

KIPAC-SLAC GLAST Physics: Dark Matter and New Physics

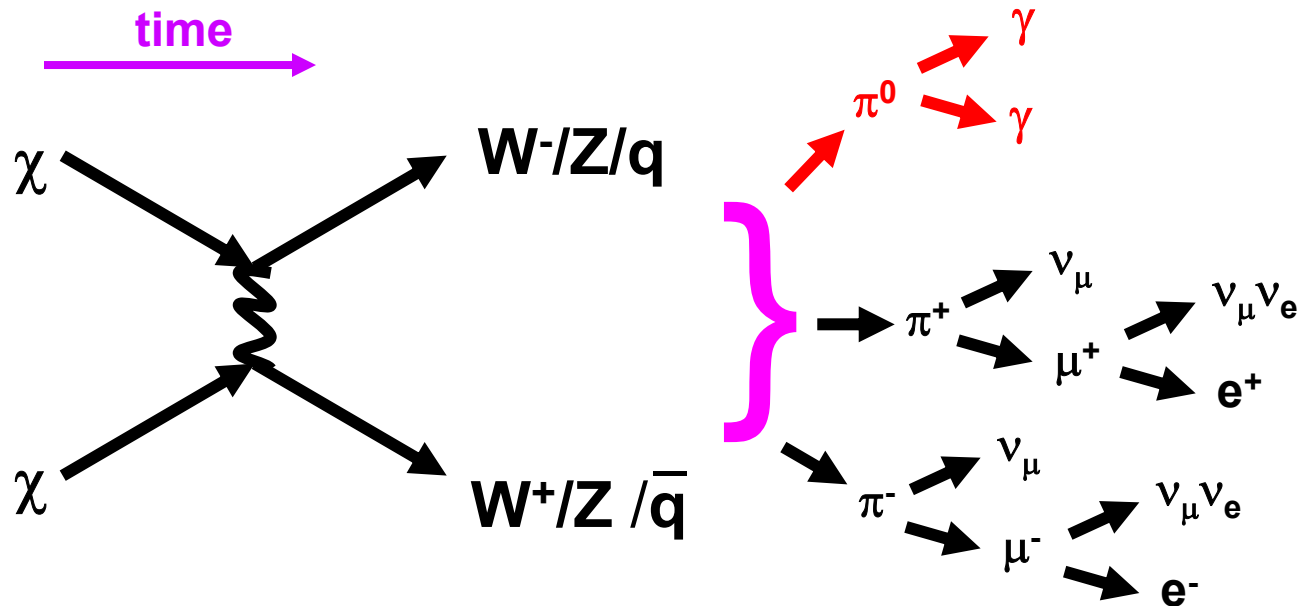


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SLAC**

**Representing the GLAST LAT Collaboration
Dark Matter and New Physics working group**

Dark matter as particles!

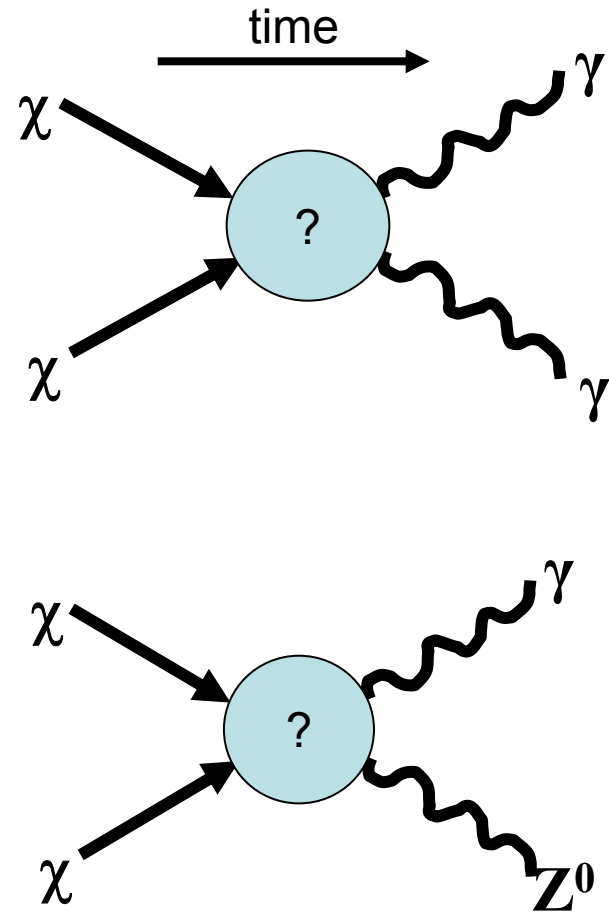
WIMP pair annihilation to
 $W, Z,$ or quark pairs



Gammas from lines

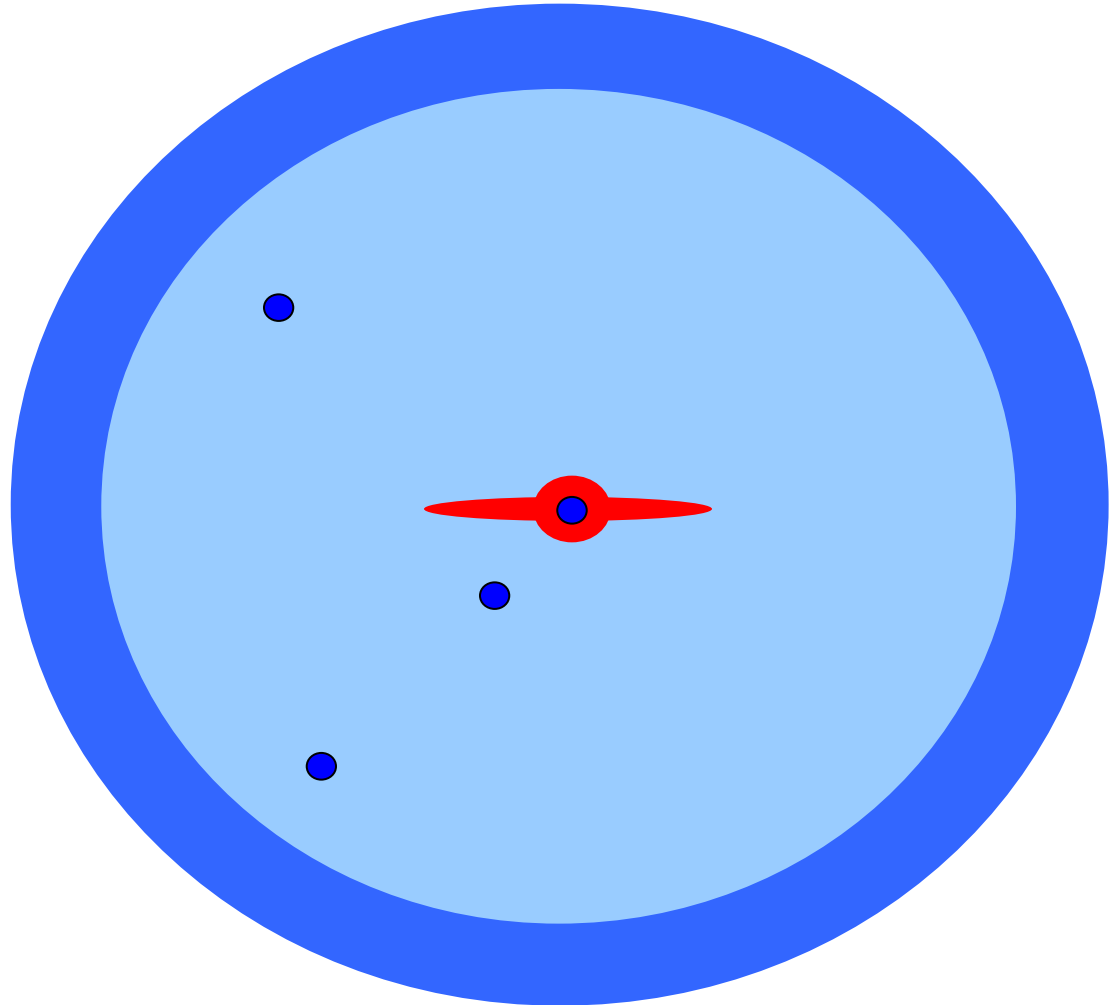
**Branching fractions are
in the range 10^{-2} - 10^{-4}**

- **For $\gamma\gamma$ Line, energy = WIMP mass**
- **For WIMP masses $> M_Z/2$
can also have γZ^0 line**
- ***Measurement of line
branching fractions would
constrain particle theory***

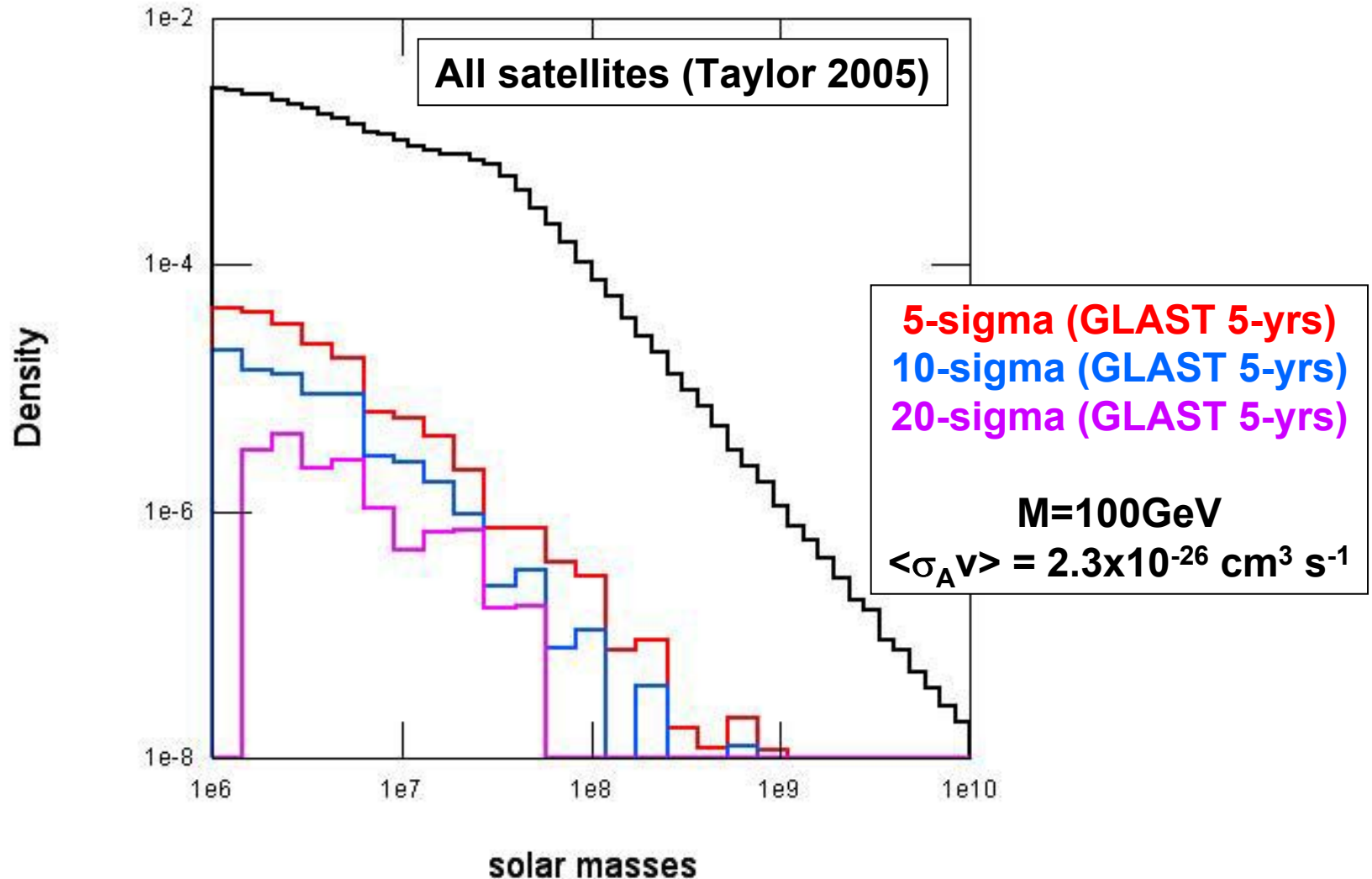


Where should we look for WIMPs with GLAST?

- ◇ Galactic center
- ◇ Galactic satellites
- ◇ Galactic halo
- ◇ Extra-galactic

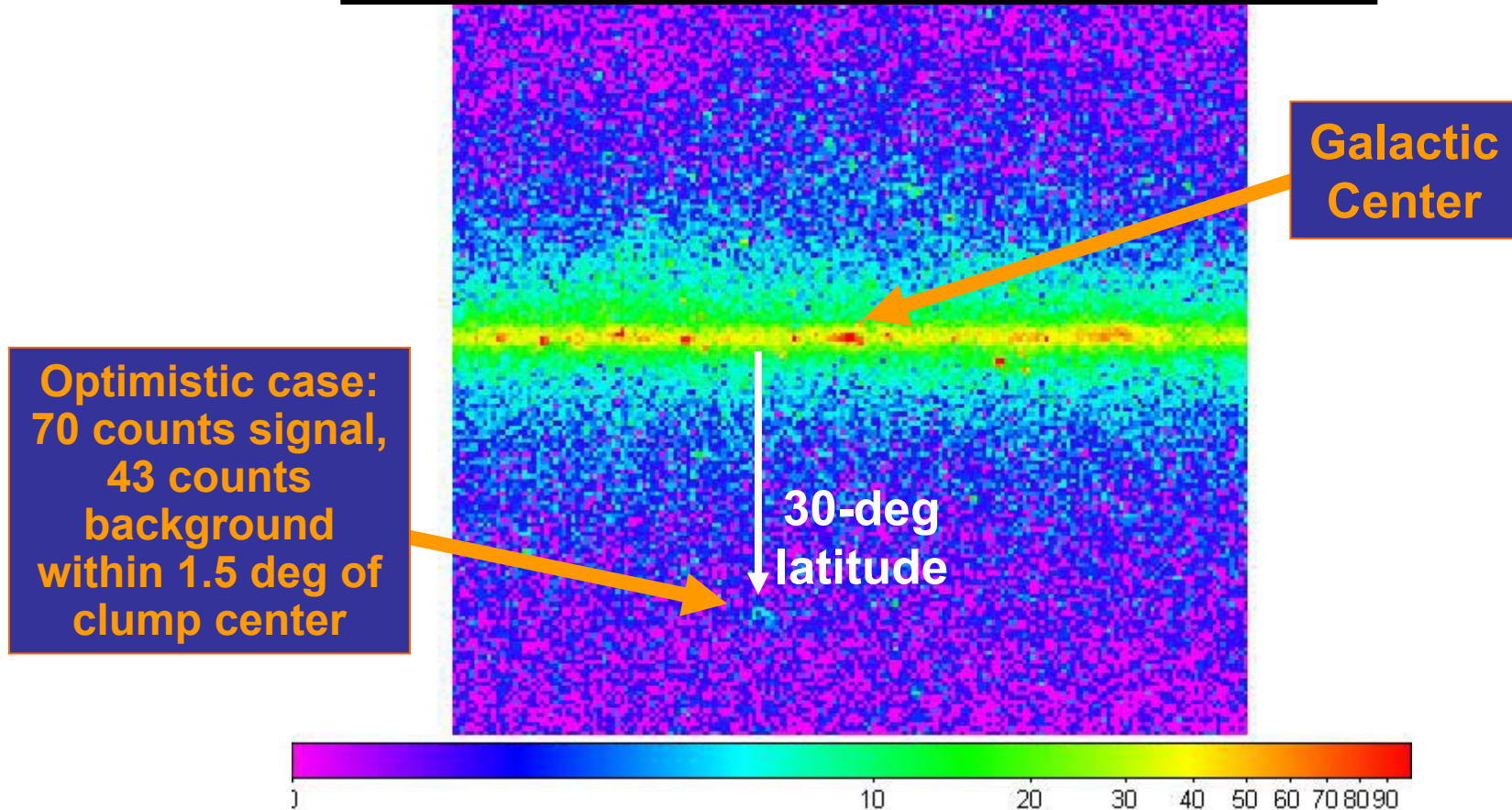


Satellite mass distributions

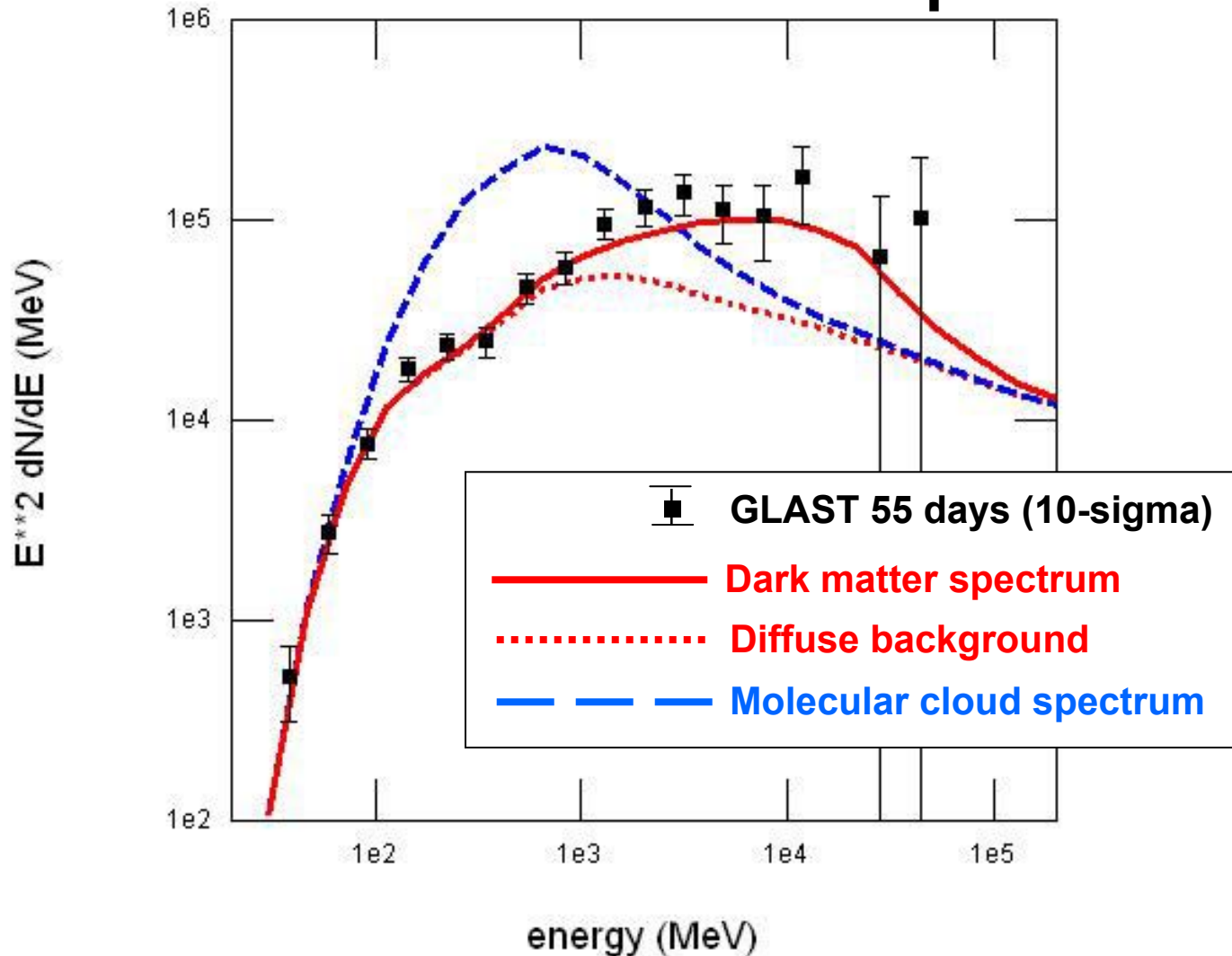


Example A. dark matter satellite

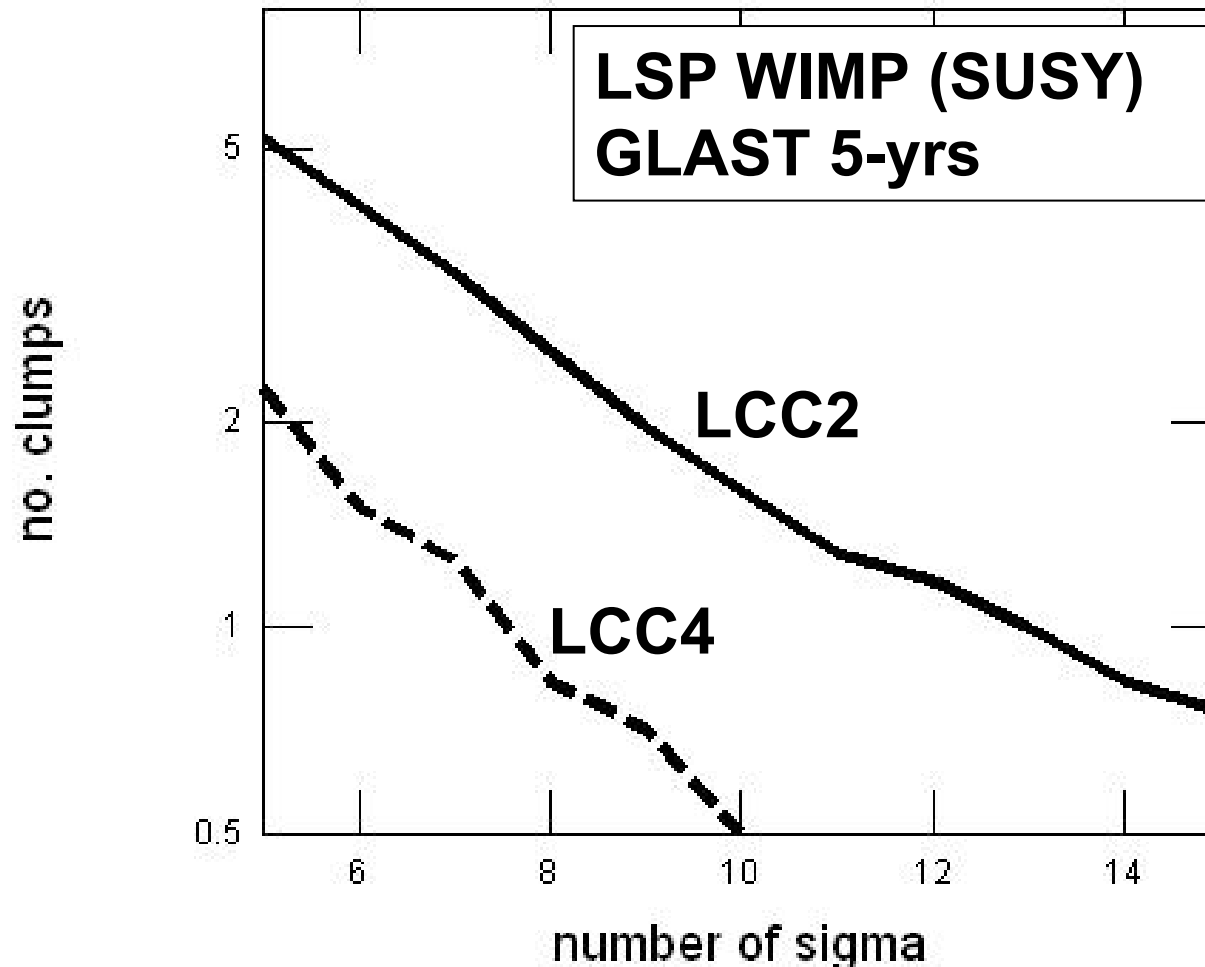
55-days GLAST in-orbit counts map ($E > 1\text{ GeV}$)



Dark matter source spectrum



How many observable dark matter sources?

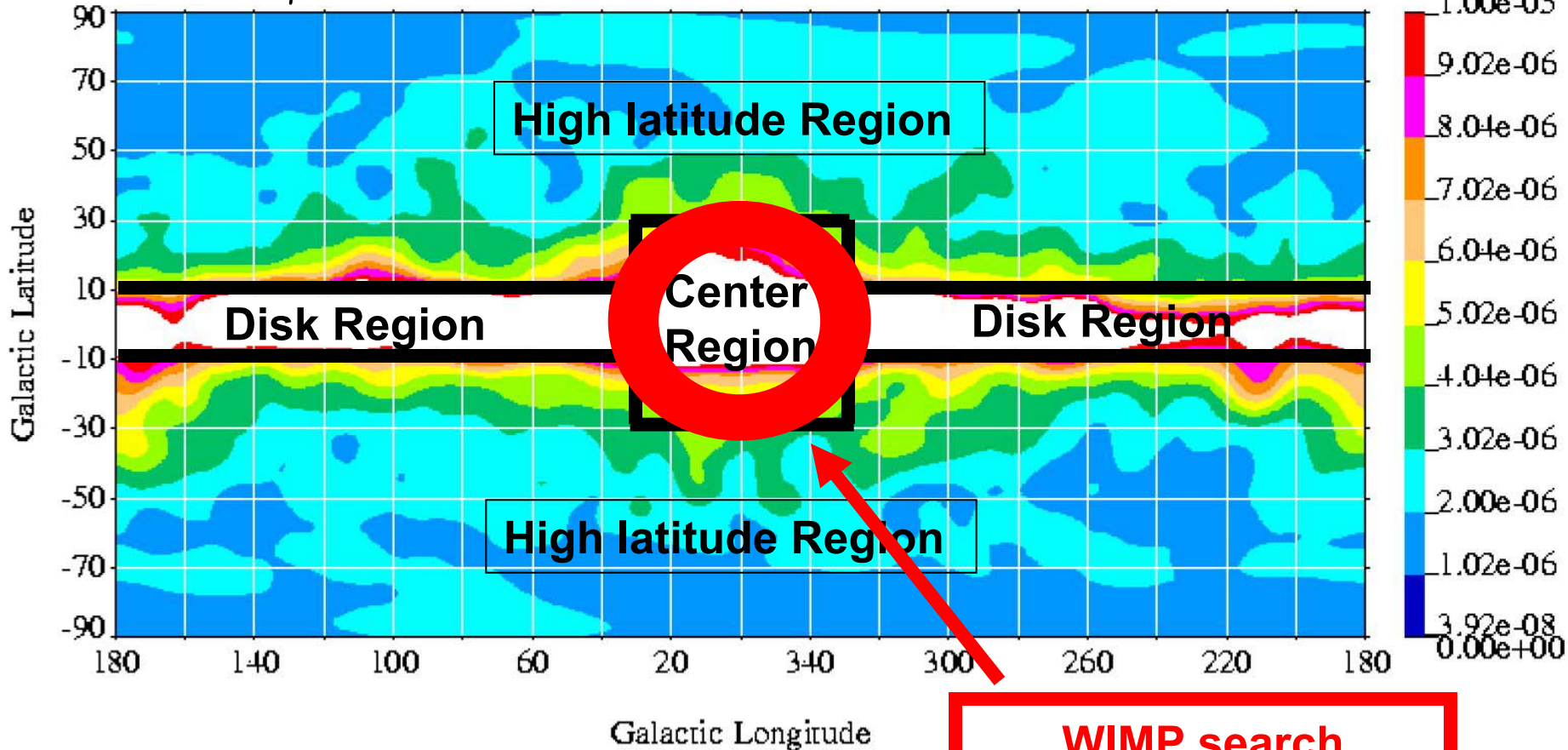


Simulation of Milky Way dark matter satellites from Taylor & Babul (2004,2005)

SUSY model definitions from Baltz, et.al. (2006); LCC2 and LCC4 are favorable to GLAST compared to LCC1 and LCC3.

Example B. Milky Way dark matter halo

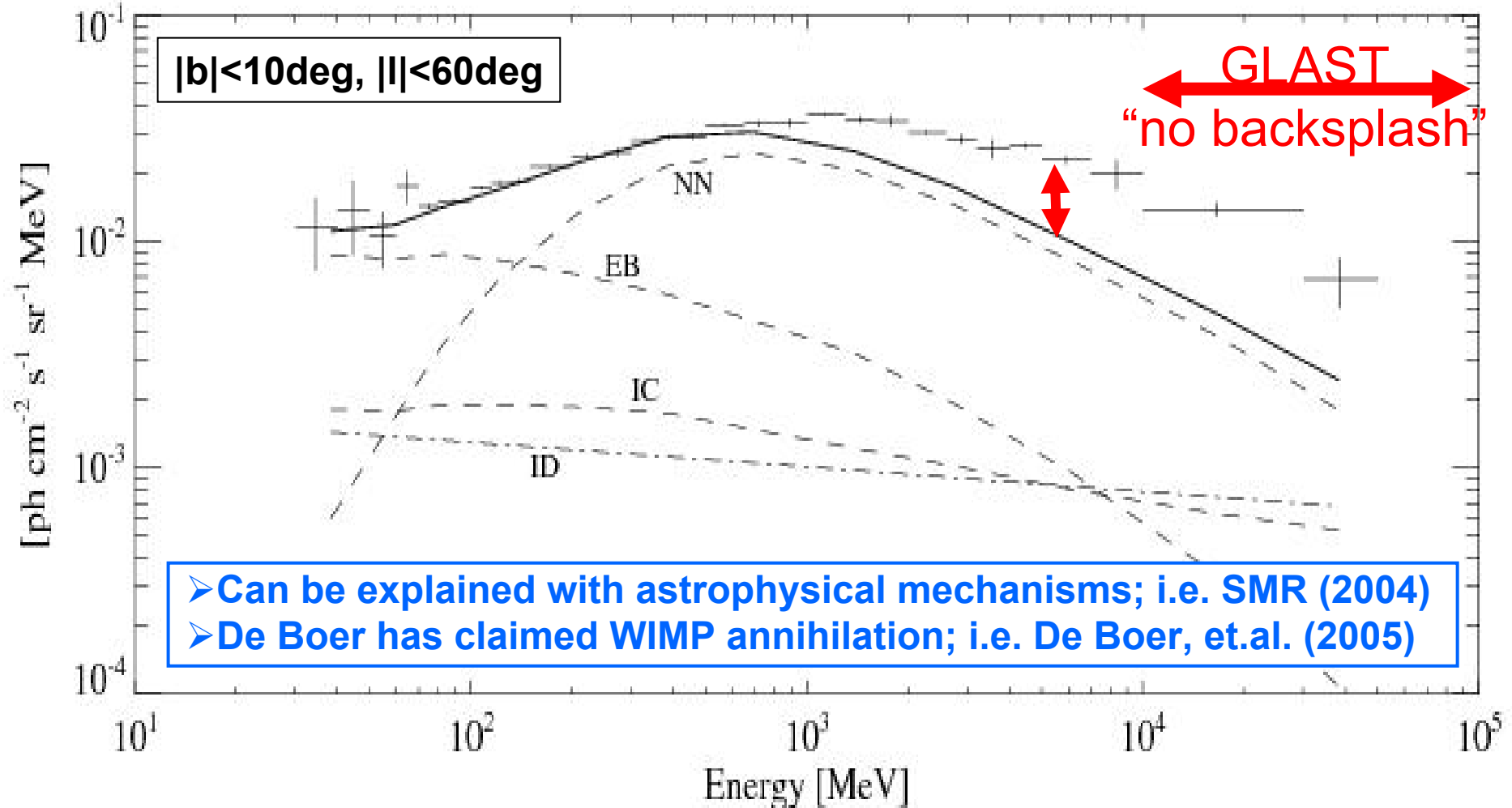
EGRET $E_\gamma > 1\text{GeV}$, point-source subtracted, Cillis & Hartman (2005)



**WIMP search
“sweet spot”
(Stoehr et.al. 2004)**

EGRET diffuse “GeV excess”

Hunter et al (1997); similar “GeV excess” in all sky regions



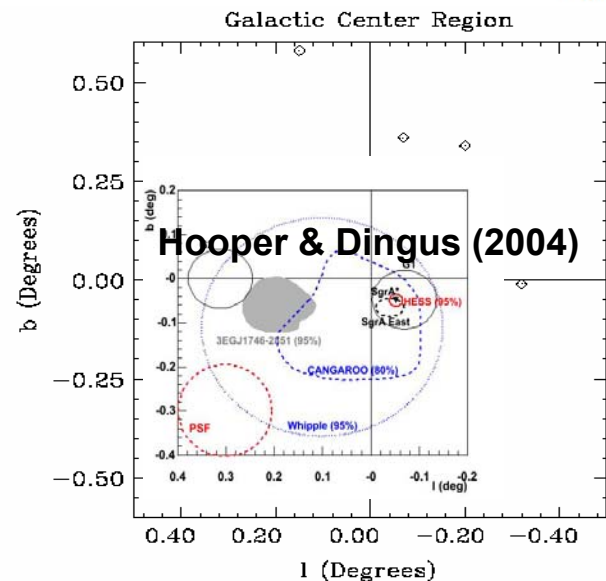
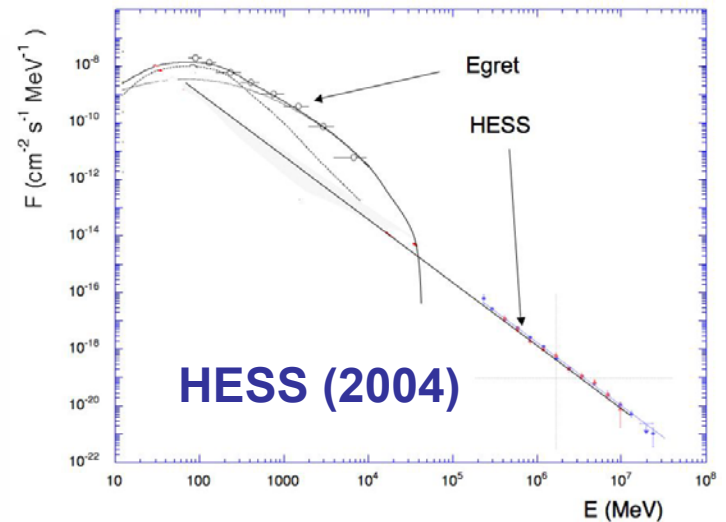
Example C: Galactic Center

Mayer-Hasselwander (1998)
- EGRET point source

Spatial analysis

- 100MeV-300MeV ($l \sim -0.75\text{deg}$)
- 300MeV-1GeV ($l \sim -0.30\text{deg}$)
- > 1GeV ($l \sim 0.05\text{deg}$)
- > 5GeV ($l \sim 0.20\text{deg}$)

New diffuse component in the galactic center region, HESS (2006)



Summary

- **The GLAST collaboration will search for WIMP annihilation gamma rays from 4 regions: galactic center, galactic satellites, galactic halo, and extragalactic**
- **If we locate a source consistent with WIMP annihilations, then we can constrain particle theory by measuring the line branching fractions (if not with GLAST, then perhaps with an IACT)**