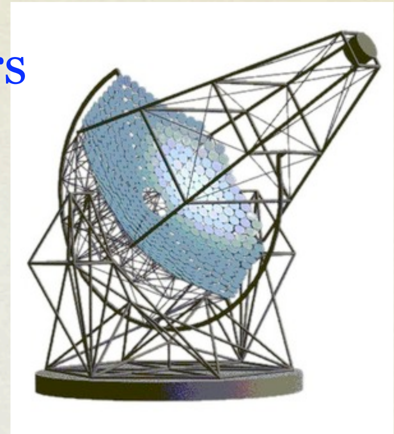
Workshop Summary:

Fermi and ground-based gamma-ray observations

Fermi satellite
> 1000 sources
@ GeV

Cherenkov detectors
~100 sources
@ TeV



- Issues:
  High-energy Astrophysics, Cosmic-ray Origin,
  Nature of Dark Matter, Fundamental Physics, etc.

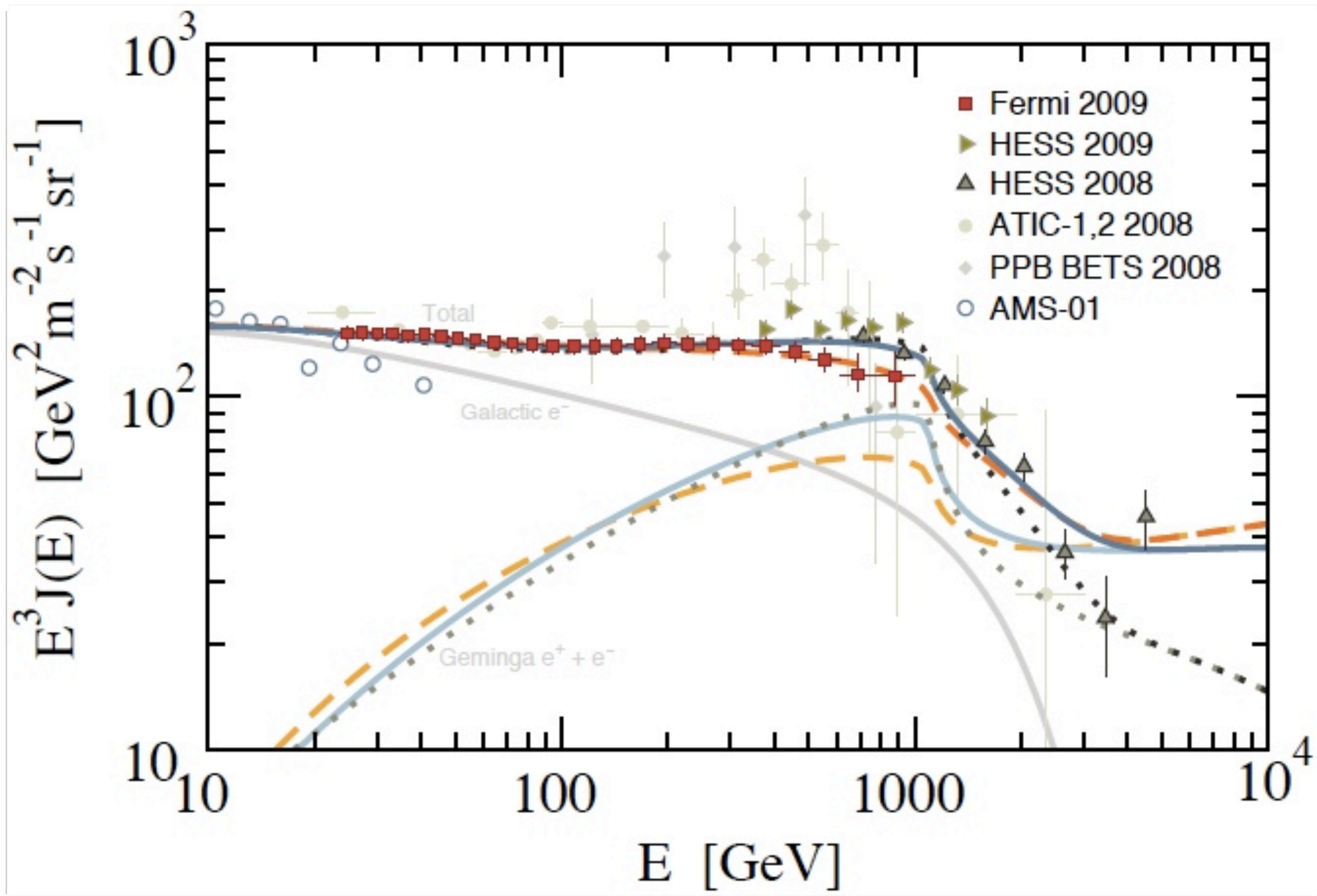
- Aims:
  New approaches to using the currently available data?
  Best ways to enhance science by the next-generation detectors?

Jennifer Siegal-Gaskins
Kohta Murase

Cosmic-ray Electrons and Positrons

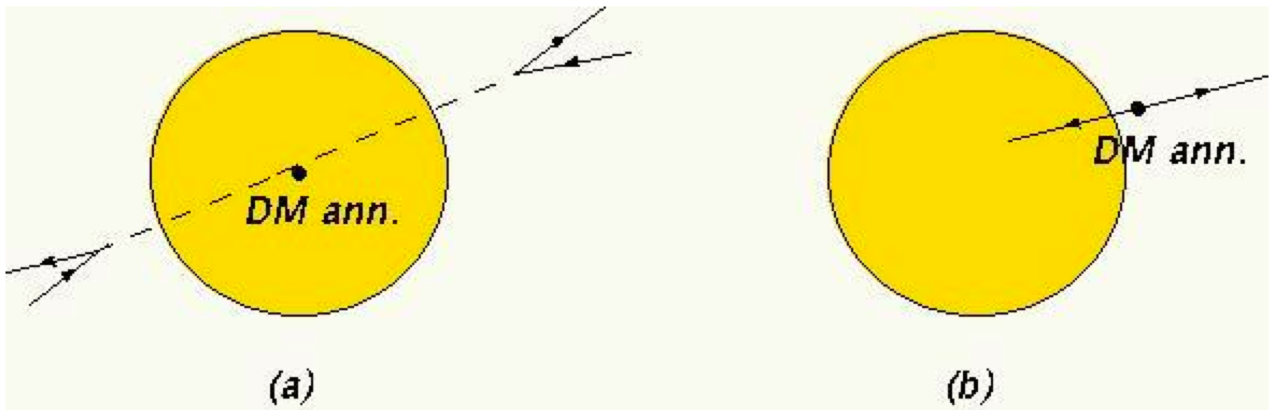
Fermi and ground-based gamma-ray telescopes measure CREs too!

CRE spectrum including Geminga



See M. Kistler's slides

Dark matter signals in CREs and gamma-rays from the Sun

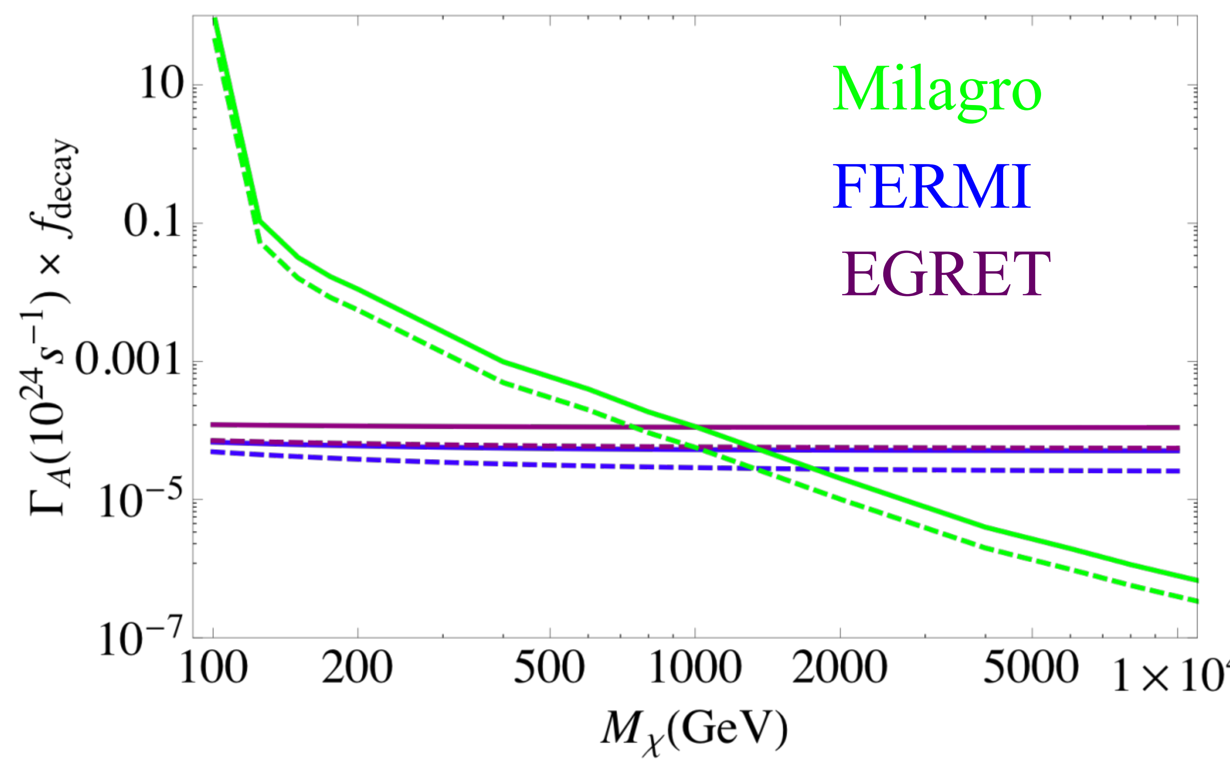


a) Annihilation into a new light state that escapes the sun and then decays.

b) Dark Matter does not accumulate in the center, annihilates *outside* the sun.

Some DM models (inelastic DM, secluded DM) motivated to explain recent data imply a flux of CREs and gamma-rays from the Sun

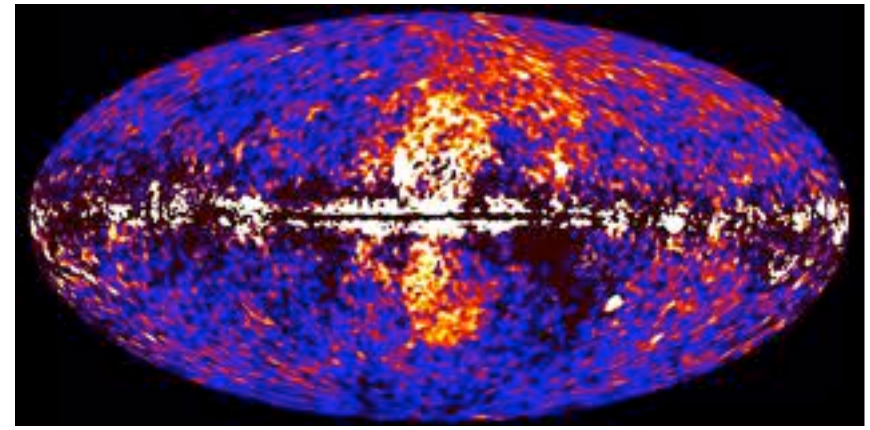
Constraints on DM annihilation rate from solar gamma-ray measurements

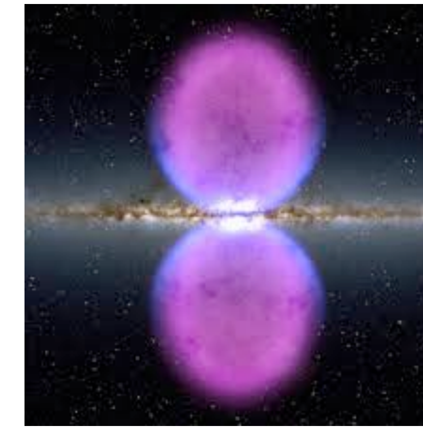


See I. Yavin's slides

Models are detectable/ constrainable by Fermi and ground-based gamma-ray telescopes

Fermi bubbles





Diffuse Excesses in the Fermi–LAT Data

The Fermi Bubbles and Galactic Center Excess

Explanations of Fermi

- 1.) Inverse Compton Scattering of leptons injected near galactic center (Lin et al. 2010)
- 2.) Energetic Proton Emission from Galactic Center (Crocker & Aharonian, 2011)
- 3.) Dark Matter Annihilation (Dobler et al. 2011)
- 4.) Millisecond Pulsars (Malyshev et al. 2010)
- 5.) Transient AGN Activity (Guo & Mathews. 2011)
- 6.) Systematics in foreground subtraction (Linden & Profumo, 2010)
- 7.) Extremely unfortunate nearby source

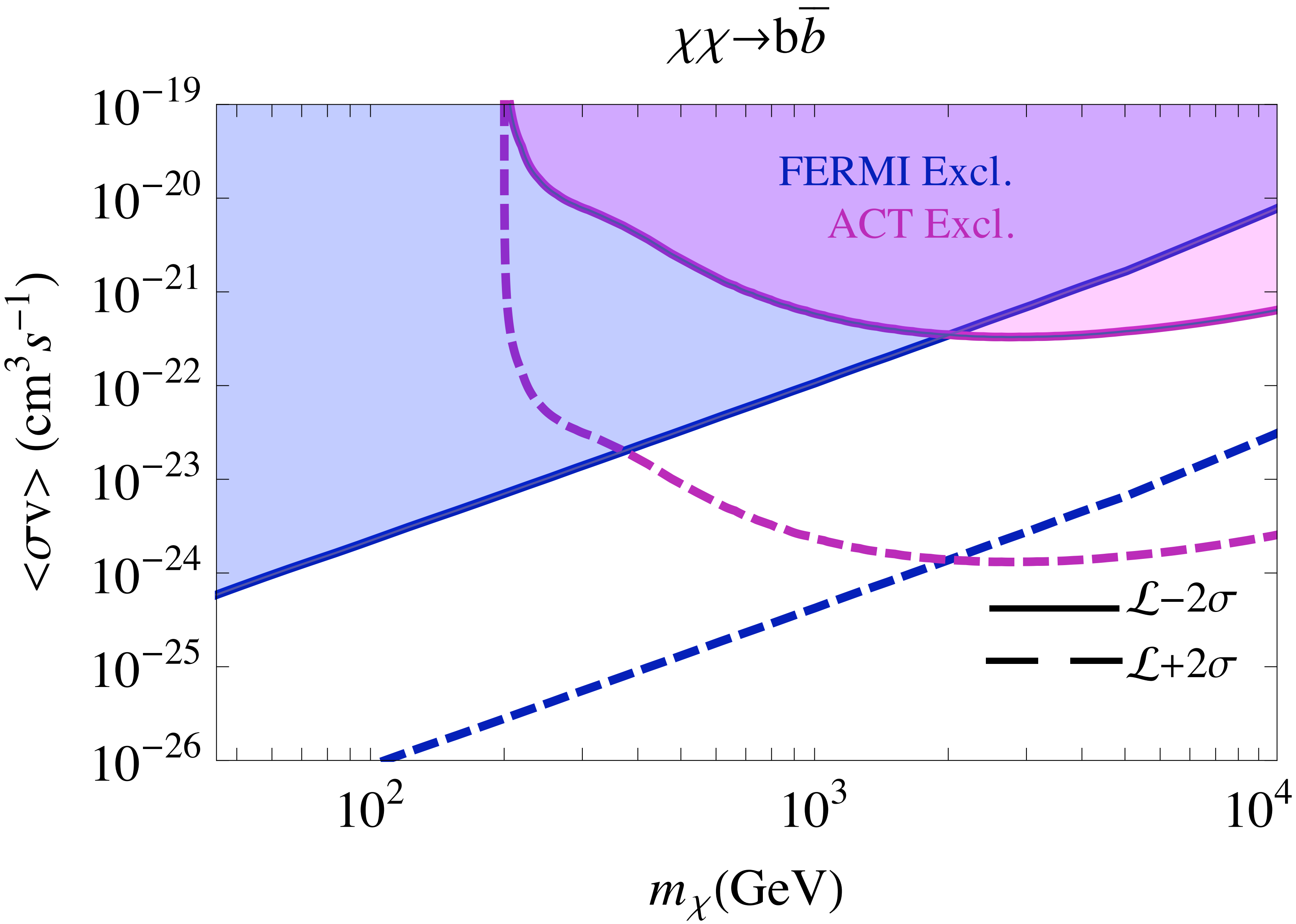
No convincing explanation yet

How to differentiate?

See T. Linden's slides

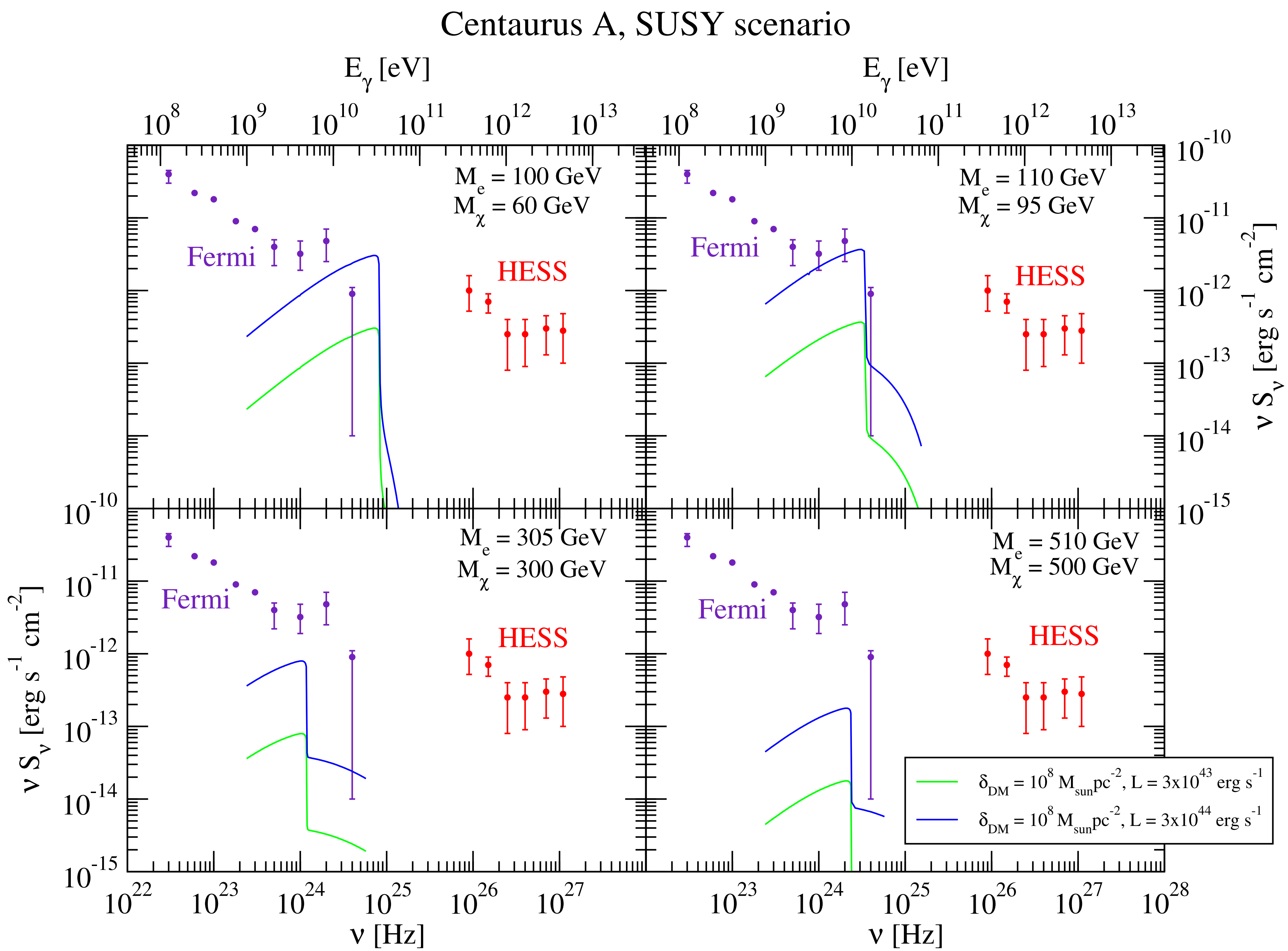
Dark matter constraints from dSph galaxies

Fermi and MAGIC observations of Segue 1 constrain DM models



See L. Strigari's slides

Probing dark matter with AGN jets

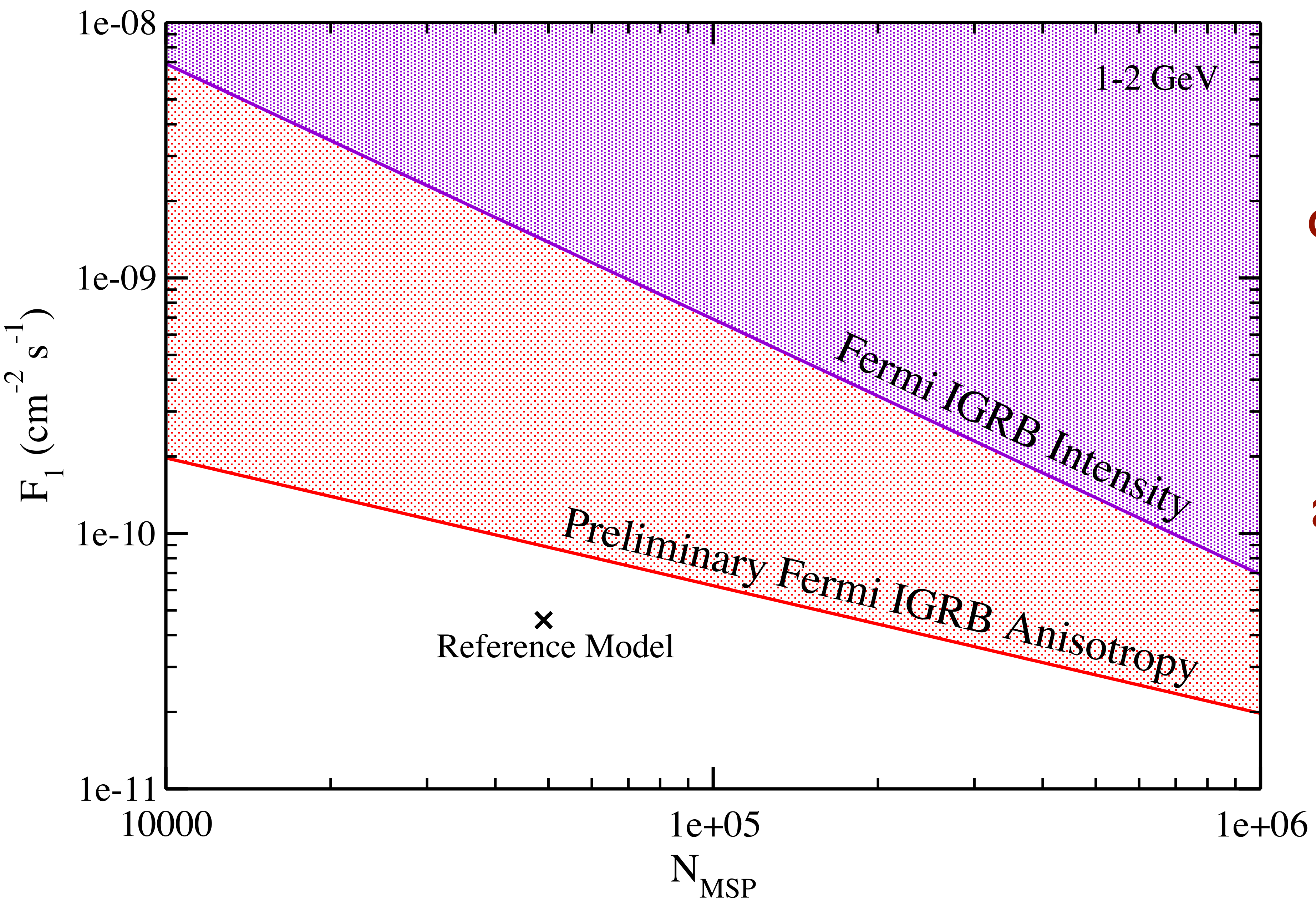


DM interactions with electrons could produce spectral signatures in off-axis gamma-ray emission from AGN

See L. Ubaldi's slides

Anisotropy constraints on gamma-ray source populations

Constraints on Galactic MSP population from measurements of high-latitude diffuse intensity and anisotropy



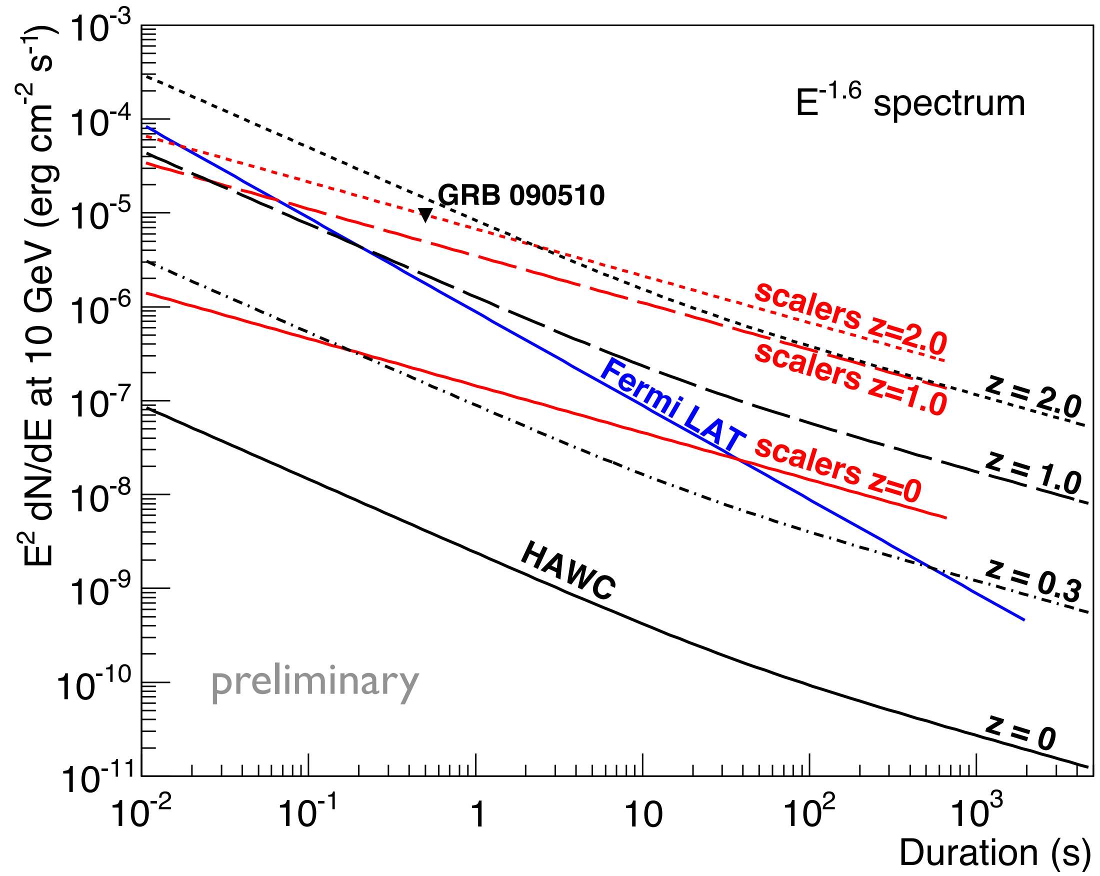
Anisotropy constraints promising: for some source classes such as millisecond pulsars, anisotropy provides a stronger constraint than intensity

See R. Reesman's slides

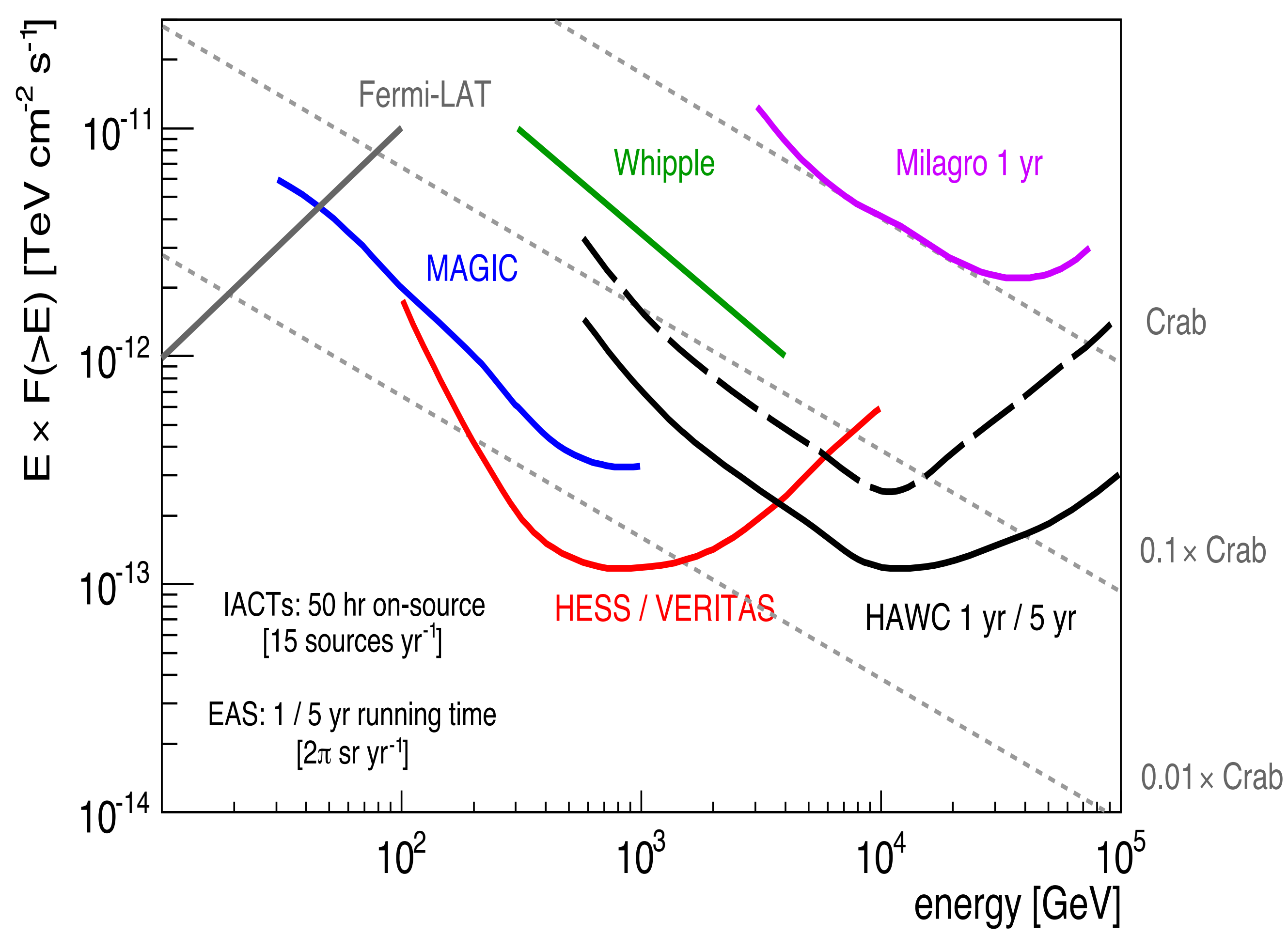
Robust dark matter signatures?

The HAWC Observatory

HAWC sensitivity to GRBs



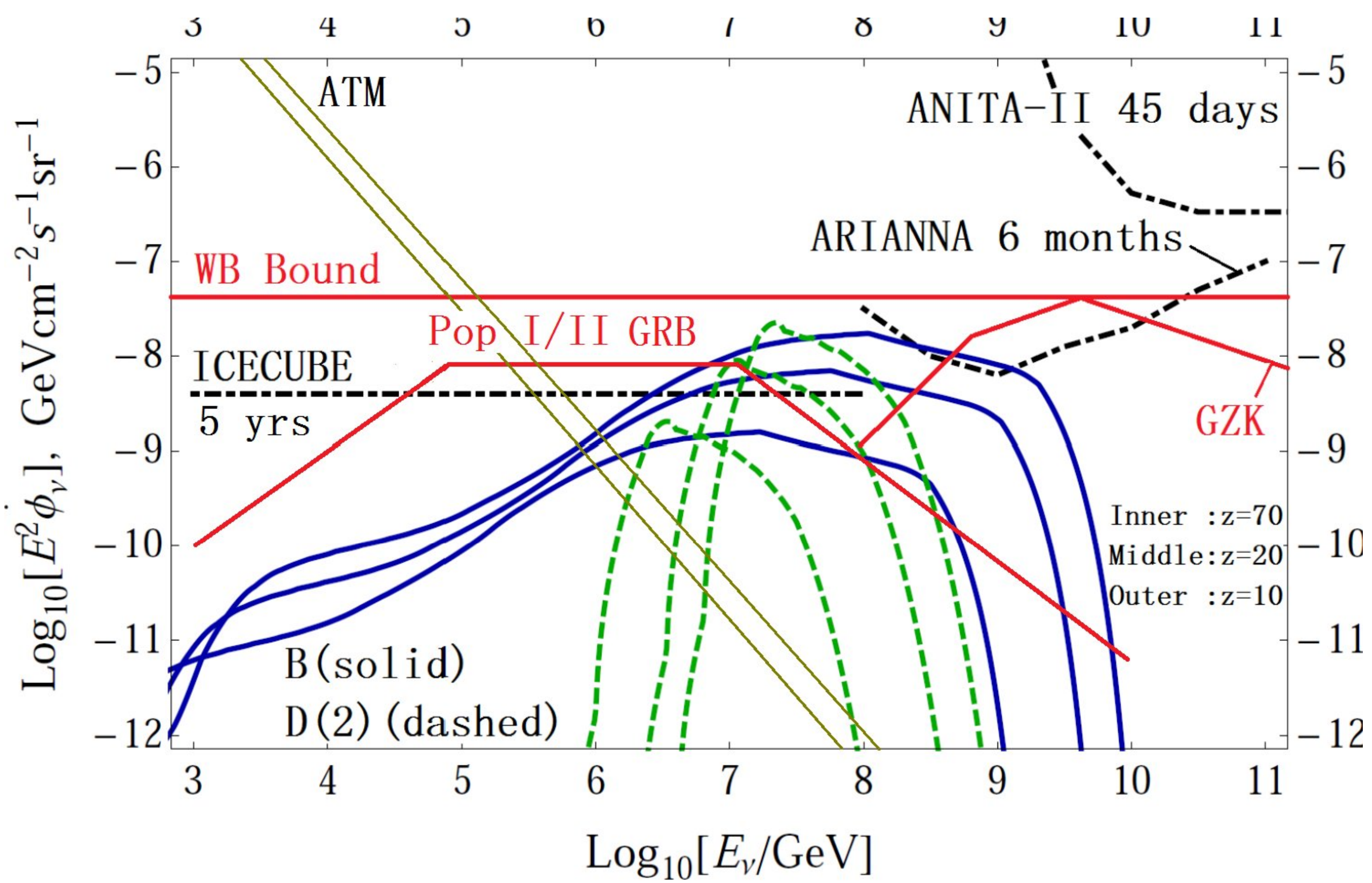
HAWC sensitivity to Crab-like sources



HAWC will significantly improve high-energy gamma-ray sensitivity, some overlap with Fermi

See D. Zaborov's slides

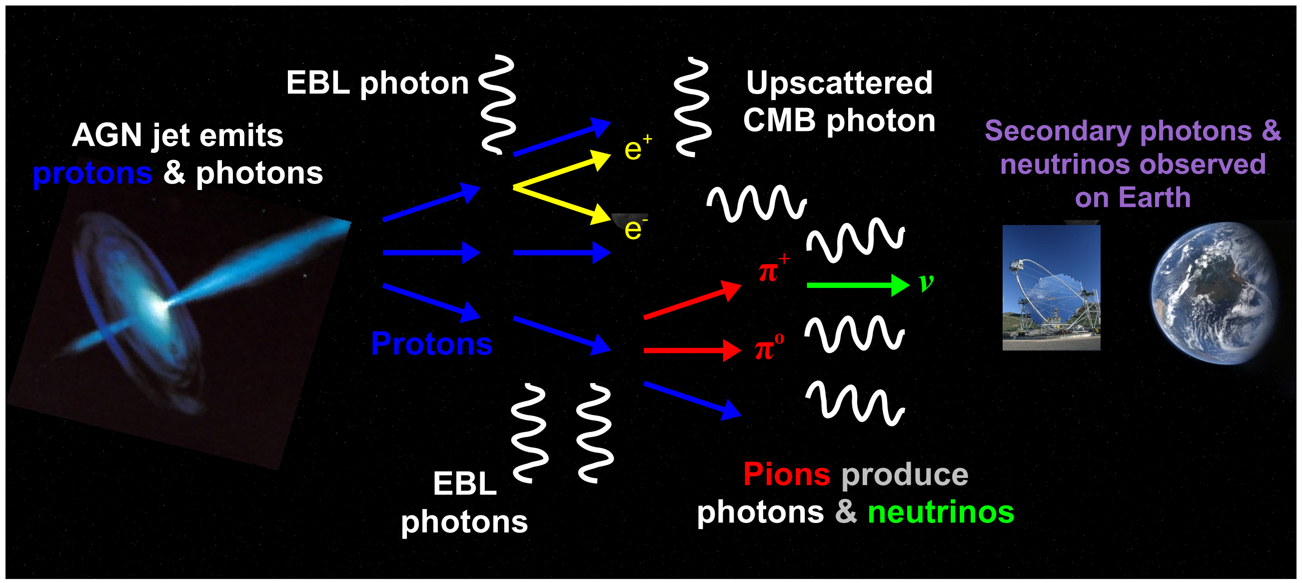
High-energy neutrinos from GRBs



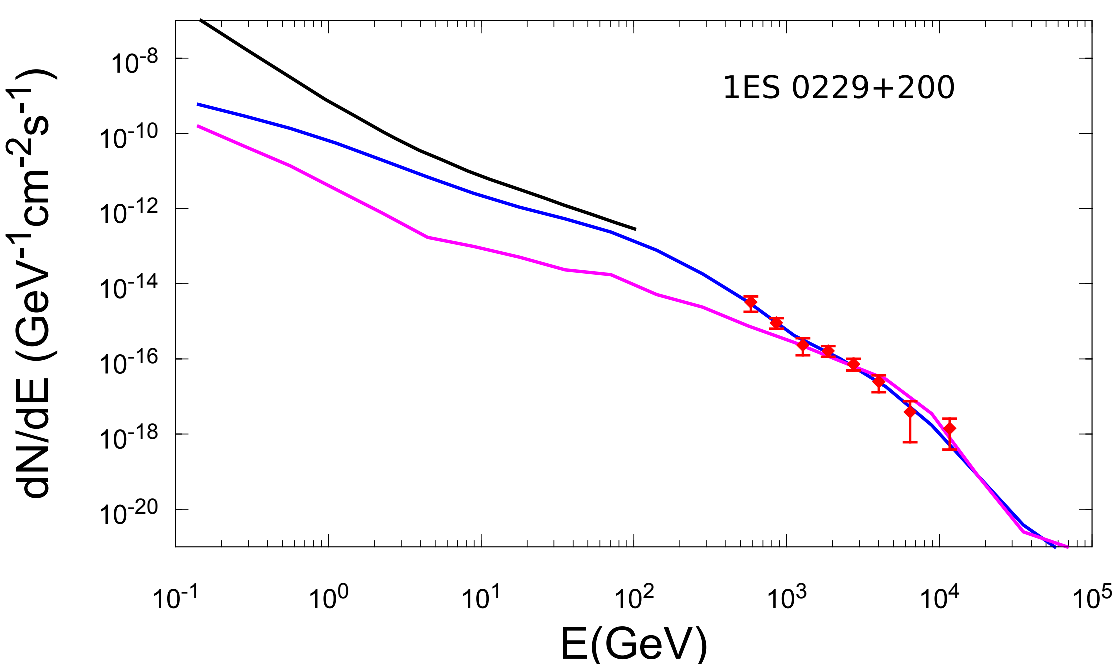
Models predict diffuse flux of neutrinos from early GRBs

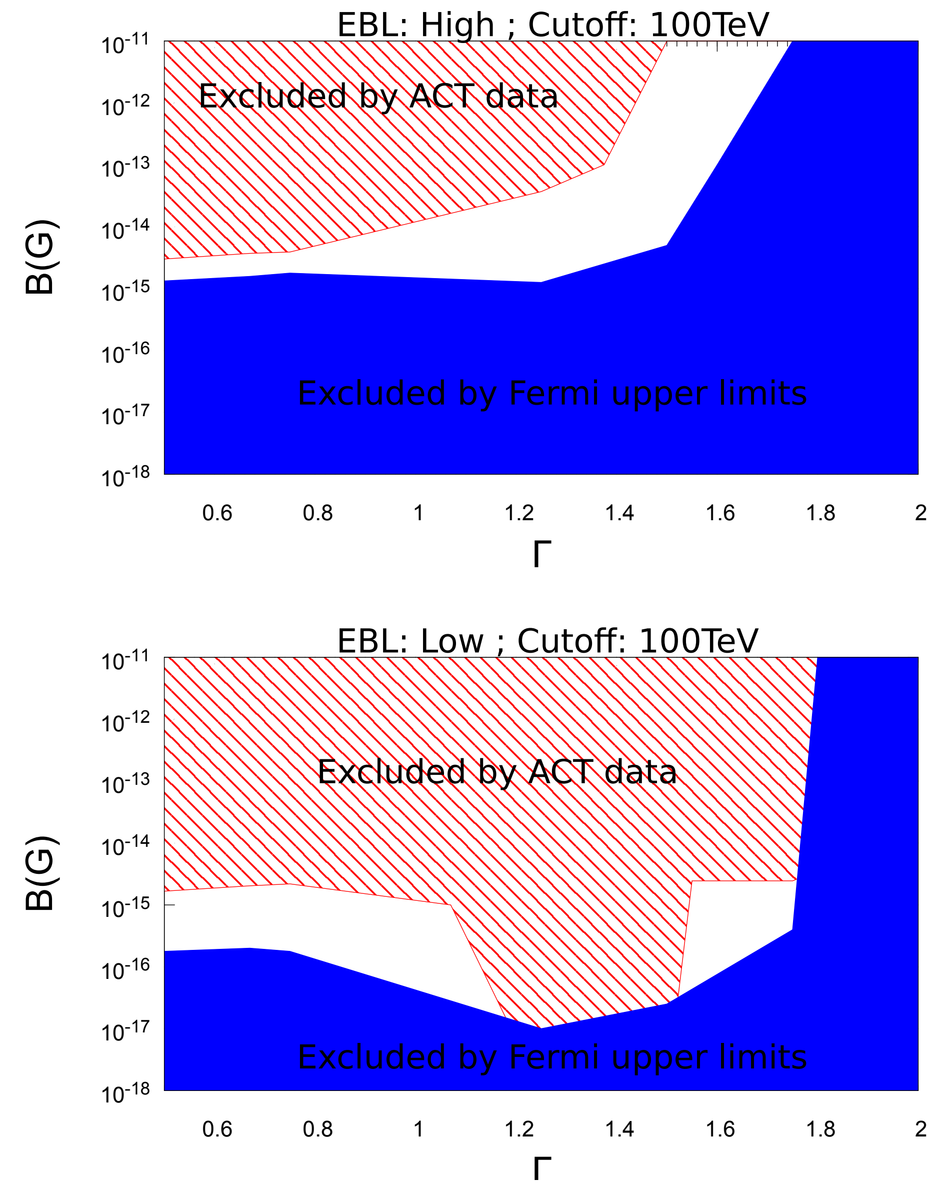
See S. Gao's slides

Secondaries as a probe of the EBL and IGMF



Gamma-rays from secondaries from cosmic-ray protons

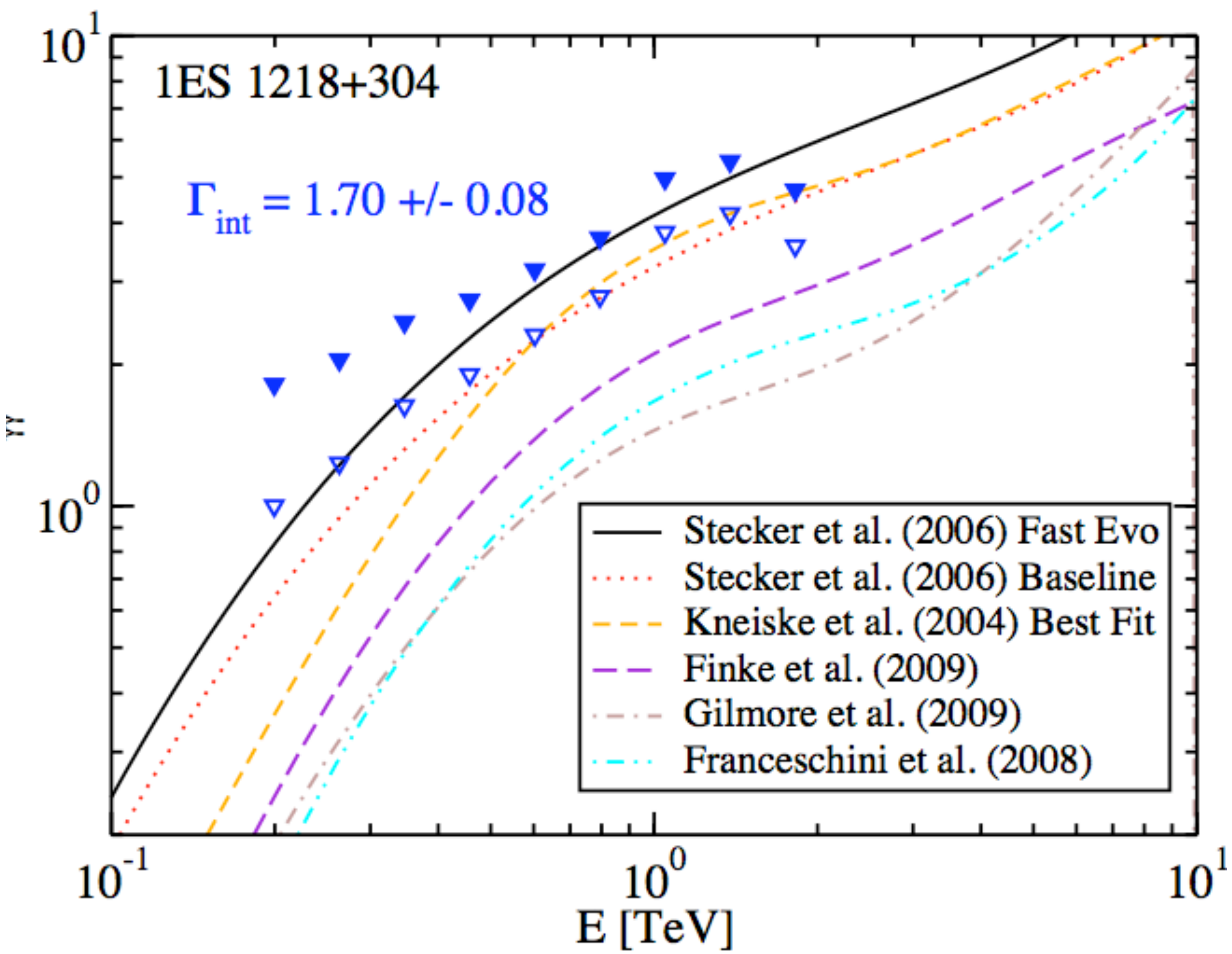




See W. Essey's slides

Constraints can be placed on EBL and IGMF from Fermi and ACT observations of blazars

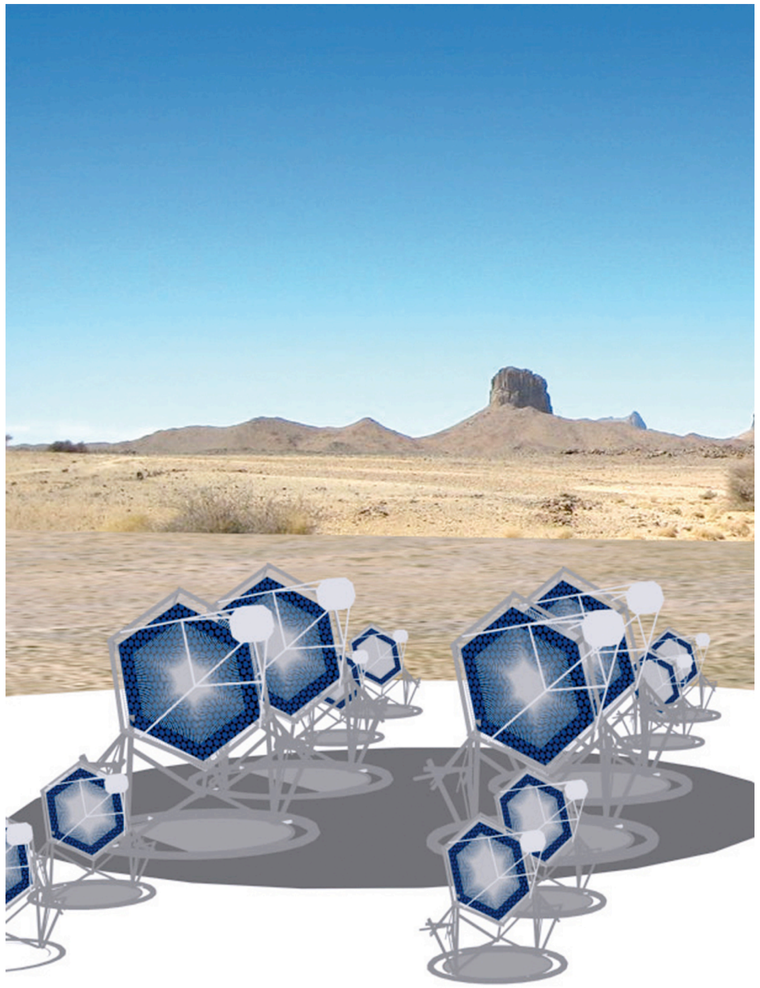
Gamma-ray constraints on the extragalactic background light



High EBL models ruled out by combined Fermi/ ACT constraints

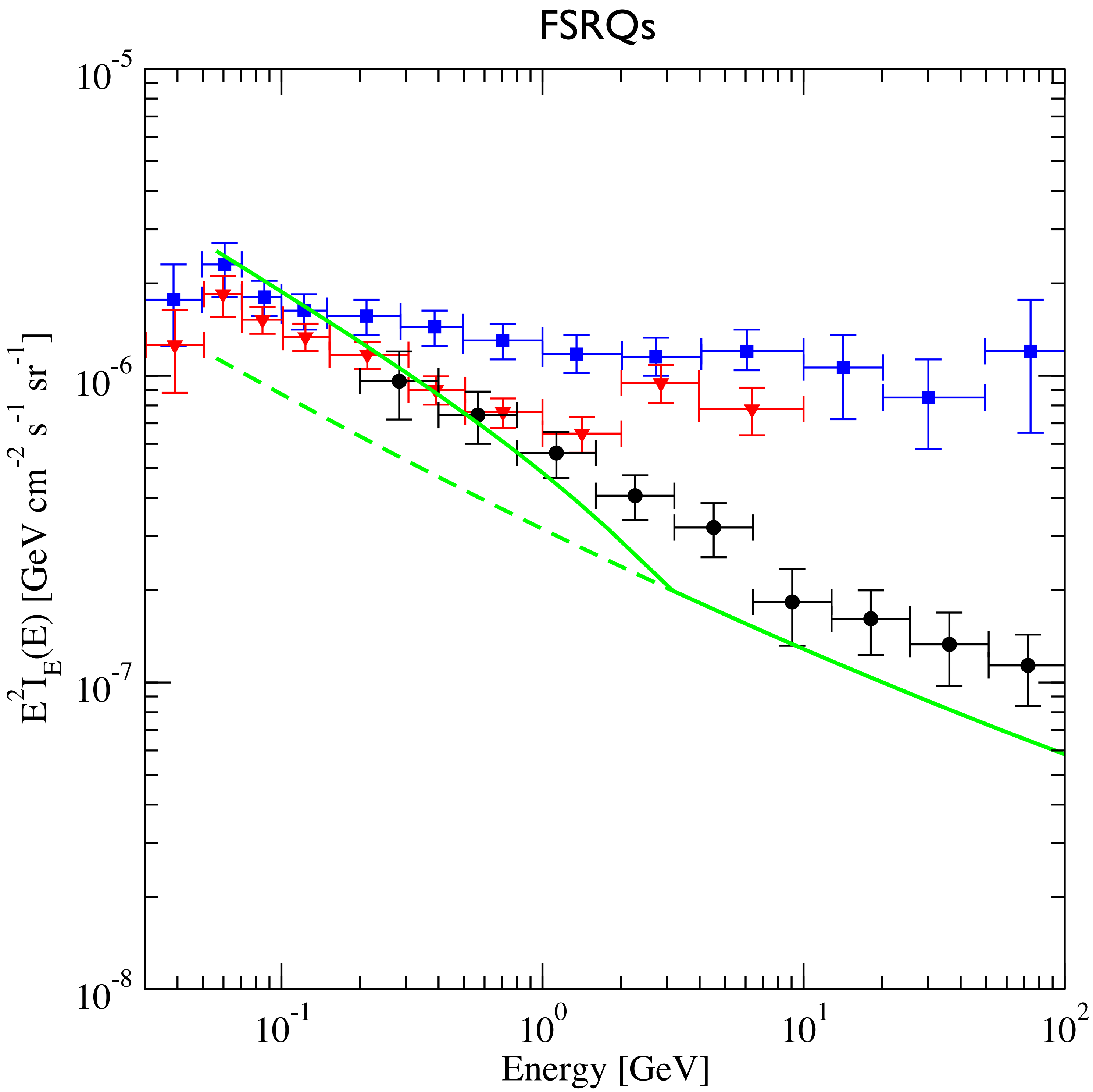
See J. Finke's slides

Fermi and CTA data access and support



See H. Tajima's slides

Contribution of astrophysical sources to the gamma-ray background



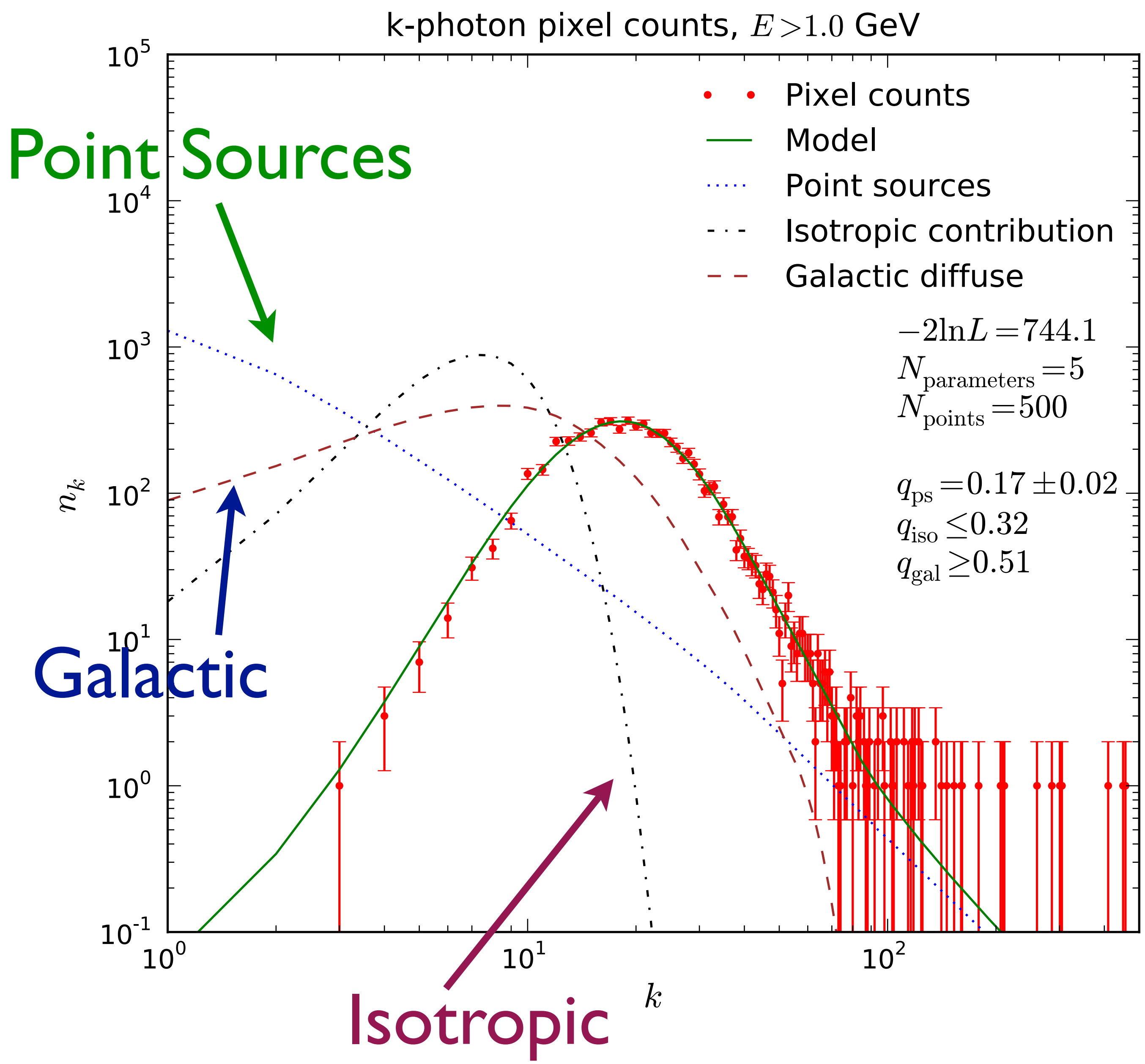
Scenario in which EGRB dominated by emission from blazars consistent with Fermi source count data

See T. Venter's slides

Origin of the extragalactic diffuse background

Results:

1. AGN-like point sources ~ 20%
2. Galactic non-isotropic ~ 50%
3. Isotropic ~ 30%



Pixel count statistics constrain contribution of point sources to diffuse emission

See D. Malyshev's slides