The search for Milky Way halo substructure WIMP annihilations using the GLAST LAT

Larry Wai and Ping Wang

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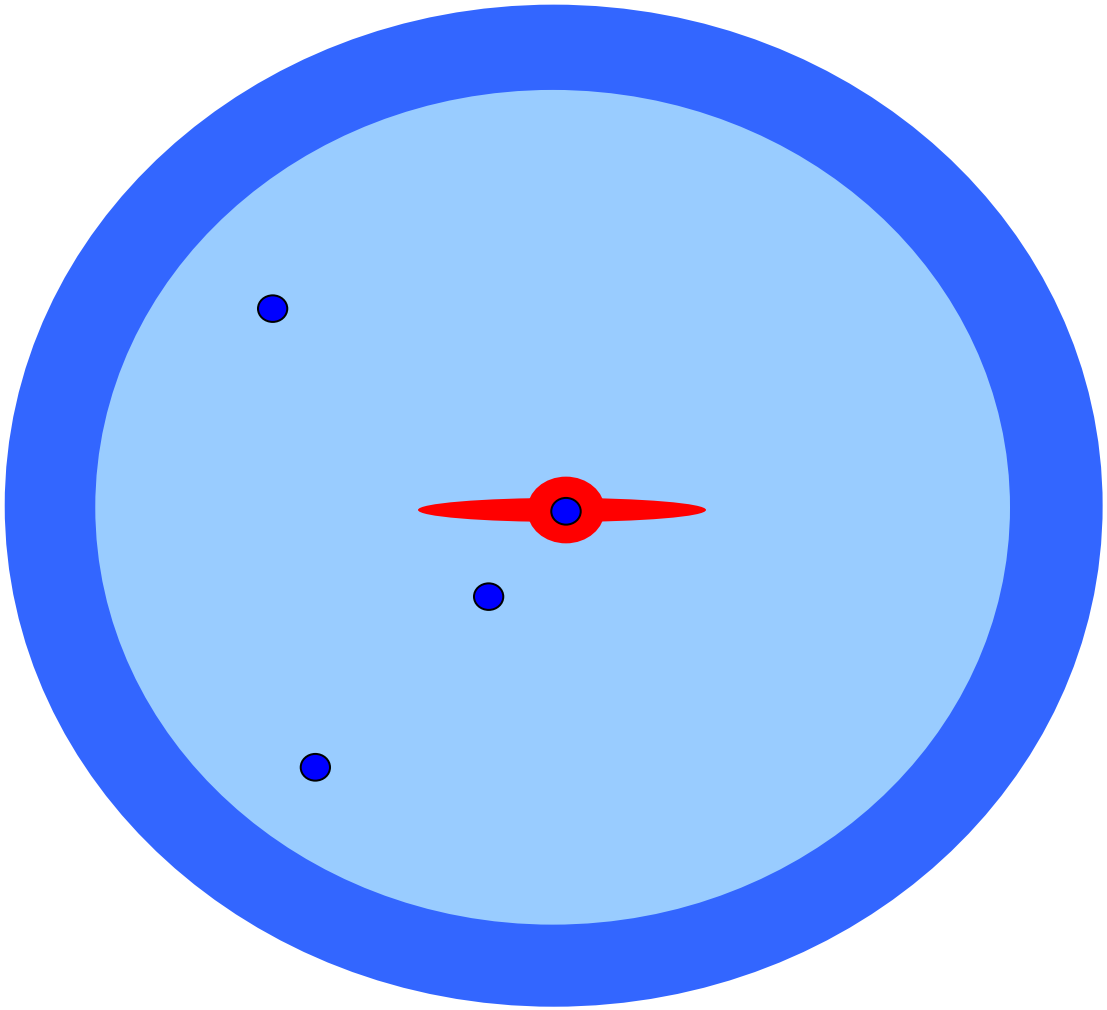
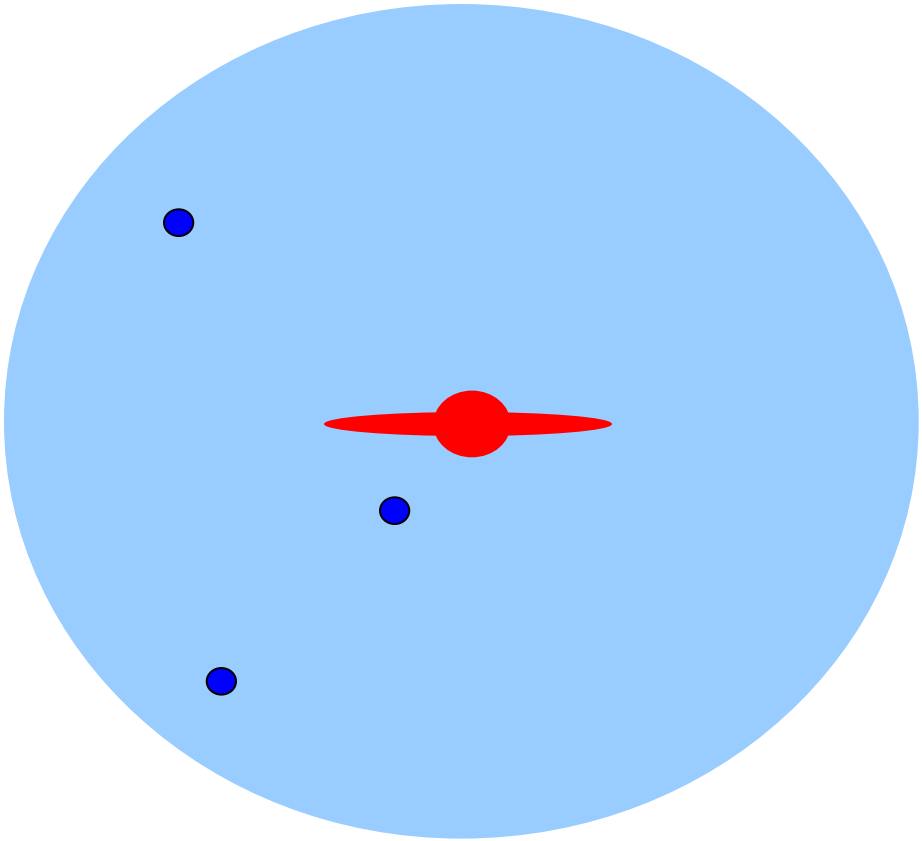
Where should we look for WIMPs with GLAST?

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



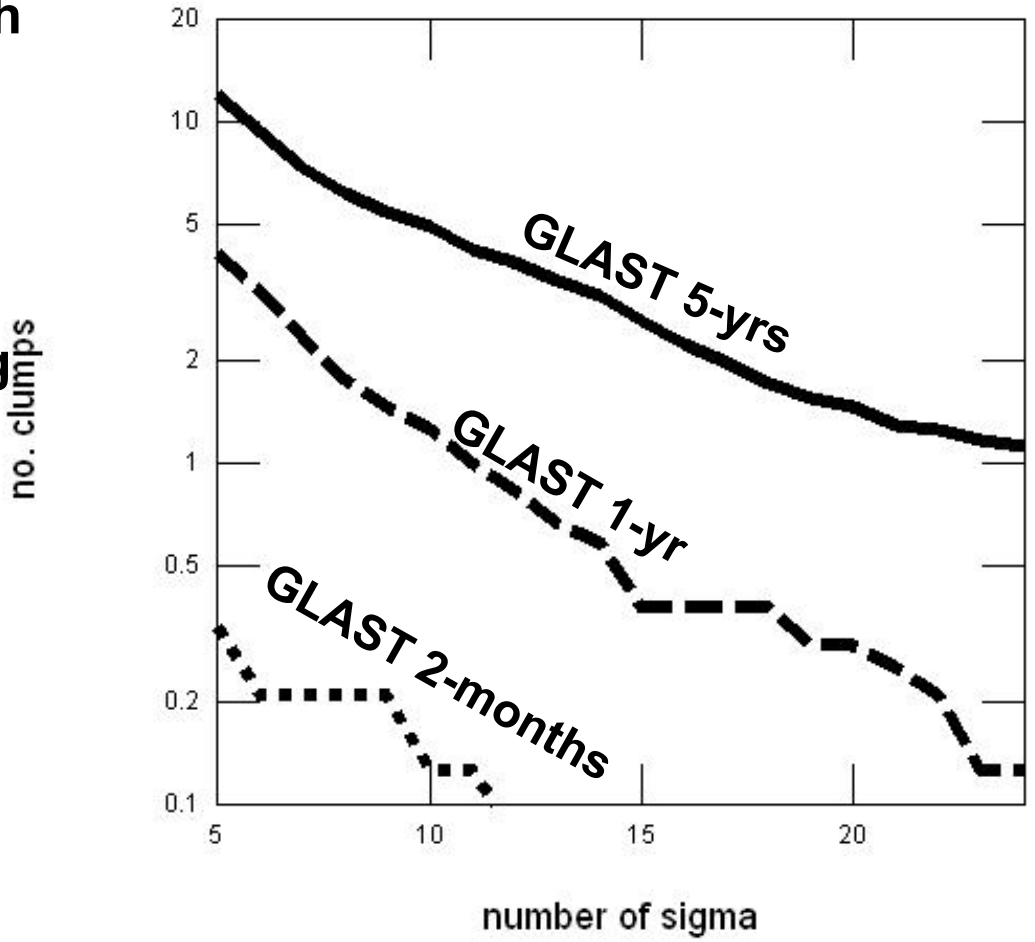
Milky Way Satellites

- **Estimate of satellites observable by GLAST**
- **See Ping's talk for detailed analysis**

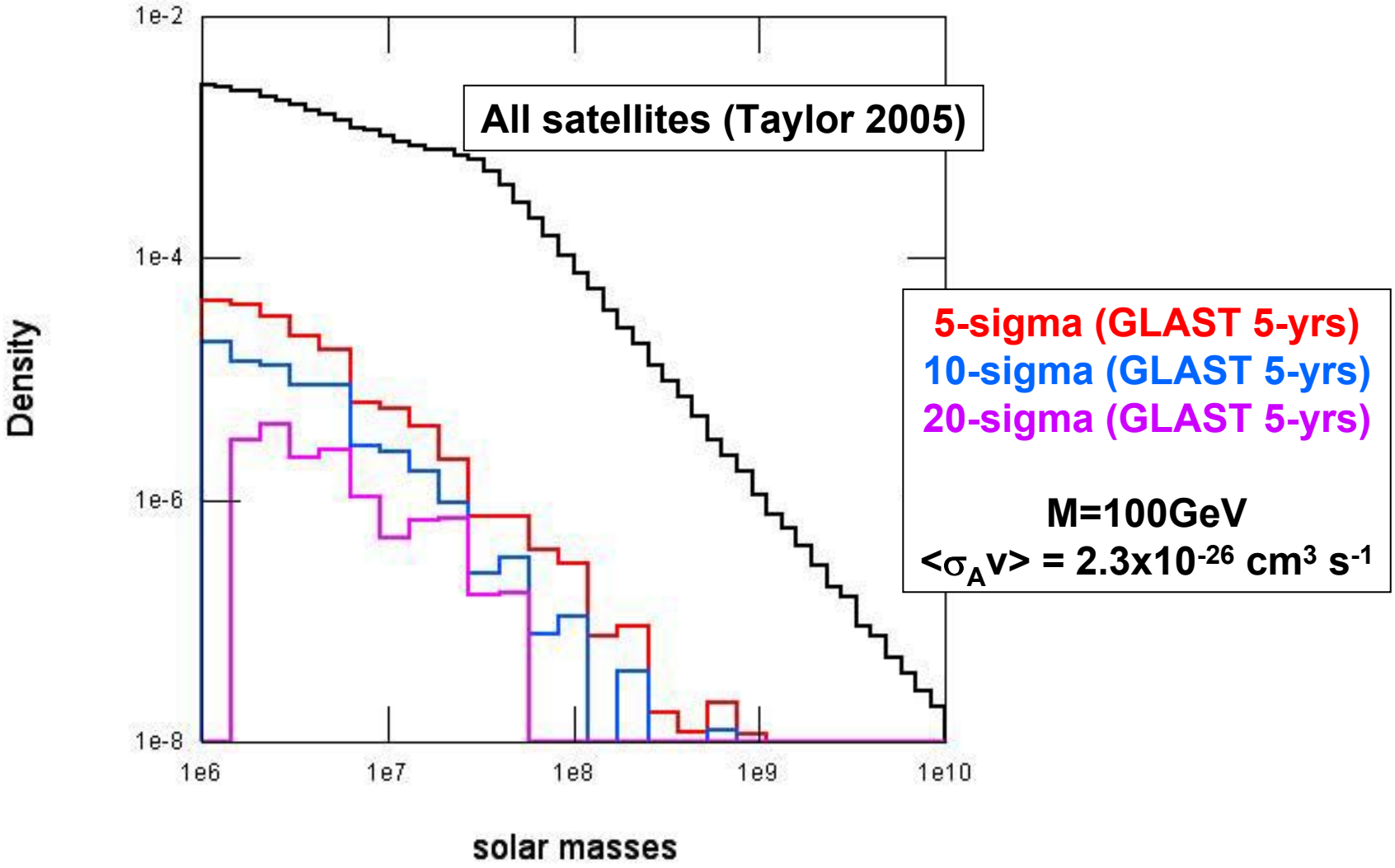


Observable satellites (estimate)

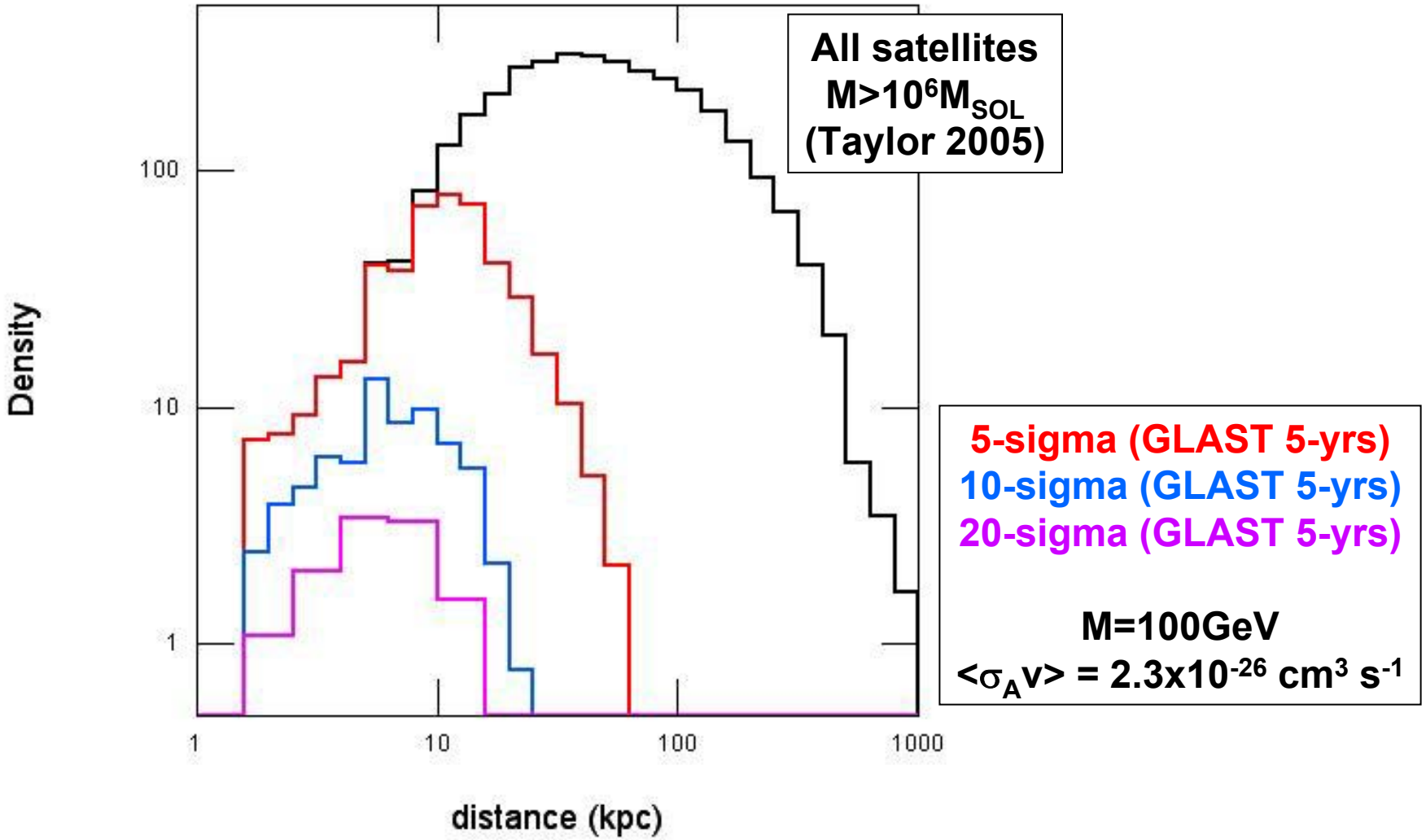
- **Dark matter calculation with semi-analytic method of Taylor & Babul 2004, 2005**
- **Taylor 2005 (satellite ntuples)**
- **Background estimate using EGRET above 1GeV (point-source subtracted) from Cillis & Hartman 2005**
- **Signal, background flux inside of tidal radius**
- **M=100GeV**
- **$\langle \sigma_A v \rangle = 2.3 \times 10^{-26}$ cm^3 s^{-1}**



Satellite mass distributions

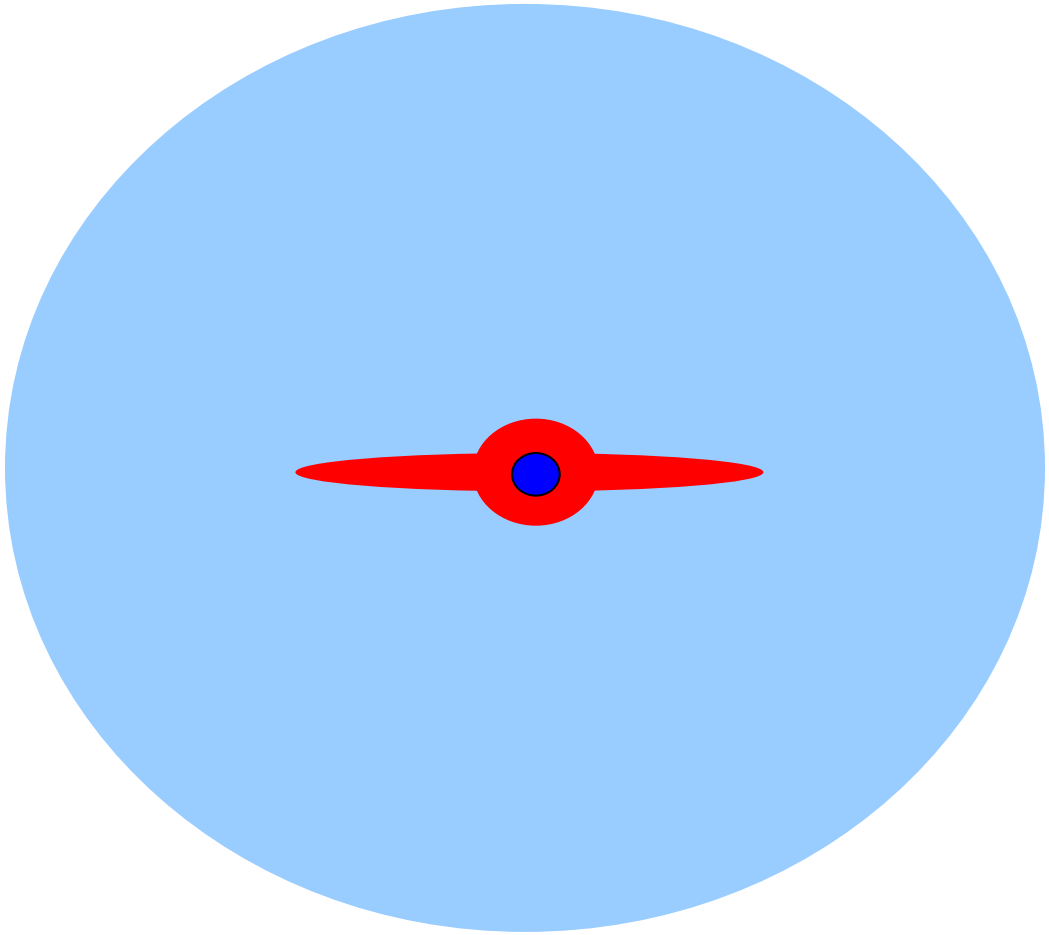


Satellite distances



Milky Way halo

- Overview of analysis
- Line significance estimate
- Halo analysis "pipeline"



halo analysis overview

Likelihood fit for mapcube (l,b,E) normalizations from:

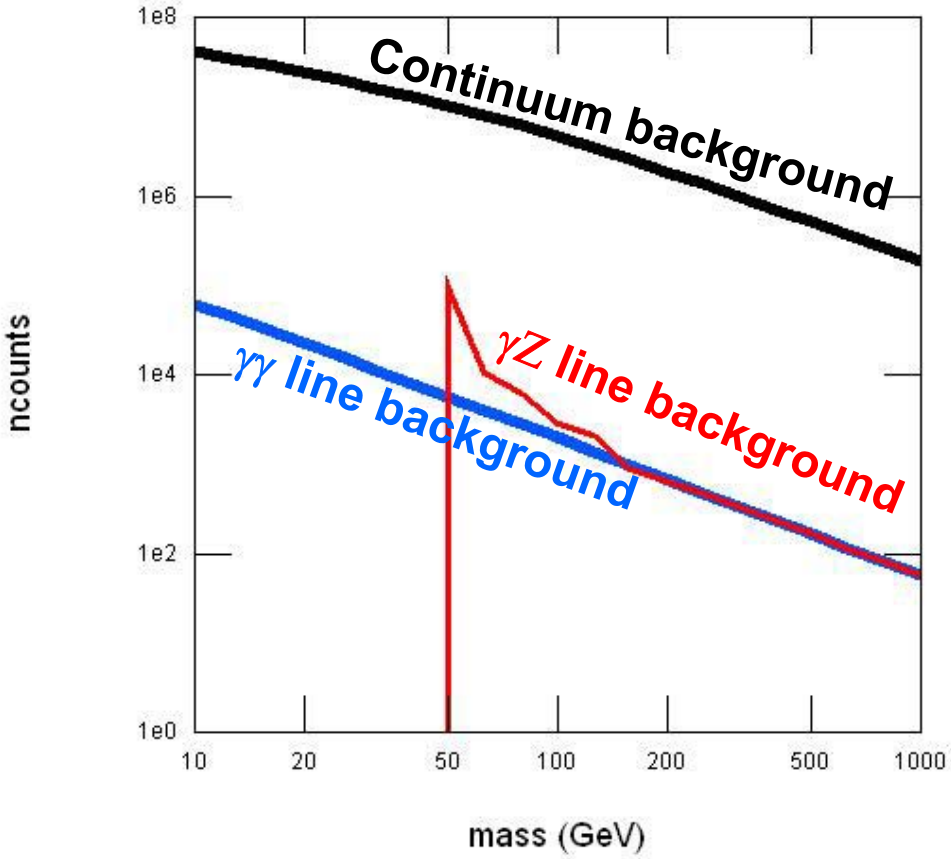
1. **GALPROP cosmic ray induced π^0**
2. **GALPROP cosmic ray inverse compton**
3. **GALPROP bremsstrahlung**
4. **GALPROP WIMP induced π^0**
5. **GALPROP WIMP induced inverse compton**
6. **residual charged particle background**
7. **Isotropic diffuse**
8. **Point sources from catalog group**

- **Scan through GALPROP cosmic ray models**
- **Scan through WIMP masses**
- **Scan through halo dark matter distributions**

- **From best fit WIMP mass value, perform blind search for $\gamma\gamma$, γZ lines**

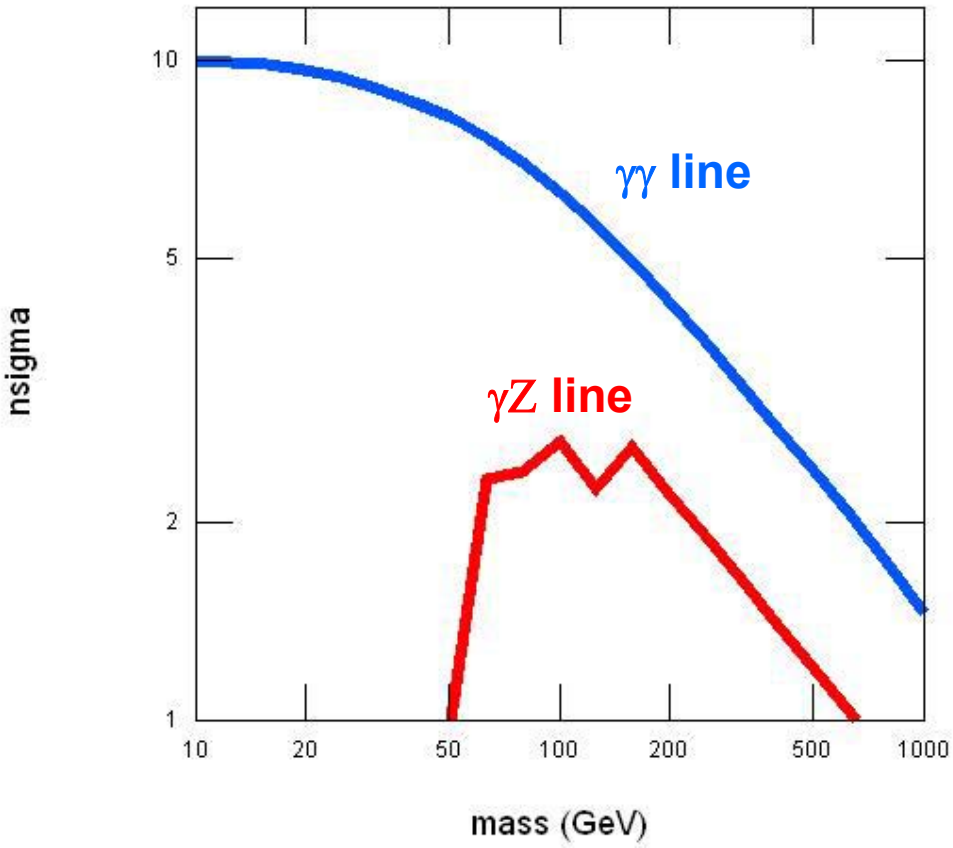
Back-of-the-envelope line background

- **Consider high latitude region |b|>10deg (|b|>30deg for |l|<30deg), 5 year on-orbit**
- **continuum background ~ cosmic ray induced galactic diffuse flux for E>.01M_{WIMP}**
- **$\gamma\gamma$ line background is flux within 0.235 FWHM at M_{WIMP}, γZ line**



Back-of-the-envelope line significance

- **Assume WIMP continuum is 30% of galactic diffuse flux for $E>.01M_{WIMP}$**
- **Assume 0.1% branching fraction to line**
- **nsigma is no. line counts/sqrt(no. bkgd counts)**



Test run

GALPROP configuration

- **Gamma energy range: 10 MeV – 1TeV**
- **nucleus injection indices 1.5/2.42 (break rigidity 10e3MV)**
- **electron injection indices 1.5/2.42 (break rigidity 20e3MV)**

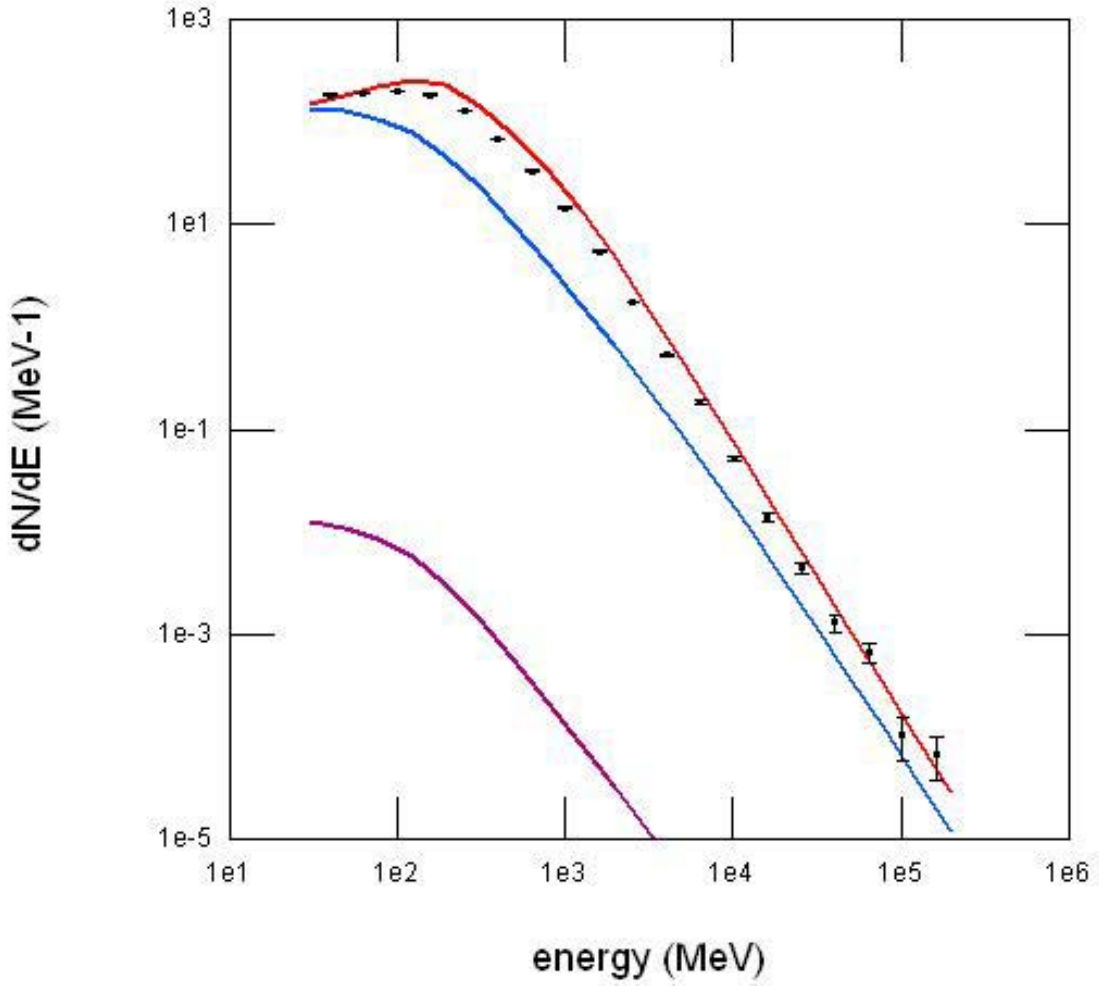
Observation simulation

- **1-day in-orbit, DC1A IRF**
- **GALPROP cosmic ray induced π^0**
- **GALPROP cosmic ray inverse compton**
- **Isotropic extragalactic**

Likelihood model fit

- **Energy range 30MeV-200GeV, all sky**
- **GALPROP cosmic ray induced π^0 (free normalization)**
- **GALPROP cosmic ray inverse compton (free normalization)**
- **Isotropic extragalactic (free normalization)**

Data vs best fit models (whole sky)



Things to do…

Halo analysis

- **Complete halo analysis pipeline, including residual charged particle background, point source catalog**

Satellite analysis

- **See Ping's talk**