



Kavli Institute
for Cosmological Physics
AT THE UNIVERSITY OF CHICAGO

Unidentified EGRET Sources and the Extragalactic Gamma-Ray Background

Vasiliki Pavlidou
University of Chicago

Brian Fields

University of Illinois

Jennifer Siegal-Gaskins

University of Chicago

Angela Olinto

University of Chicago

Carolyn Brown

University of Chicago




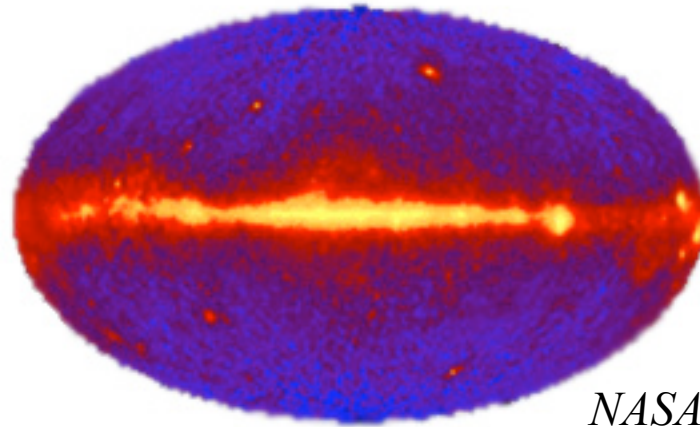
The National Science Foundation



The Kavli Foundation

GeV Diffuse Emission

- Origin:
 - Galactic
 - Extragalactic
- Nature:
 - Truly Diffuse Emission
 - Collective emission from unresolved sources
- Guaranteed sources of diffuse emission: 
 - Faint, unresolved objects of known gamma-ray emitting classes (e.g.: blazars, normal galaxies, pulsars)



NASA - EGRET team



Kavli Institute
for Cosmological Physics
AT THE UNIVERSITY OF CHICAGO

UnID Sources & Diffuse Emission

- Some contribution from unIDs guaranteed:
 - Most numerous sources
 - If most unIDs are extragalactic: (see Siegal-Gaskins talk on Friday)
 - Similar unresolved extragalactic objects contribute to EGRB
 - If most unIDs are Galactic:
 - similar objects in other galaxies enhance unresolved normal galaxy contribution to EGRB
 - Similar unresolved objects in MW contribute to diffuse Galactic emission
- However: uncertainties!



The National Science Foundation



The Kavli Foundation



Kavli Institute
for Cosmological Physics
AT THE UNIVERSITY OF CHICAGO

Our approach: I know one thing, that I know nothing

- An empirical model for collective emission from unresolved unIDs
- Seek to answer 2 questions:
 1. **Numbers/Fluxes:**
How plausible is that unresolved unIDs, if extragalactic, have significant contribution to gamma-ray background?
 2. **Spectral indices:**
Would collective unresolved emission from unIDs be spectrally consistent with the gamma-ray background?



The National Science Foundation



The Kavli Foundation



Kavli Institute
for Cosmological Physics
AT THE UNIVERSITY OF CHICAGO

Which resolved sources?

Only use sources which to this date remain without suggested candidate for a low-energy counterpart

- Many potential identifications suggested since 3rd EGRET catalog
- List of still-unidentified sources maintained by Carolyn Brown:
URL:

http://home.uchicago.edu/~carolynb/unidentified_sources



The National Science Foundation



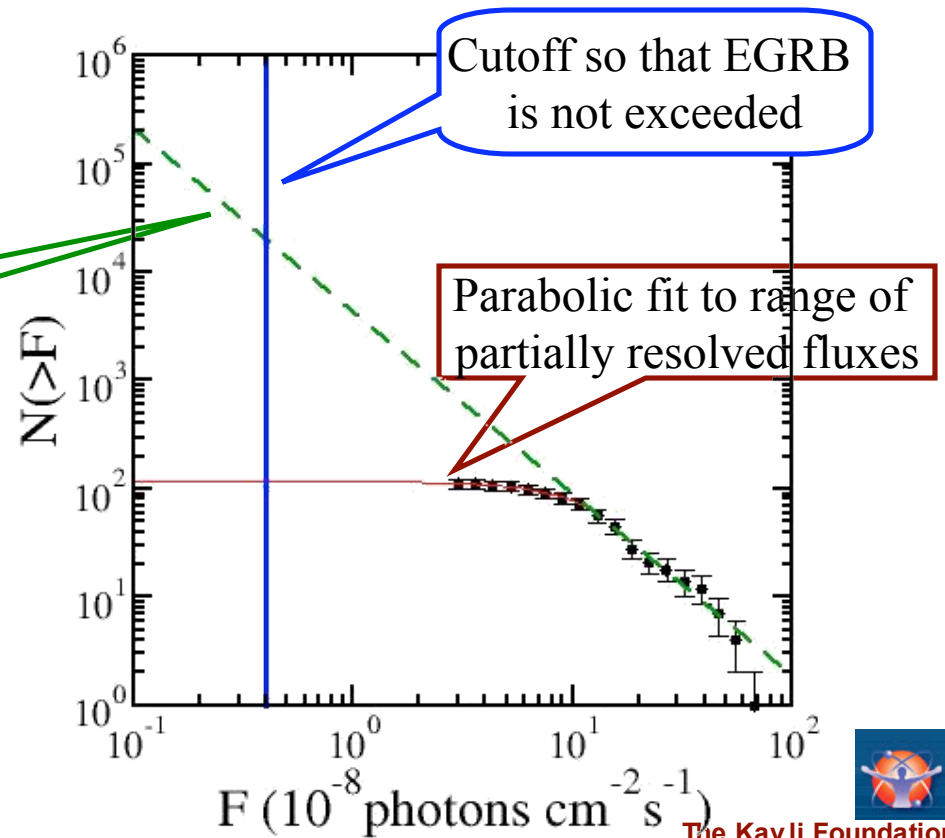
The Kavli Foundation

Are there enough?

Use cumulative flux distribution of resolved objects and extrapolate to lower fluxes

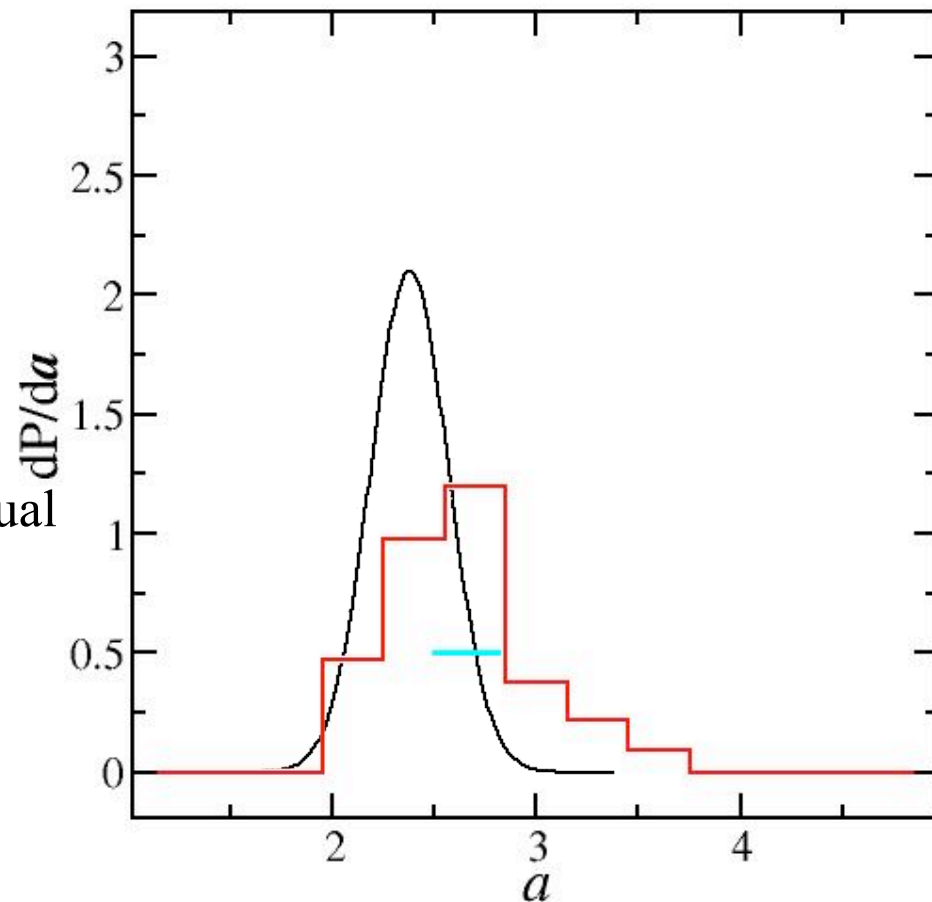
(cutoff so that EGRET EGRB is not exceeded)

Power-law fit to range of fully resolved fluxes



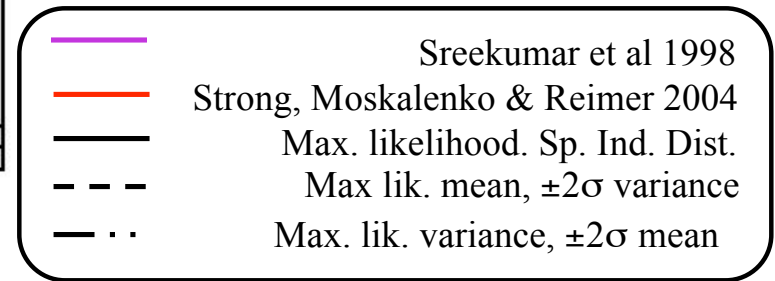
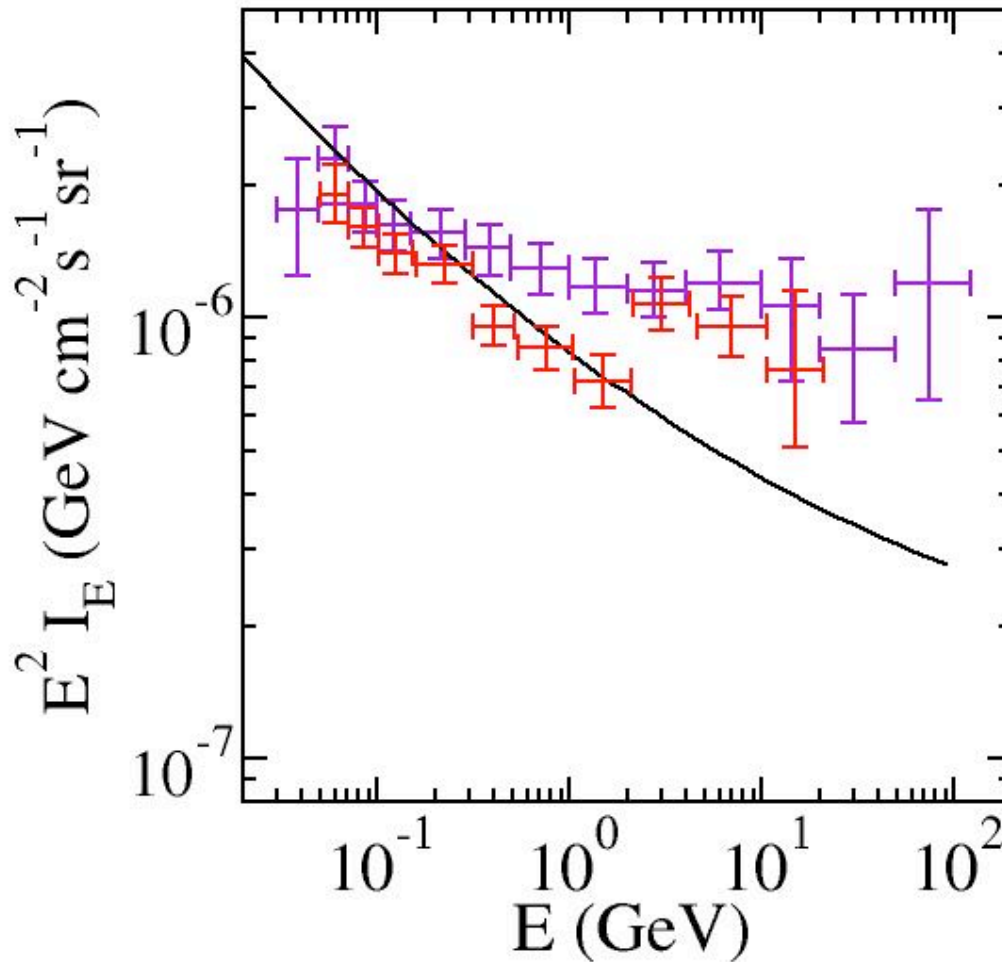
Does the spectrum work?

- The spectral index distribution:
Assume spectral index distribution of unresolved objects same as that of resolved objects (BUT - accounting for individual measurement errors! likelihood approach, similar to T. Venters & VP treatment of blazars)

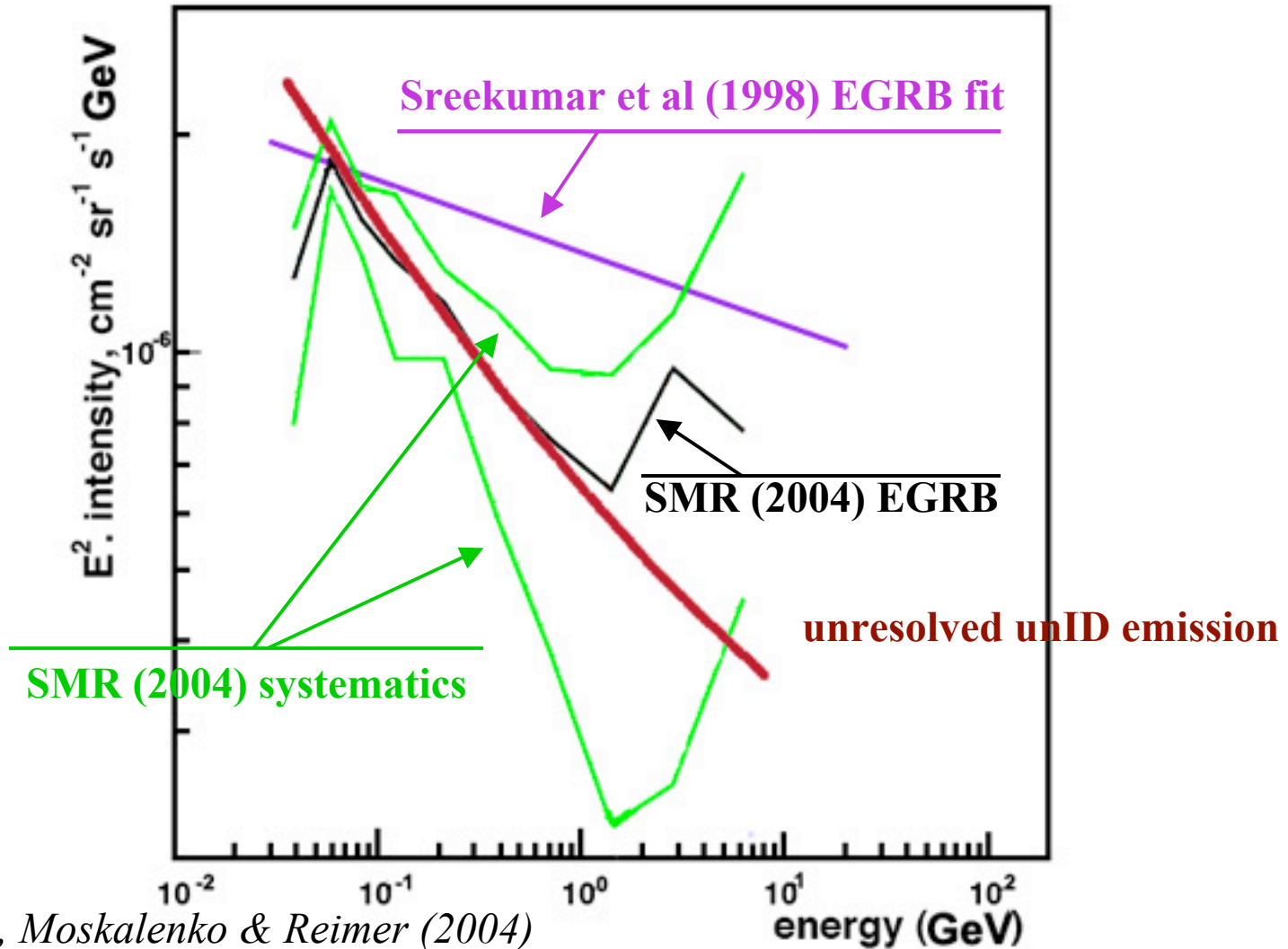




Results



Results





Kavli Institute
for Cosmological Physics
AT THE UNIVERSITY OF CHICAGO

GLAST!

- Whatever the nature of the EGRET unIDs, GLAST will resolve many more
 - if unresolved unIDs currently responsible for considerable fraction of EGRB:
⇒ associated reduction of GLAST EGRB
 - If unresolved unIDs currently responsible for considerable fraction of Galactic diffuse emission:
⇒ associated reduction of GLAST diffuse MW
(GeV excess affected?)



The National Science Foundation



The Kavli Foundation



Kavli Institute
for Cosmological Physics
AT THE UNIVERSITY OF CHICAGO

Future directions

- Simple empirical model \Rightarrow unresolved unIDs have potentially significant contribution to diffuse emission, with good spectra agreement.
- Worth pursuing more detailed (but also more uncertain) models:
 - What if most of them AGN?
 - What if most of them associated with cosmic structure?
 - What if most of them Galactic?



The National Science Foundation



The Kavli Foundation



Kavli Institute
for Cosmological Physics
AT THE UNIVERSITY OF CHICAGO

Conclusions

- Contribution of unresolved unIDs to diffuse emission guaranteed
- Empirical model:
 - If flux distribution does not break for ~ 1 order of magnitude, enough to account for all of EGRB in low energies
 - If spectral index distribution same in resolved and unresolved sources, spectrum consistent with *Strong et al* EGRB within systematic uncertainties
 - Hint for other component at high energies?
- GLAST will determine whether most EGRET unIDs Galactic or extragalactic
- Future directions: specific models of unID unresolved emission



The National Science Foundation



The Kavli Foundation