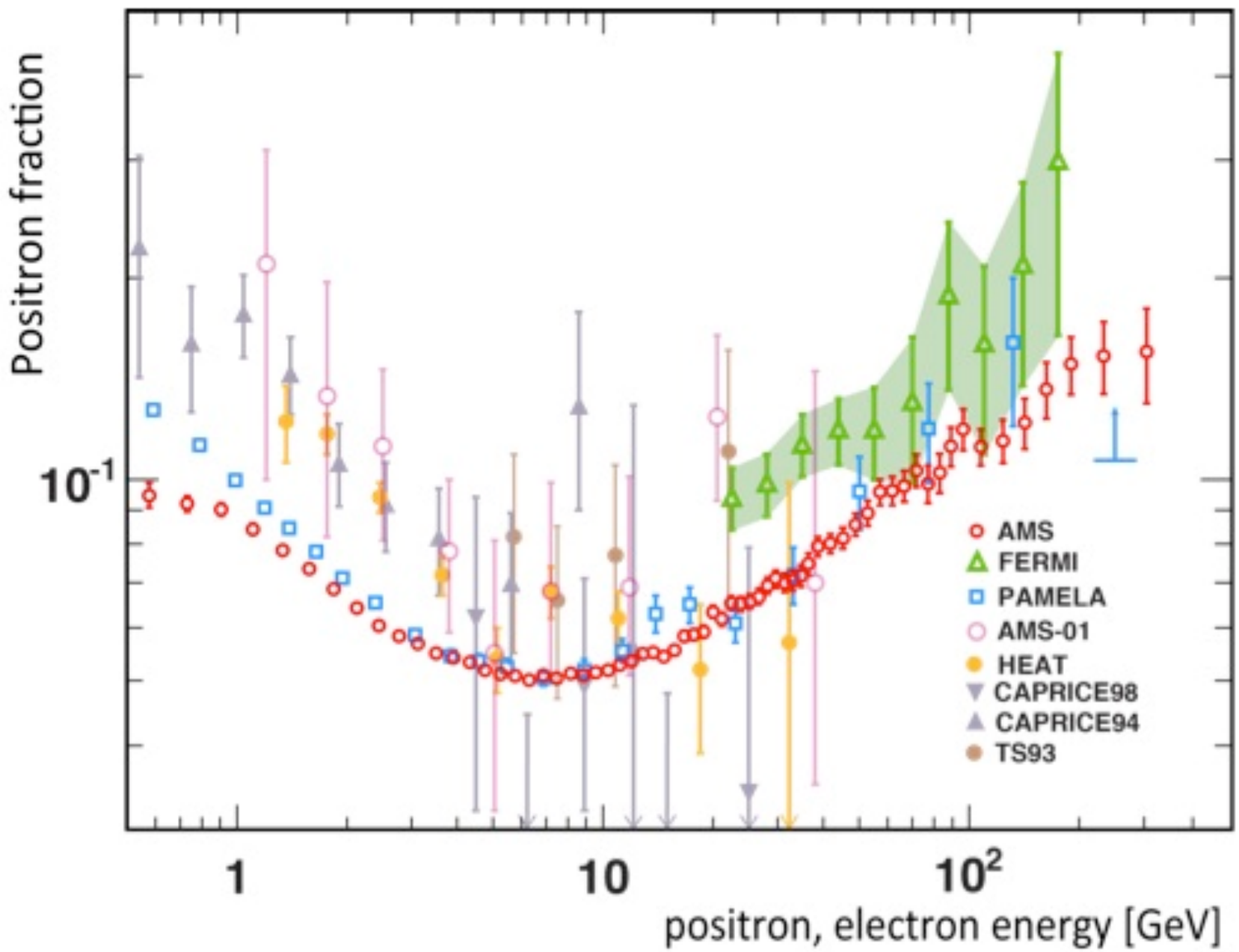
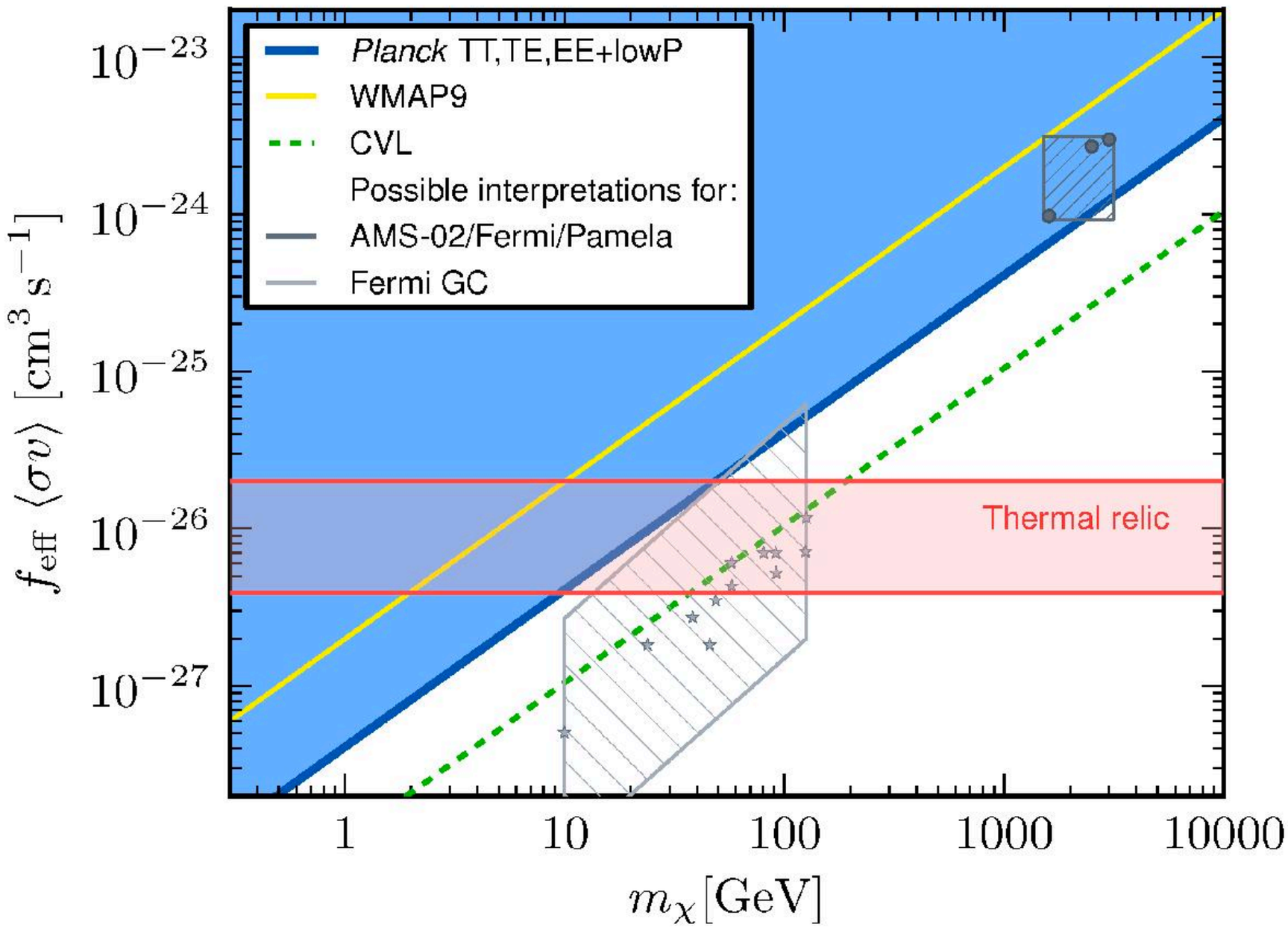
Mysterious High Energy Cosmic Positrons



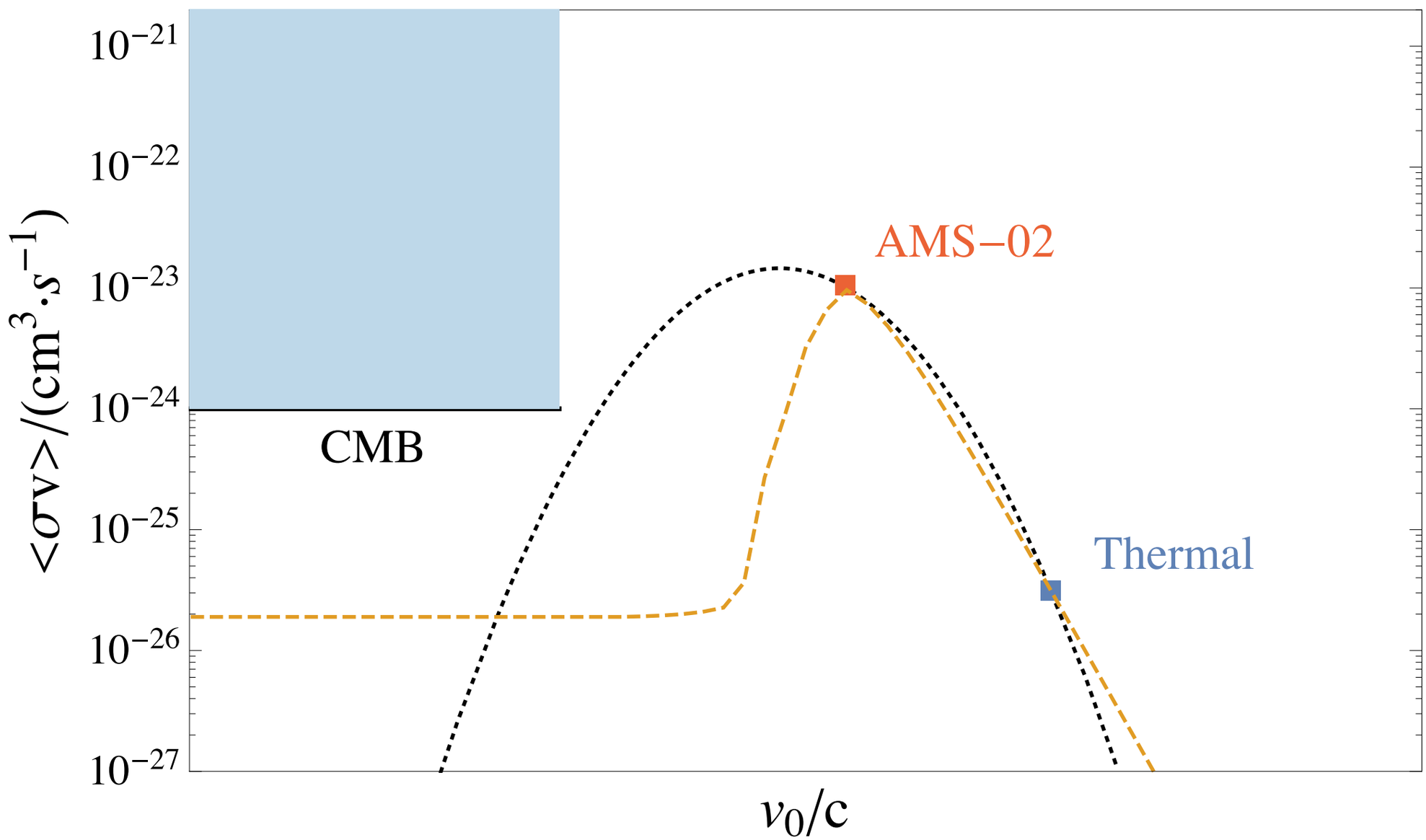
AMS-02 Collaboration

Constraints from CMB Measurements



PLANCK Collaboration

Could this be Dark Matter?



Just a Little Wiggle Room

- "Old" idea: Sommerfeld enhancement
  - Ruled out by CMB constraints
- Direct annihilation into SM particles
  - Ruled out by correlated gamma ray searches
- Our goal: thermal relic dark matter with resonantly enhanced annihilation in Milky Way without being ruled out by CMB and gamma ray searches

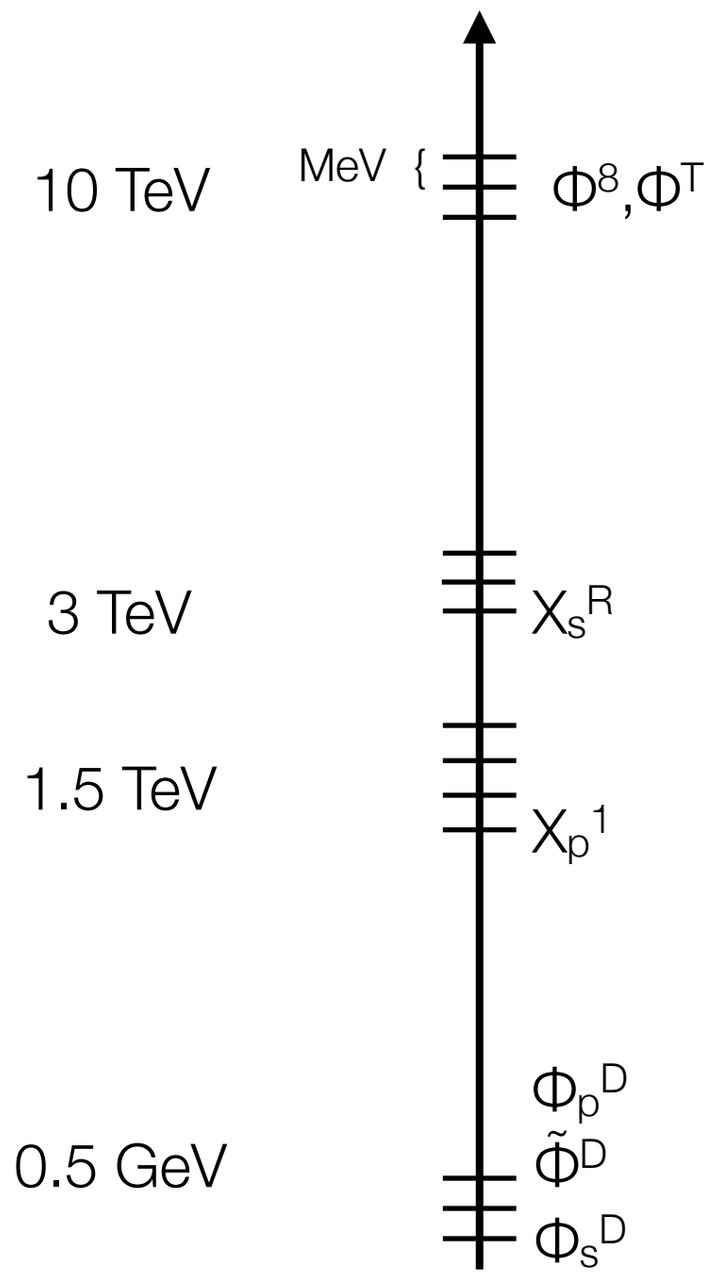
Resonant enhancement

- Dark matter in Milky Way @ $v \sim 10^{-3}$
- Deeply non-relativistic so $M_R = E_{CM} \approx 2\, M_{DM}$
- How do we get a factor of 2?
- Triplet under global SU(3) spontaneously broken by octet

$$\langle \Phi \rangle \propto T^8 = \mathrm{diag}(1, 1, -2)$$

- All other model complications: protecting this relation

Dark Sector Spectrum



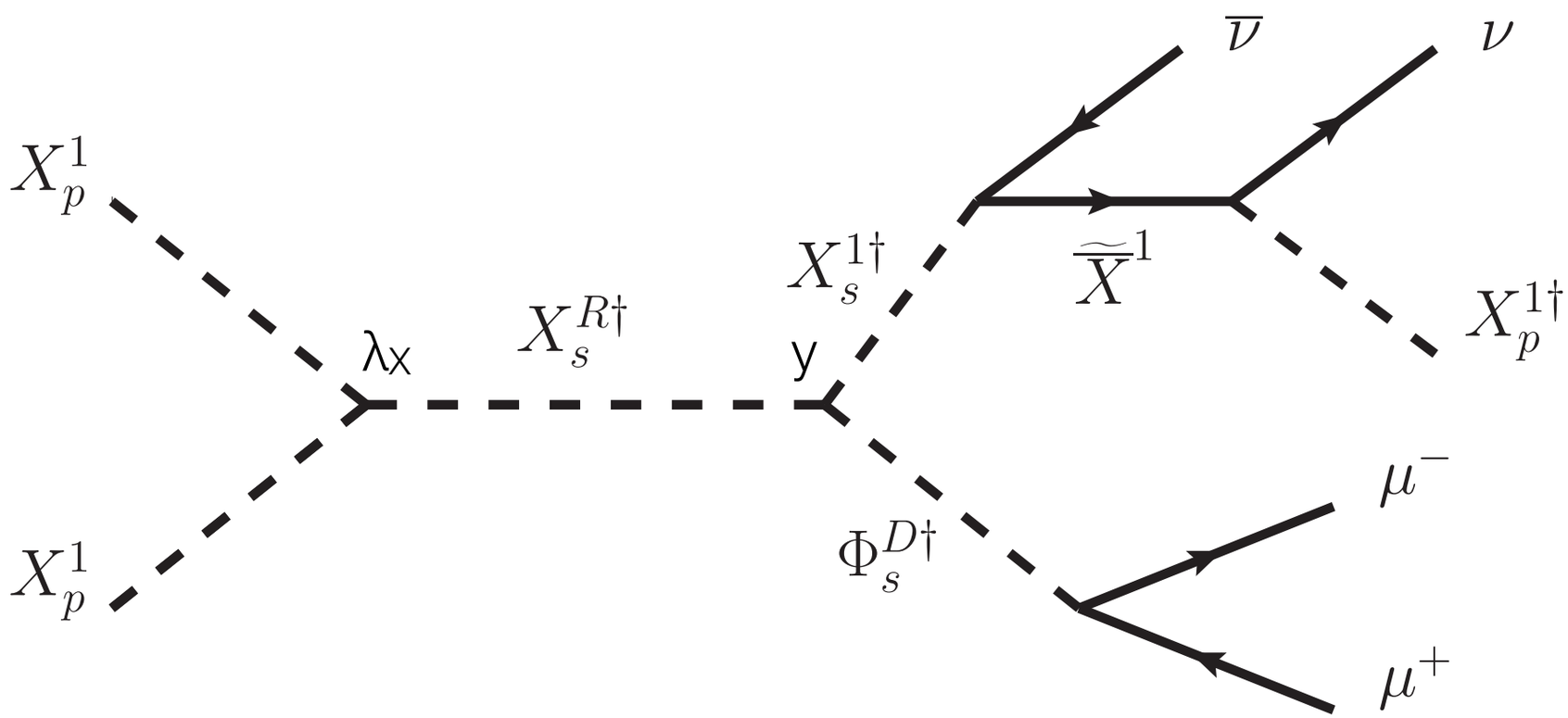
Heavy states from octet SSB

Resonance and partners

Dark matter and partners

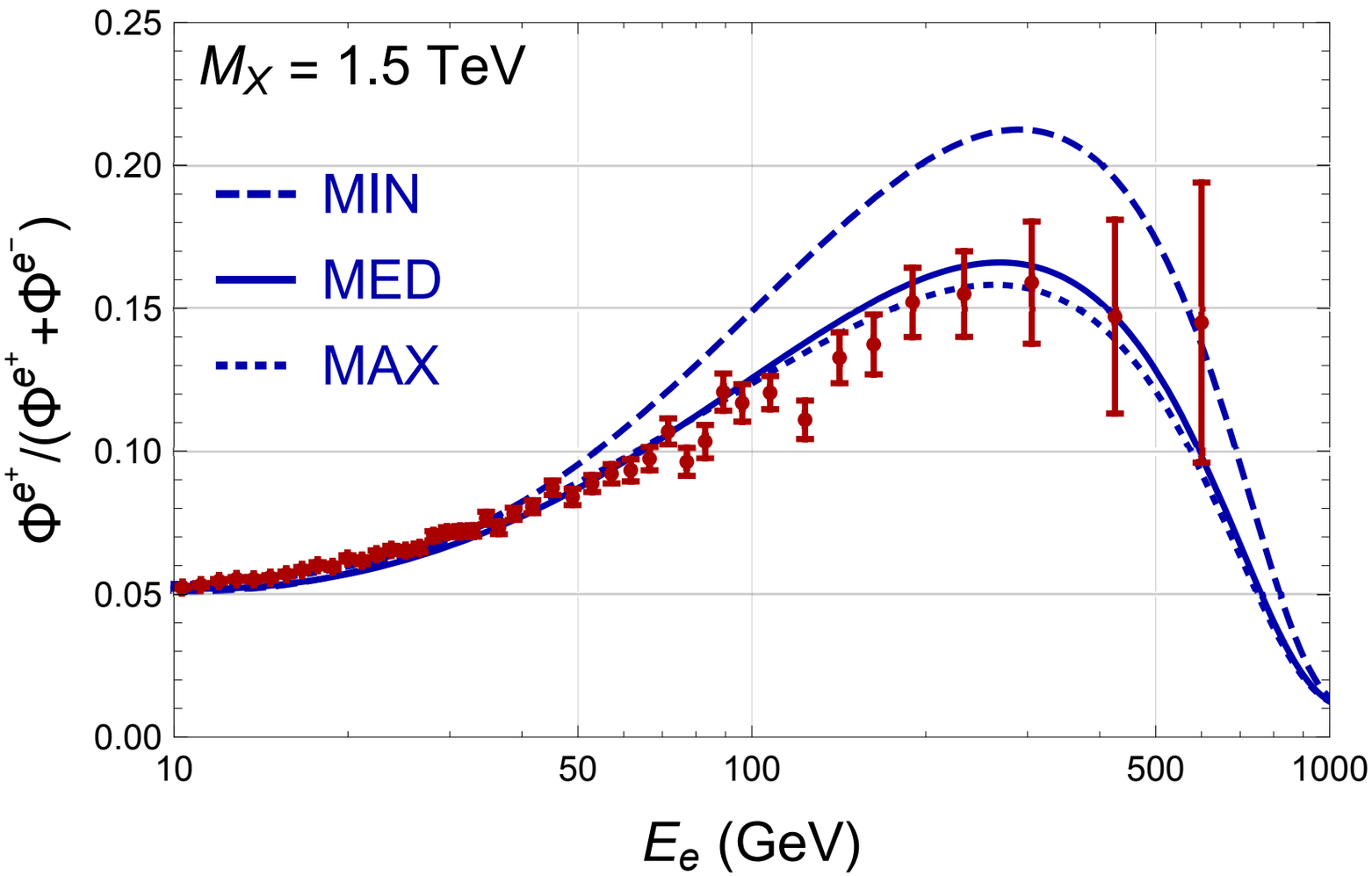
Light PNGBs
Protected by SSB + SUSY

Positron Signal Generation

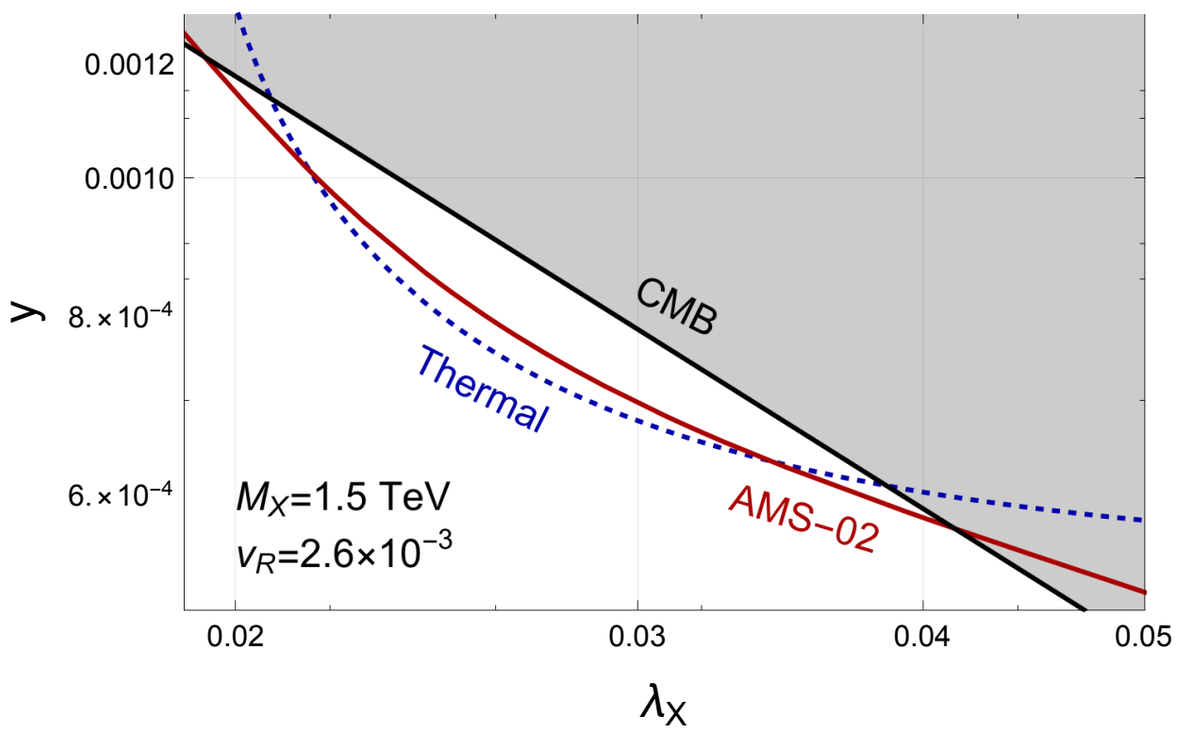


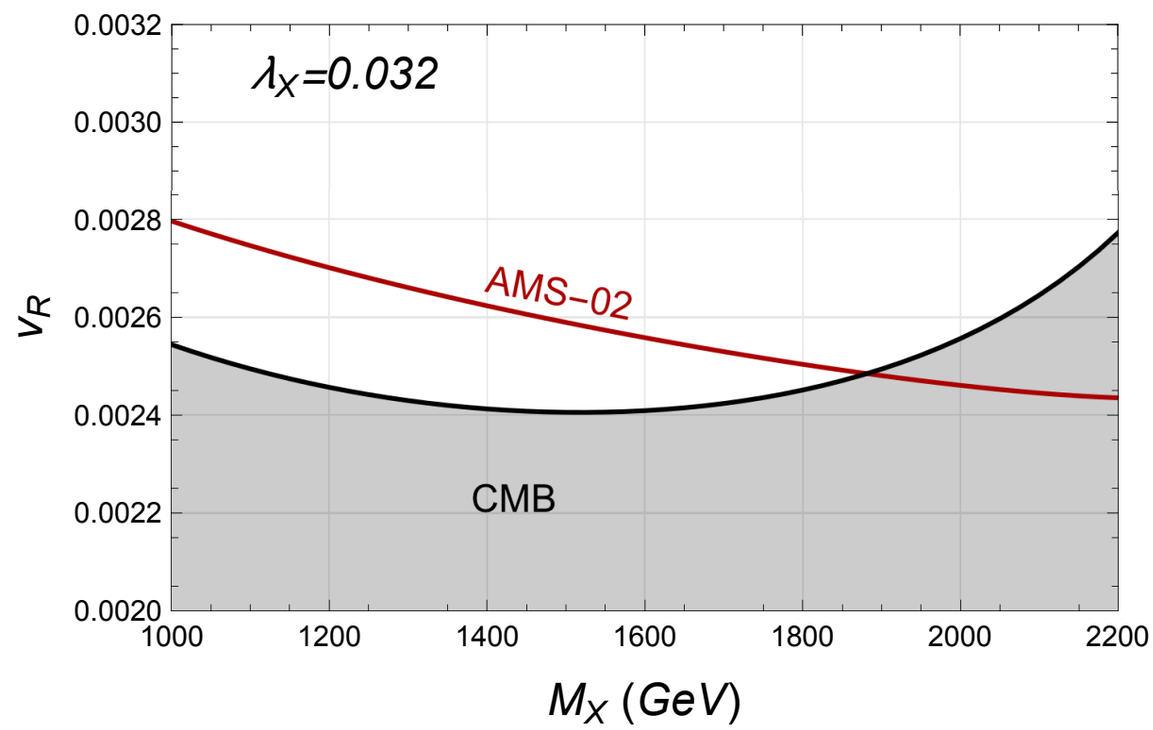
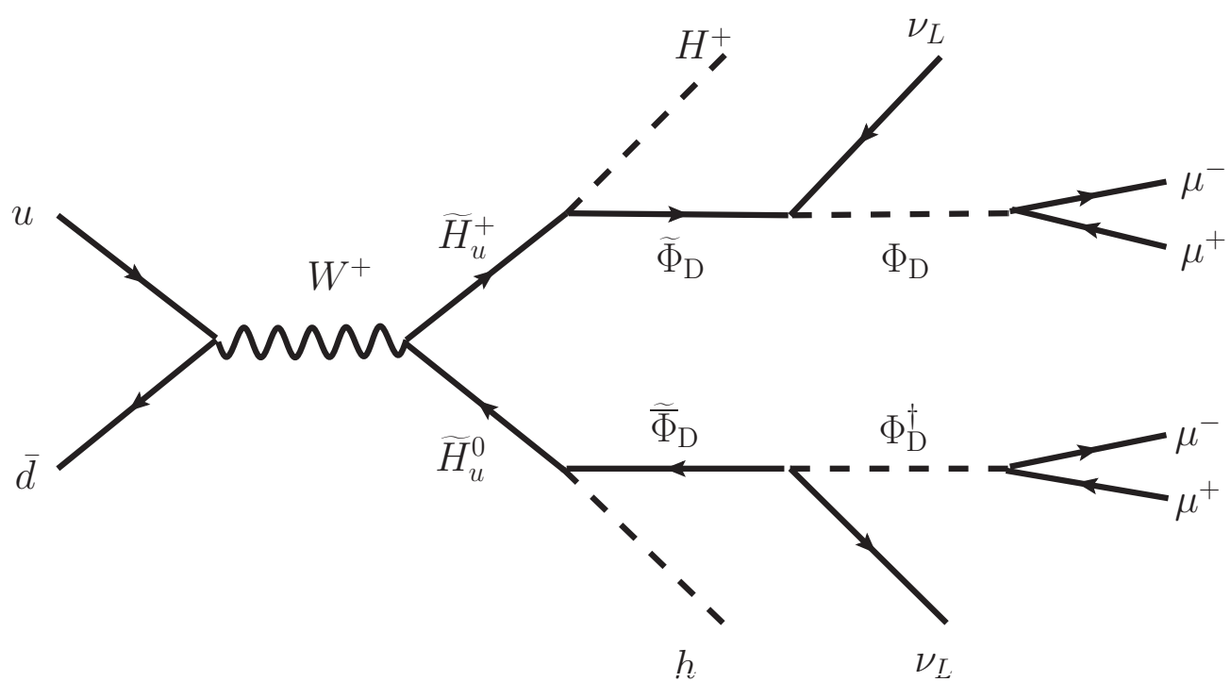
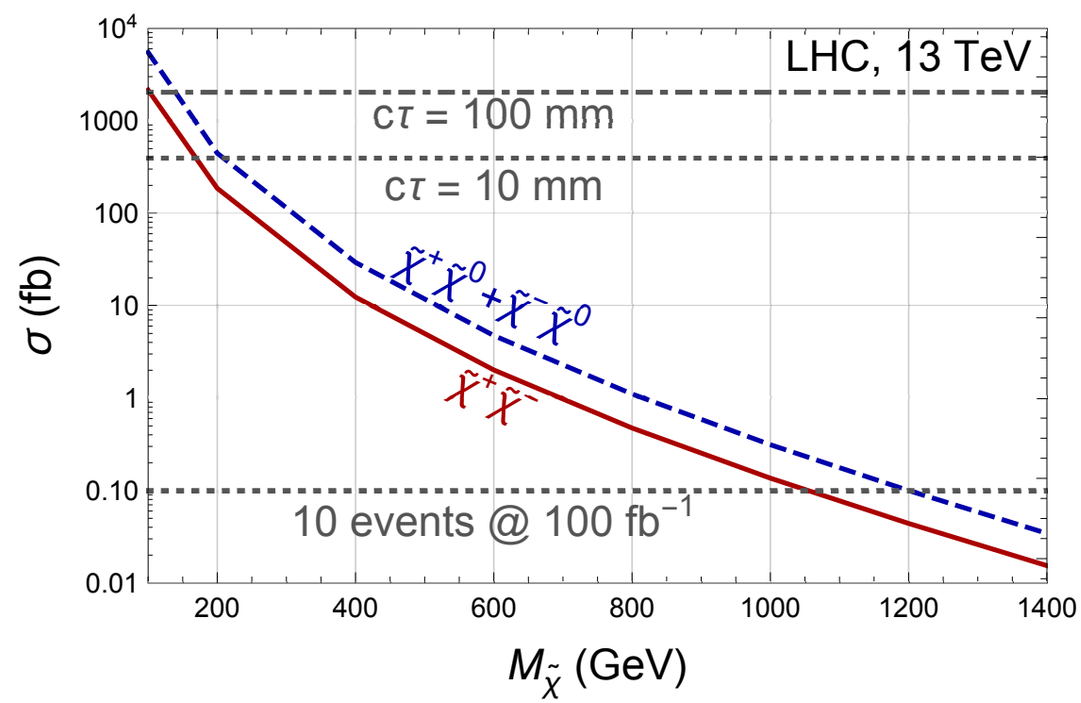
- Electrons/positrons from muons have softer spectrum
- Intermediate scalar ensures safety from γ ray searches

Can Fit the AMS-02 Data



Results and Parameter Space





Collider Signals