Indirect Detection of Dark Matter at the Galactic Center

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Introduction

- γ-rays in the galactic center
- **Three Models to Explain this Emission**
- **Future Tests**

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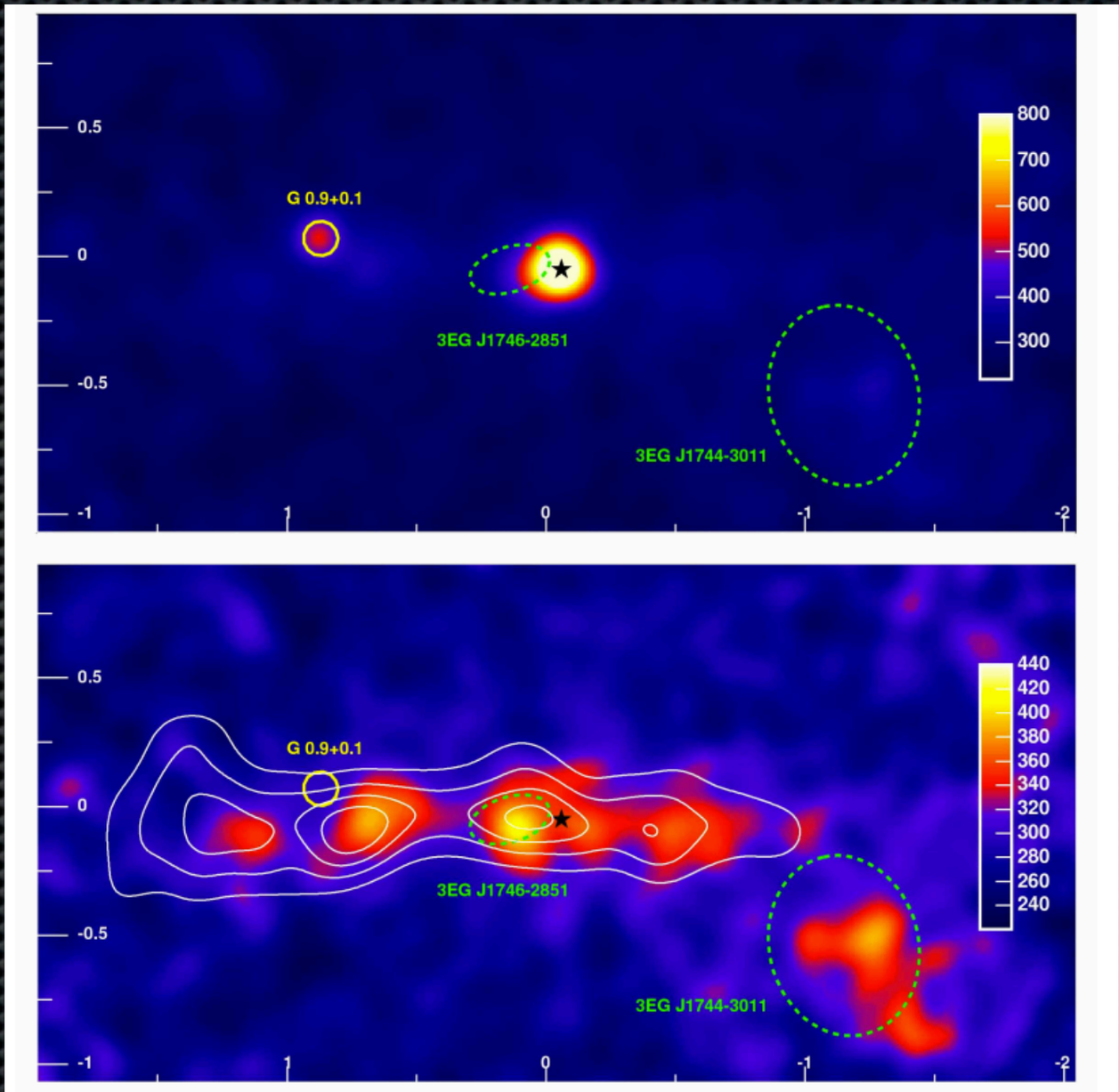
Observations - HESS

- Point source to within 1.2‘ (3 pc)
- No variability (even when variable in X-Rays)
- Not entirely spherically symmetric
- Smooth Power-law spectrum (E^{-2})



Aharonian et al. (2006)

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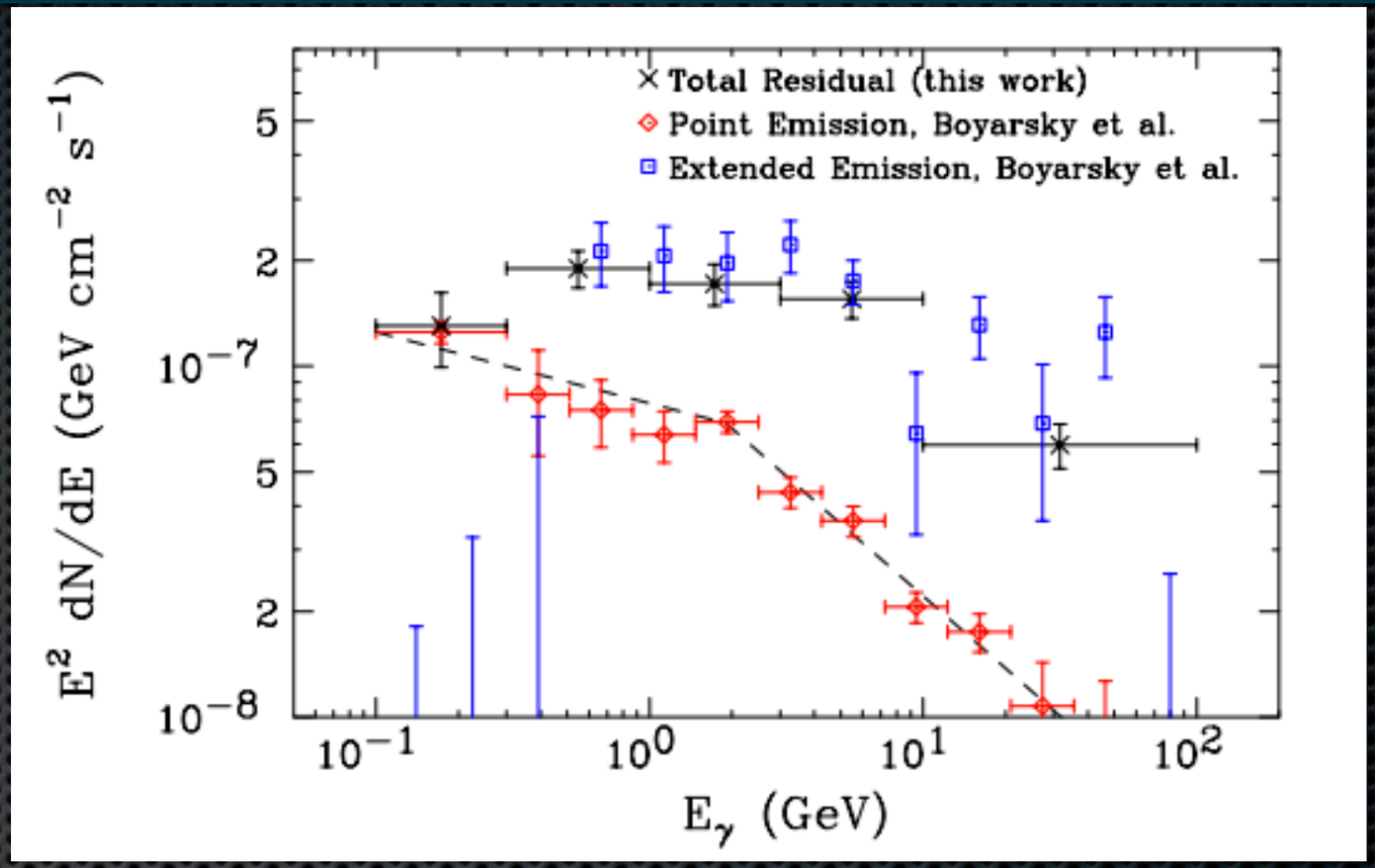
Observations - Fermi

- Possibly Extended?
- No Variability



Hooper & Linden (2011)

- "Bump" at ~1 GeV, which is concentrated in the "non point-source" component
- Point source has broken power-law spectrum breaking at ~10 GeV

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Matching Observations

- We already know the gamma-ray emission is distinct from the radio and X-Ray emission

- BUT - can all gamma-rays be explained by one source class, or do we need two?

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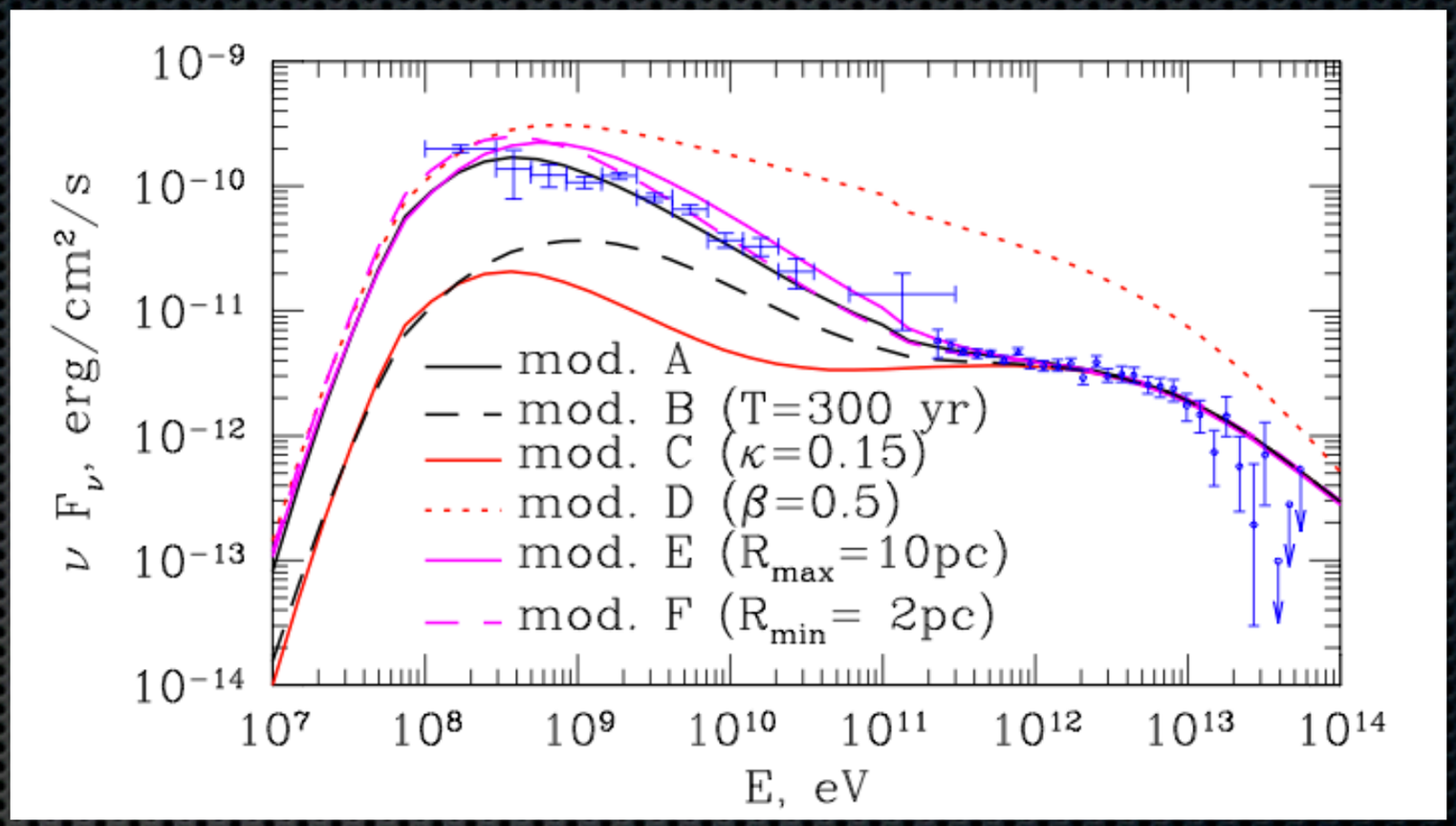
Hadronic Model

- Explain both the GeV and TeV emission

- Requires fine-tuning diffusion constants



Chernyakova et al. (2011)

- Morphology constrained by gas density

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Hadronic Model

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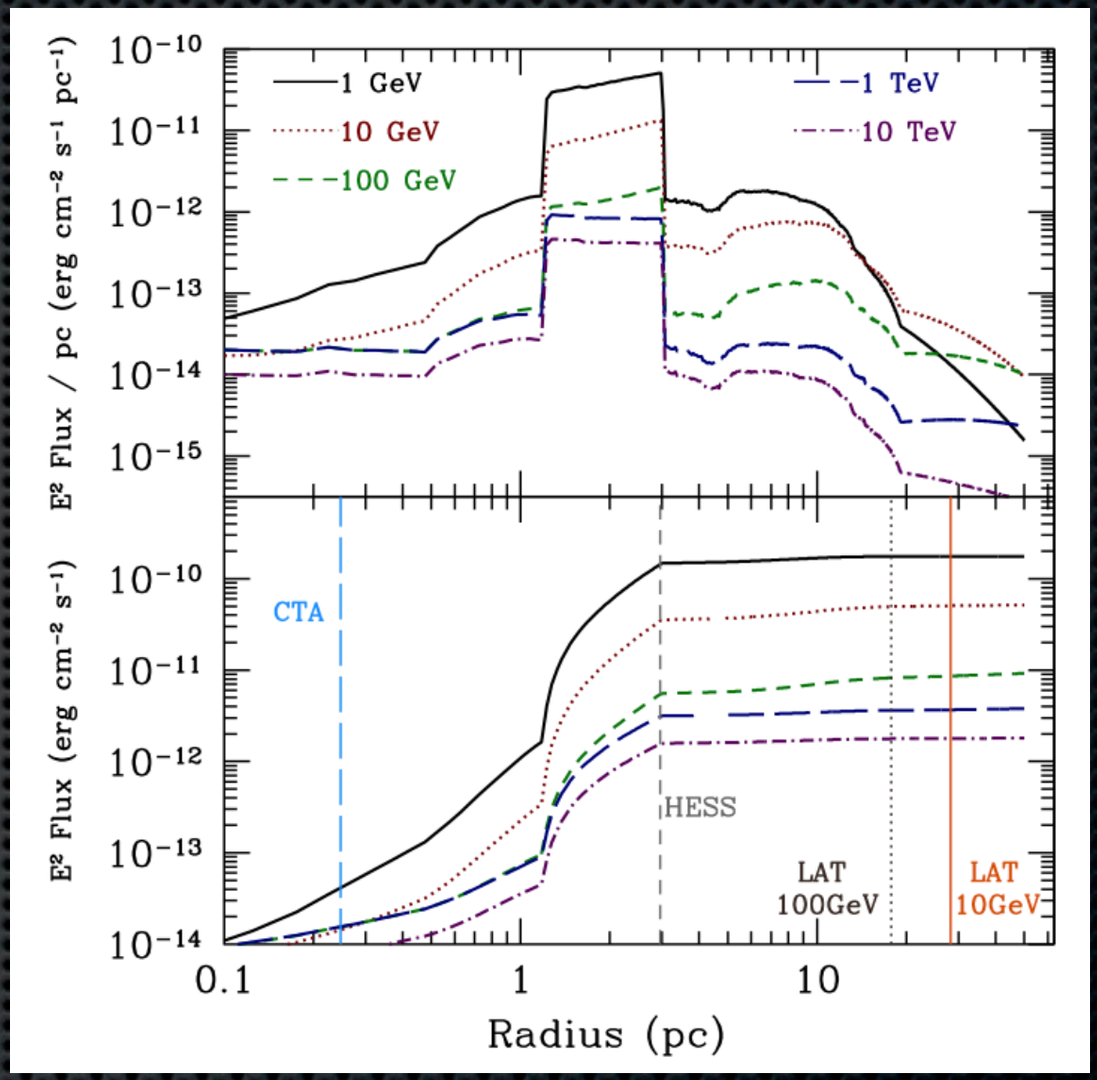

Linden et al. (in prep)

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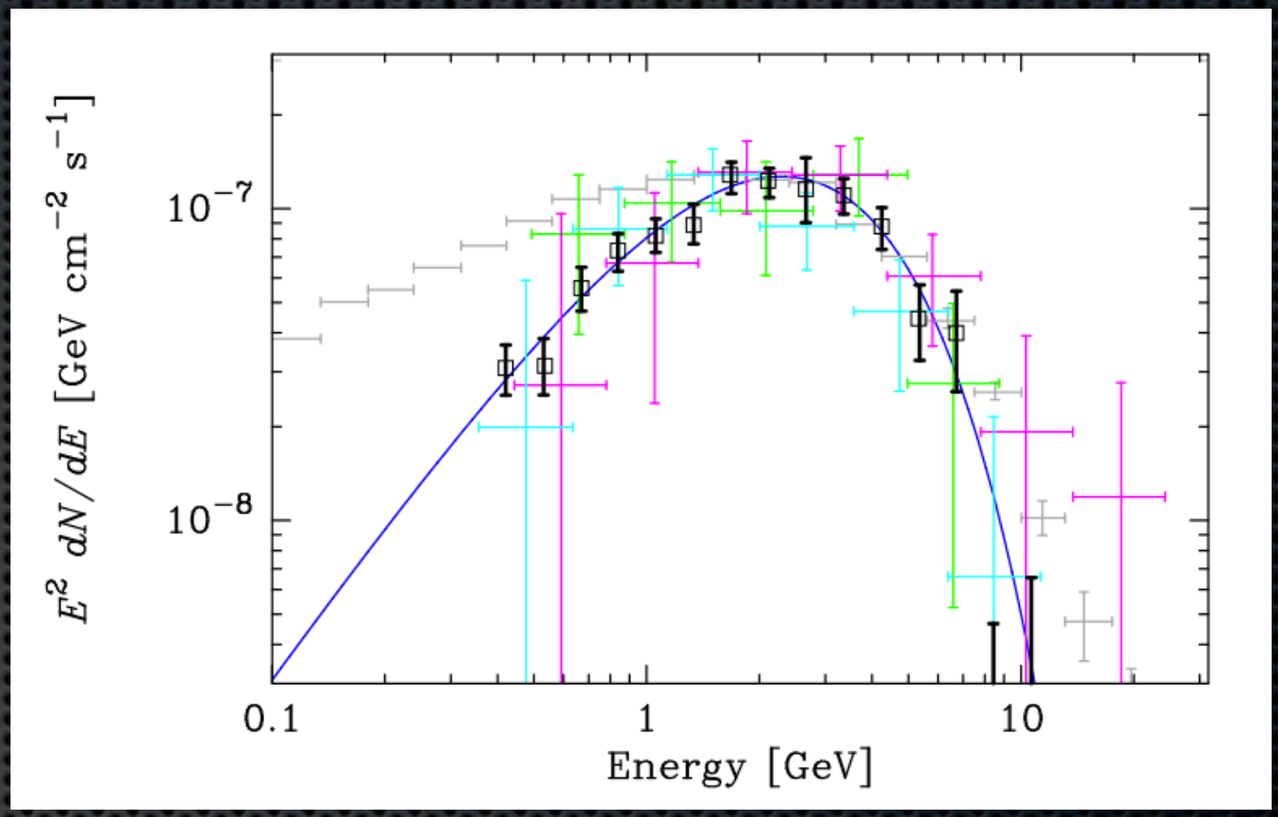
Leptonic Model (MSPs)

- Explain GeV signal only
- Known MSPs provide a reasonable (disputed) match to the gamma-ray signal



Abazajian (2011)

- May be constrained by radio observations (though we won't see pulsations)

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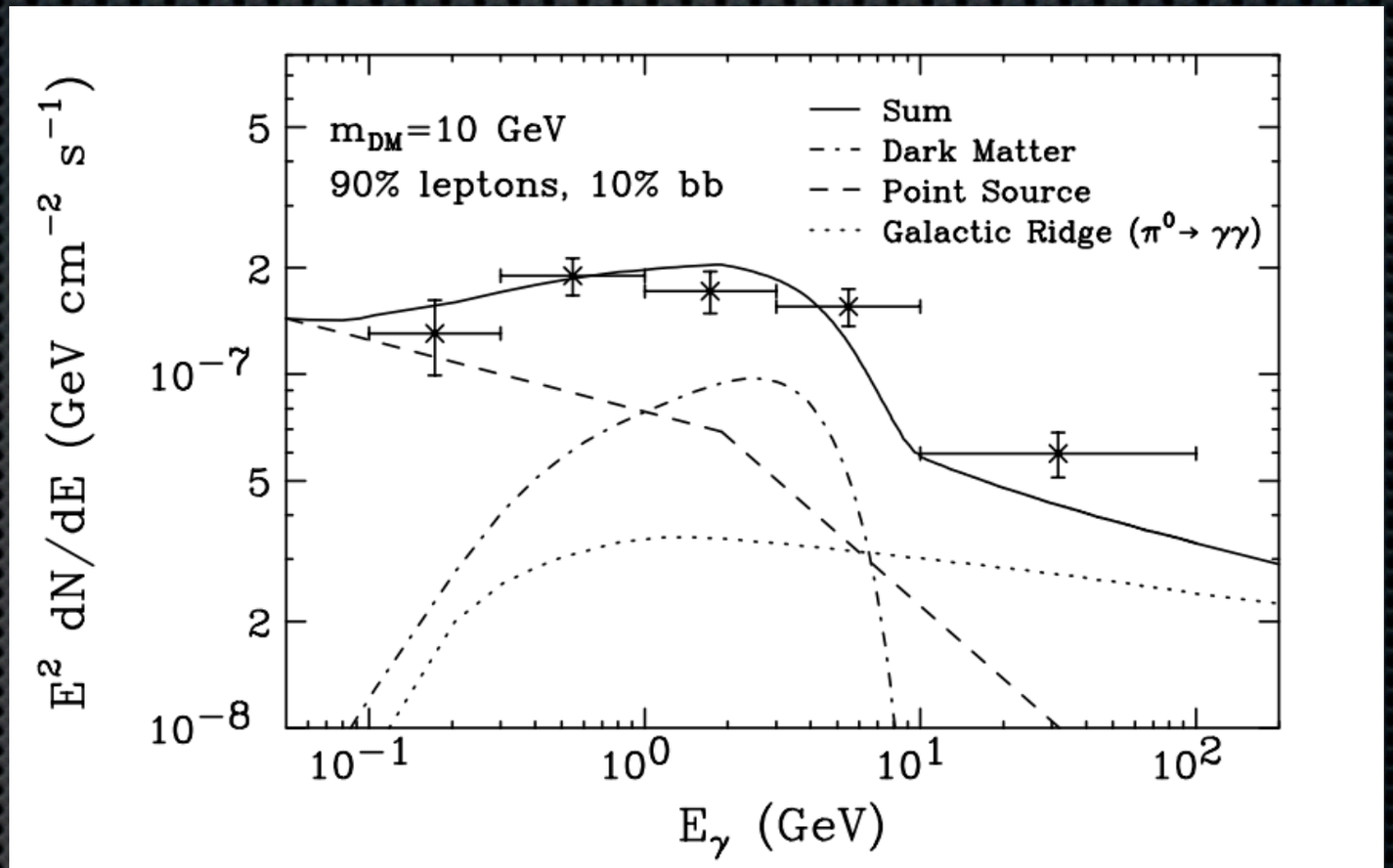
Dark Matter Model

- Light dark matter models potentially explain GeV signal



Hooper and Linden (2011)

- Cross-section is similar to the WIMP thermal cross-section

- Leads to predictable (testable) signals in direct DM searches (compatable with CoGeNT/DAMA signals)

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Conclusions

- Assuming the existence of a power-law background of emission in the galactic center region - all three sources are currently comptable with Fermi/HESS observations

- Additional multi-wavelength constraints will be necessary to separate the above sources and determine the cause of the enhanced emission from the GC region.

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