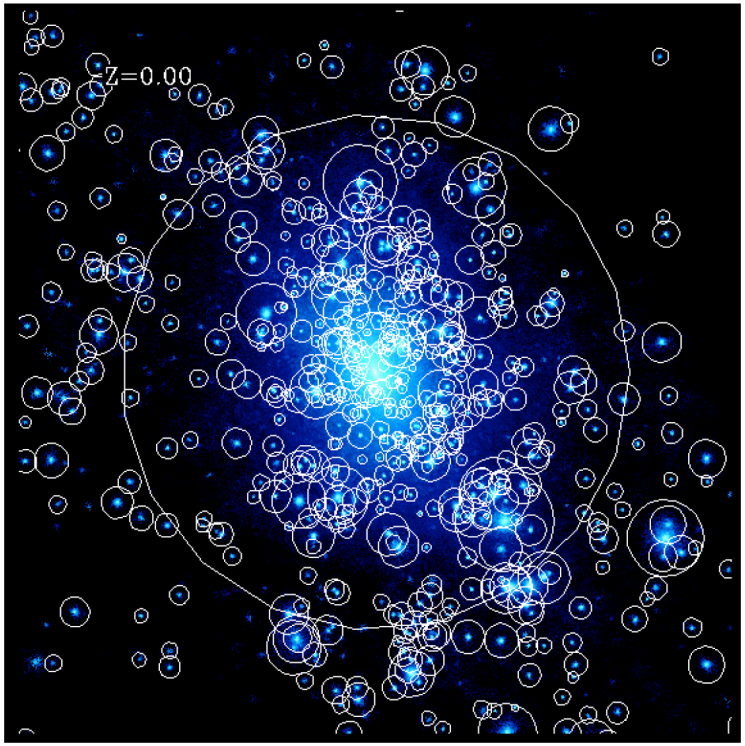
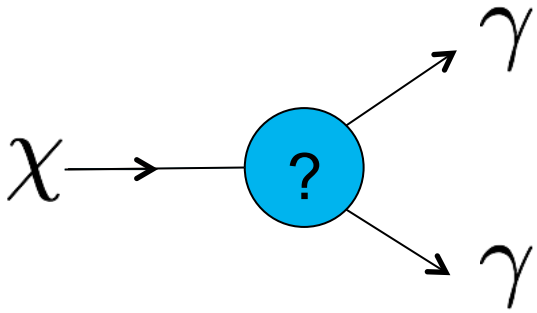
Galactic Dark Matter Subhalos

The Case of Decay



Simulation by A. Kravtsov



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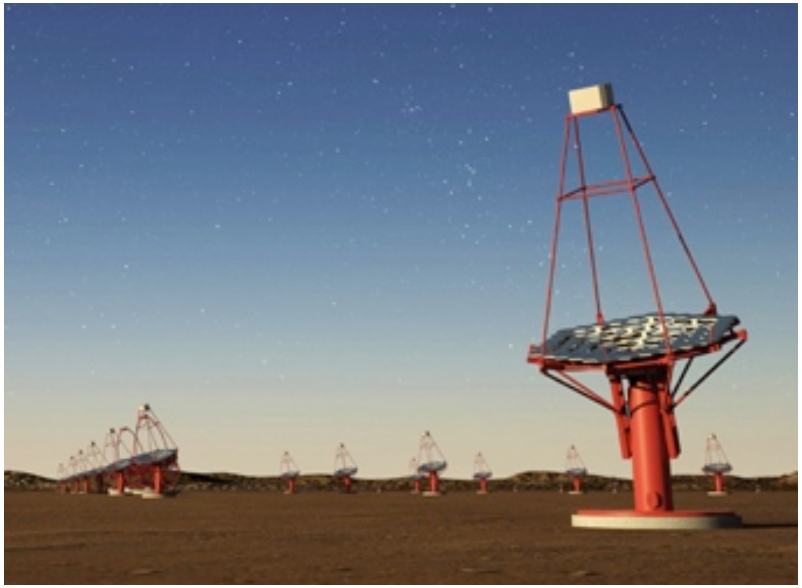
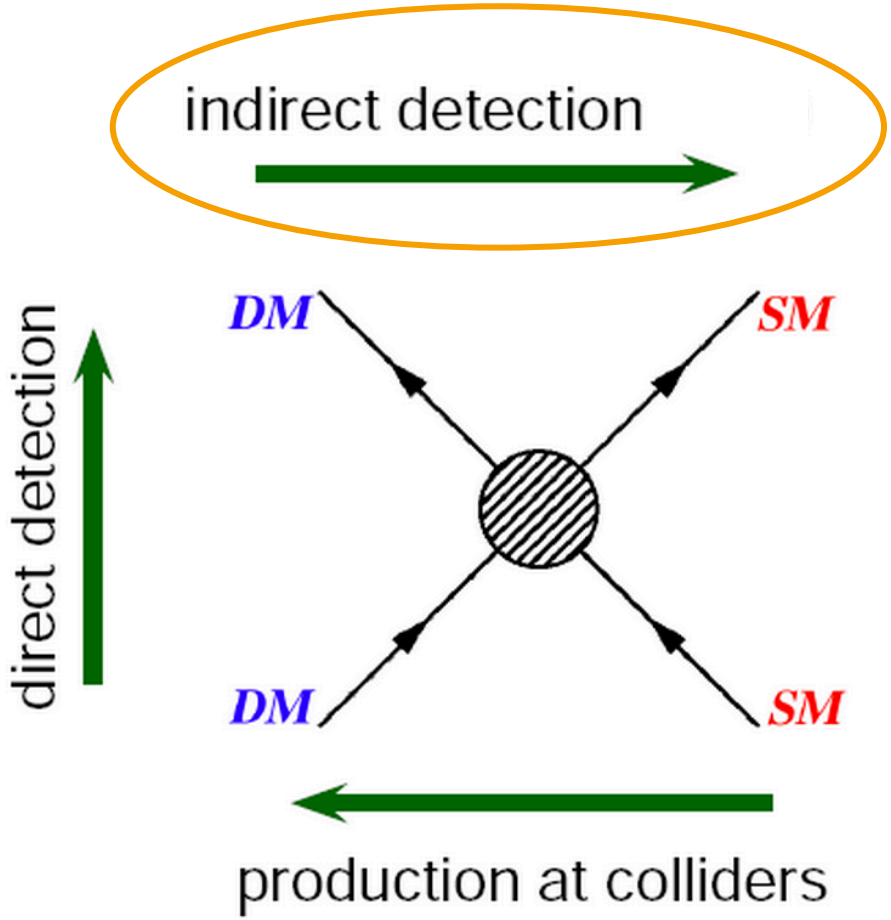
Motivation

cherenkov telescope array





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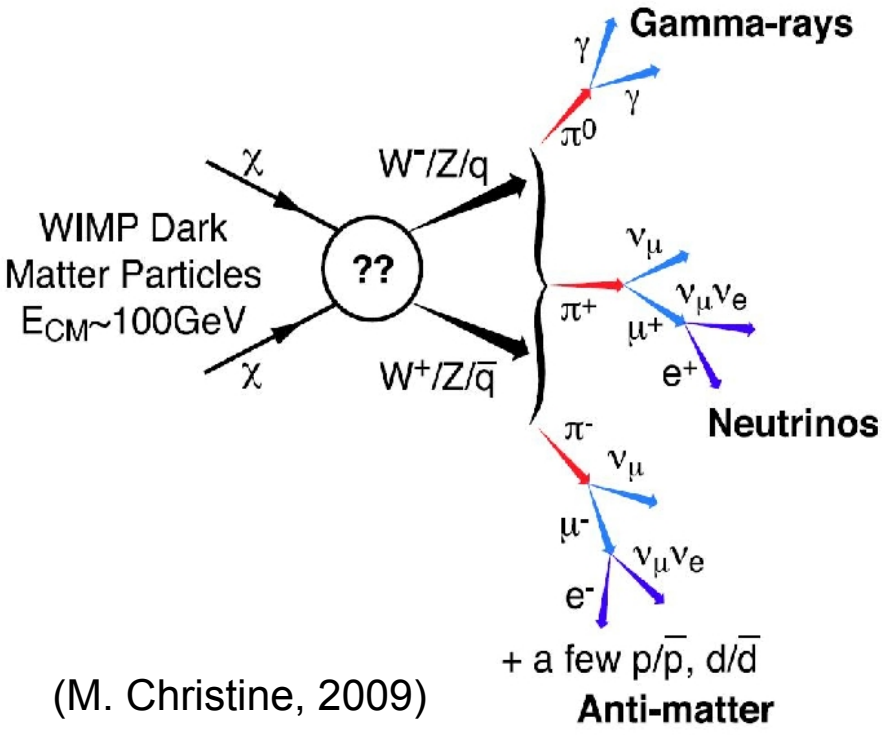
Introduction

> Weakly Interacting Massive Particle (WIMP)



(M. Christine, 2009)

> Gamma-ray Flux

γ-ray flux = Particle physics x **Astro-physics**

> Astrophysical term

- Annihilation

$$J = \int_{\Delta\Omega} \int_{l.o.s.} \rho^2 dl d\Omega$$

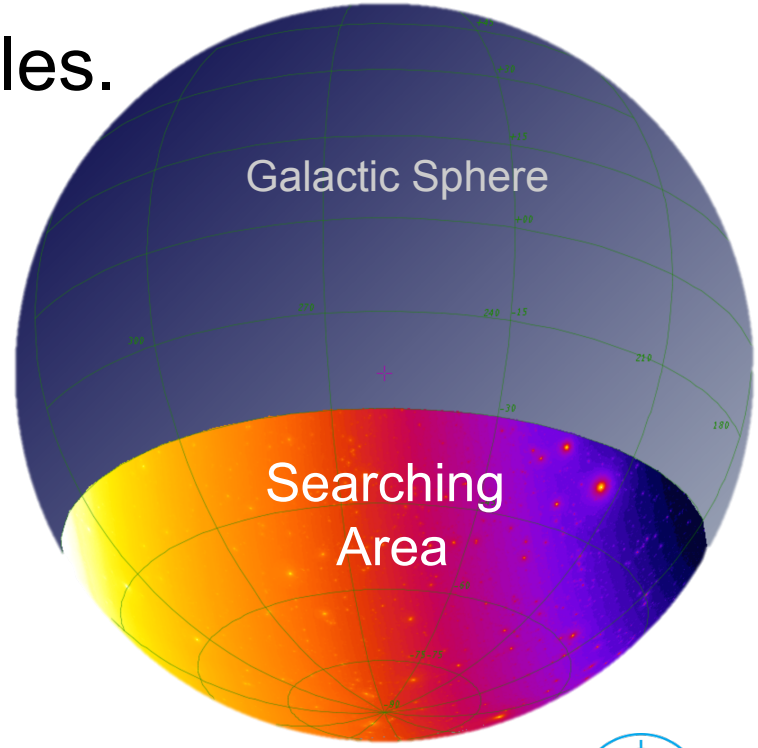
- Decay

$$D = \int_{\Delta\Omega} \int_{l.o.s.} \rho dl d\Omega$$

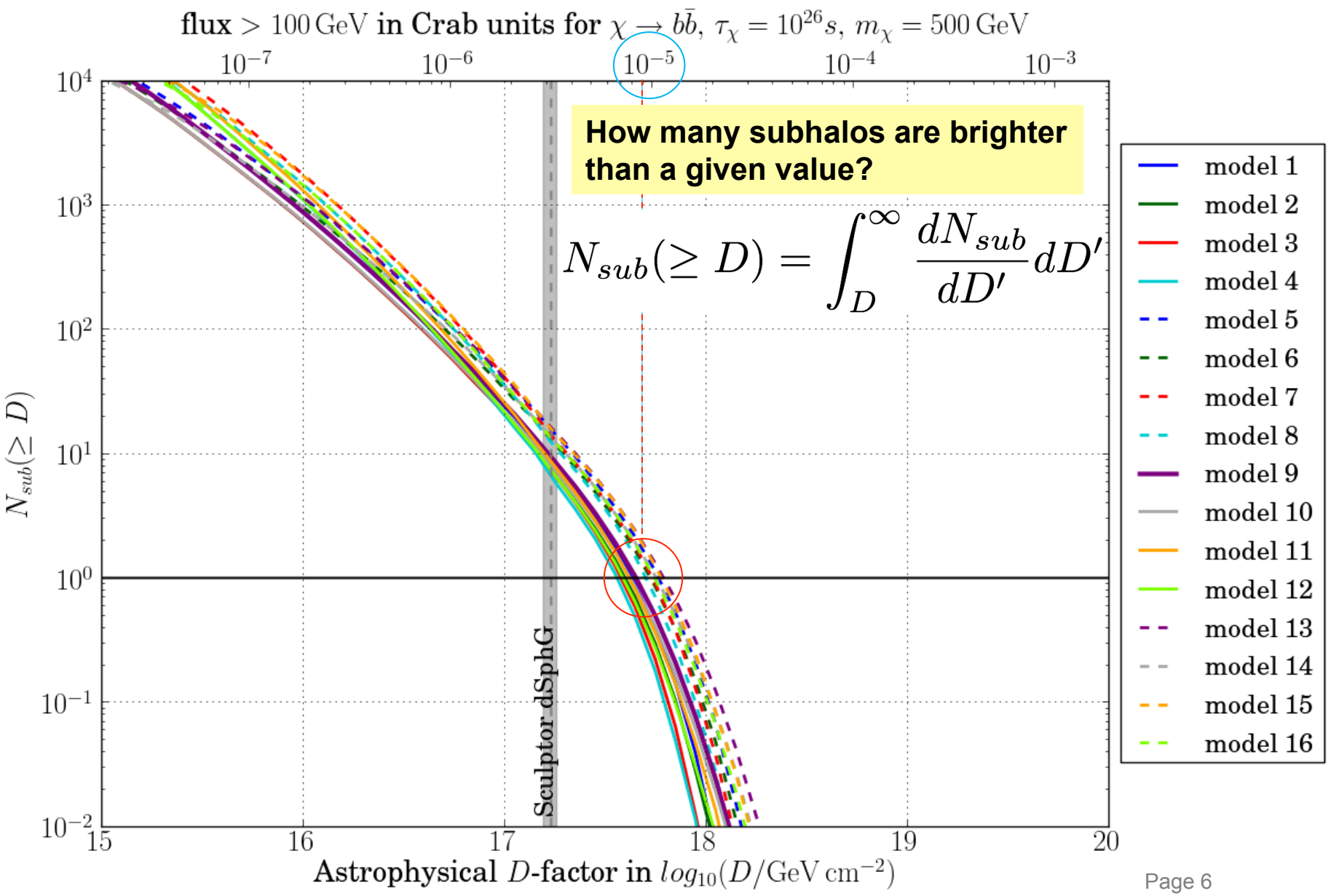
DESY

Simulation Settings

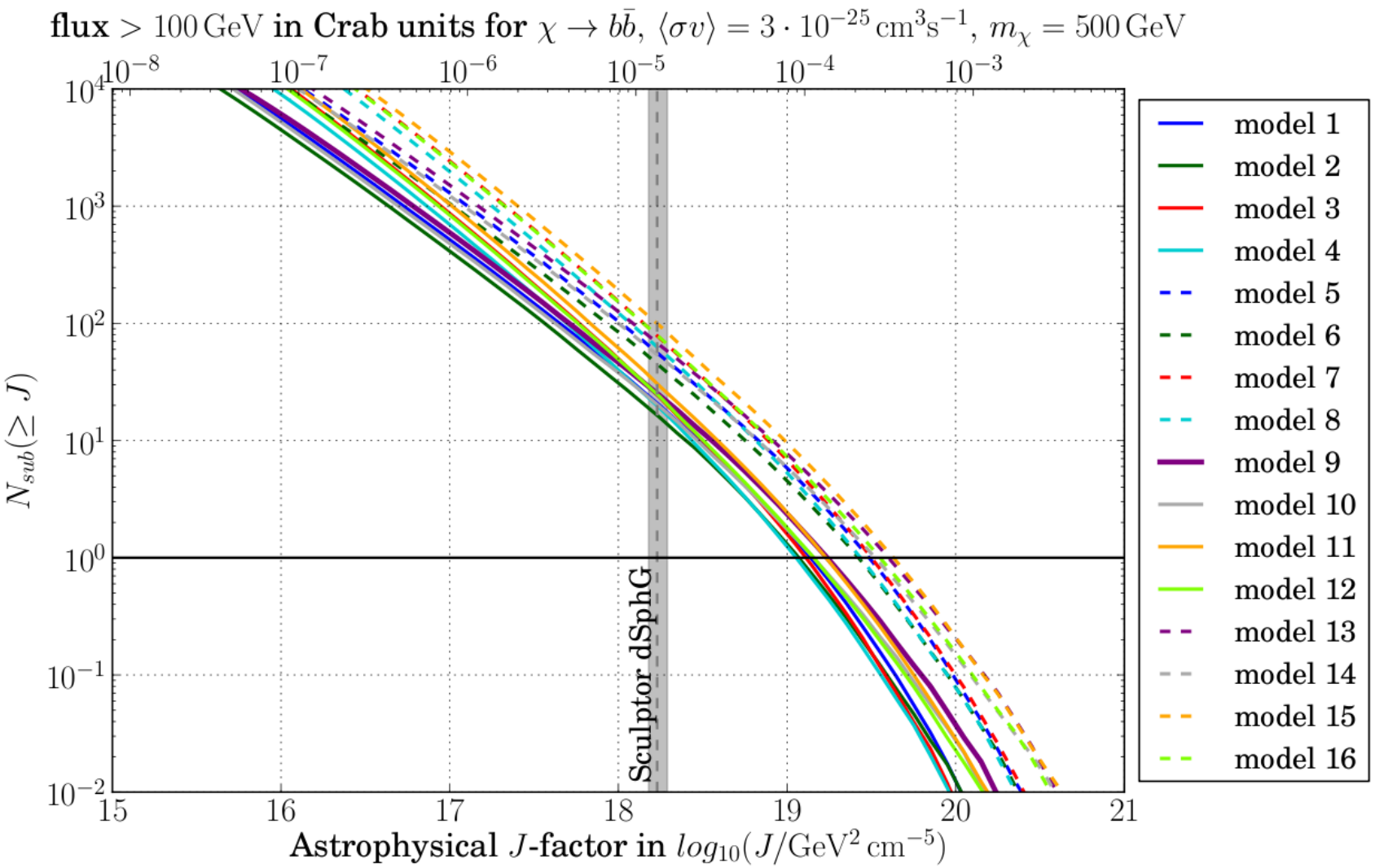
- CLUMPY code for flux calculations.
- The DM density profile ρ is taken from the cosmological N-body simulations.
- 16 models of DM density profiles.
- There are 3 prospects:
  - Source count distribution
  - Single field-of-view
  - Subhalo properties



Result 1: Source count distribution

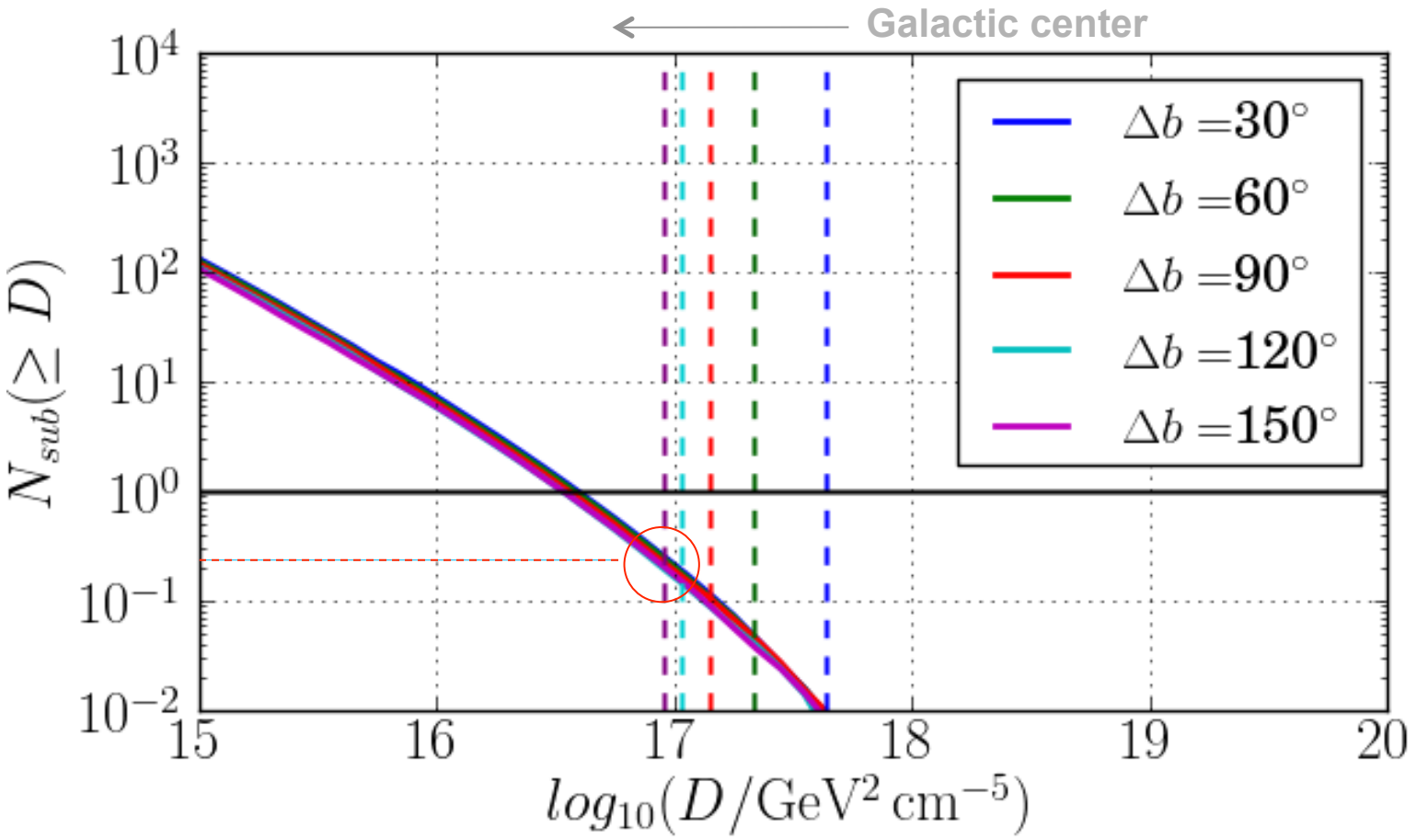


Source count distribution of annihilation (M. Hütten, 2015)



Result 2: Single field-of-view

- N_{sub} in a single CTA-like FOV of d = 10° compared to the smooth Galactic halo emission (dashed lines).



Result 3: Subhalo properties

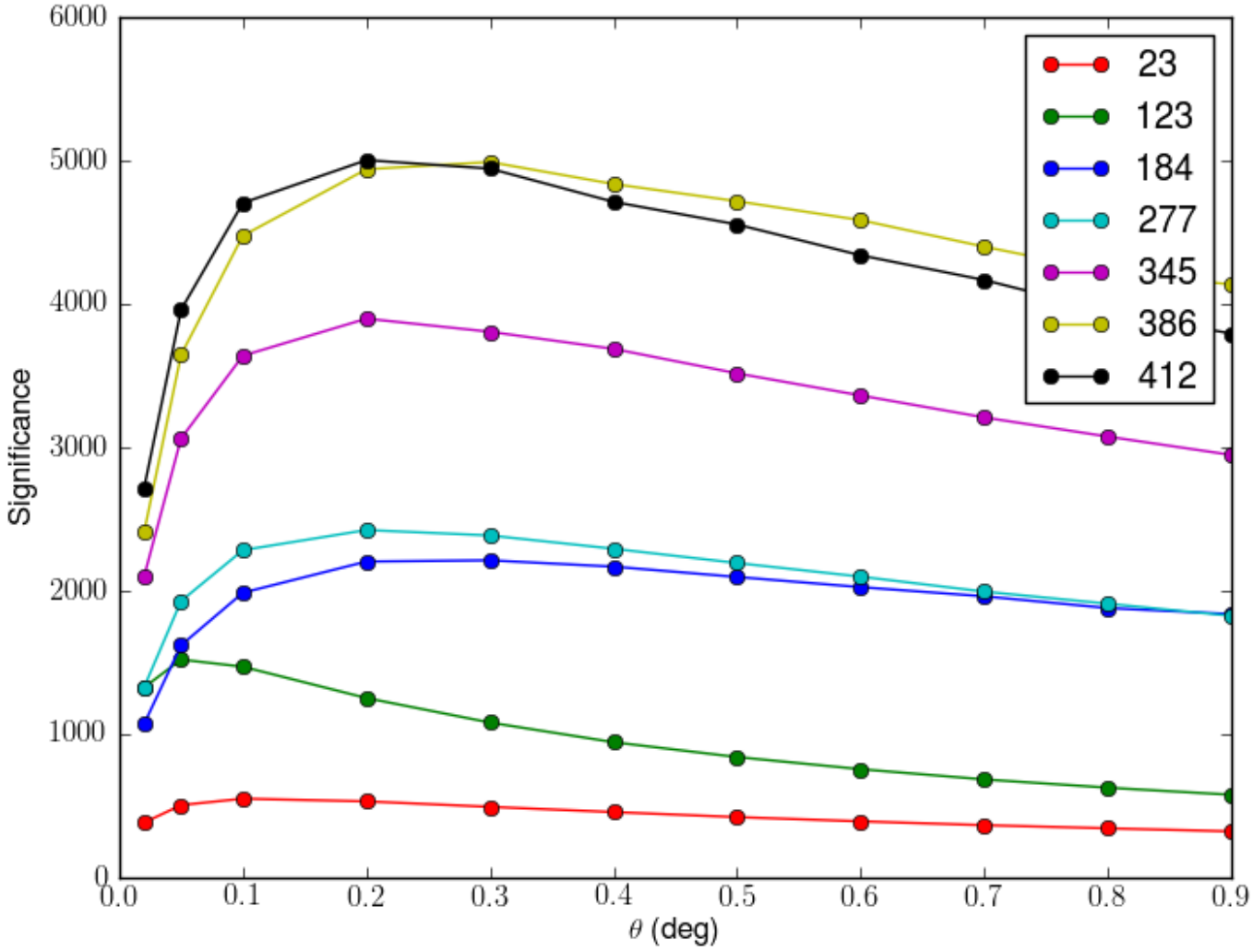
- There are 3 processes:
  - 1) Find the signigicance at different aperture angles,

$$\tilde{S} \sim \frac{D}{\sqrt{\pi\theta^2}}$$

  - 2) Count the number of subhalos that give the maximum significance at each angle.
  - 3) Find a correlation between D-factors and optimum angles.
- Population:
  - reference model 9
  - 460 brightest subhalos.

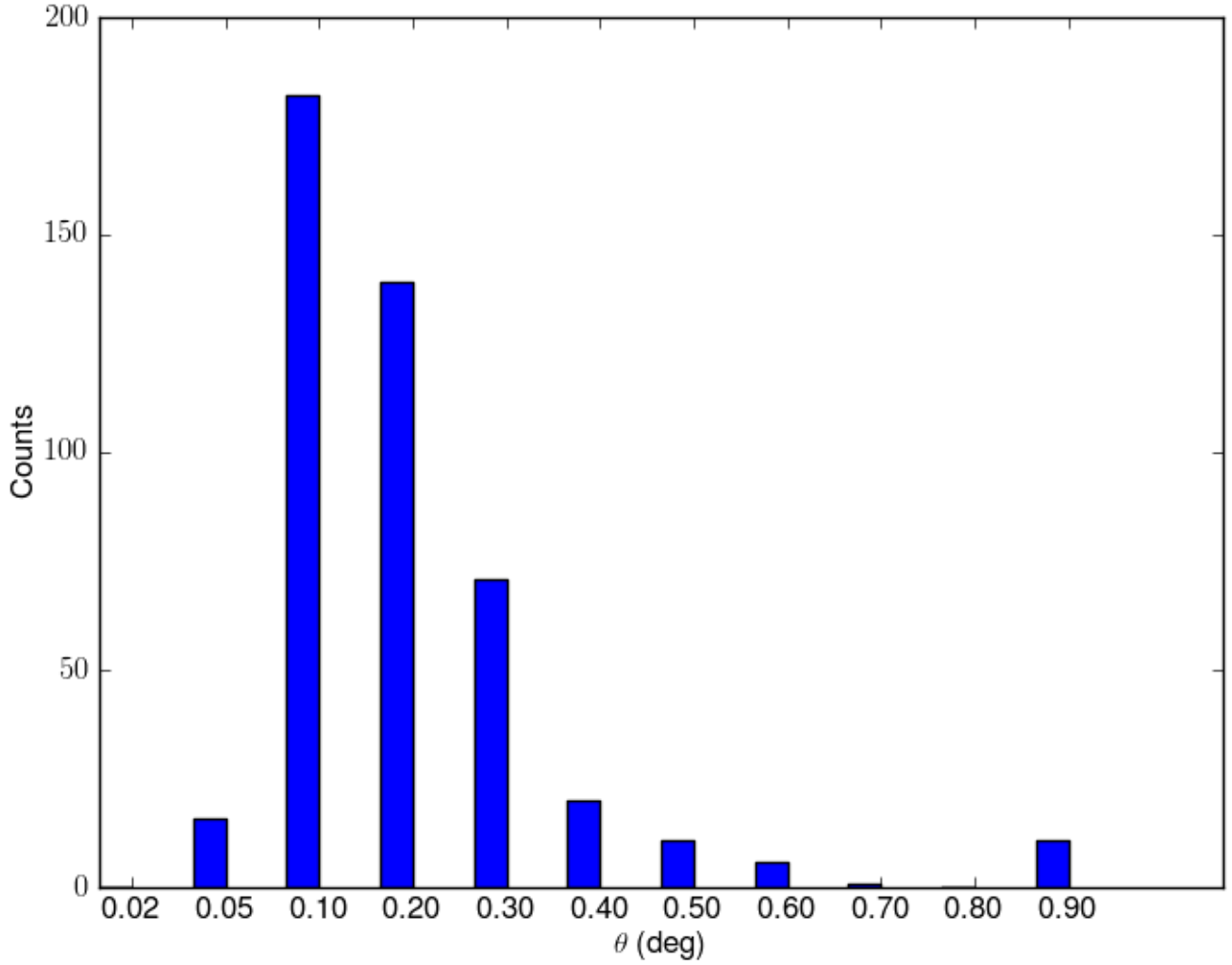
Result 3.1: Signigicance

- Significance of the sampled subhalos,



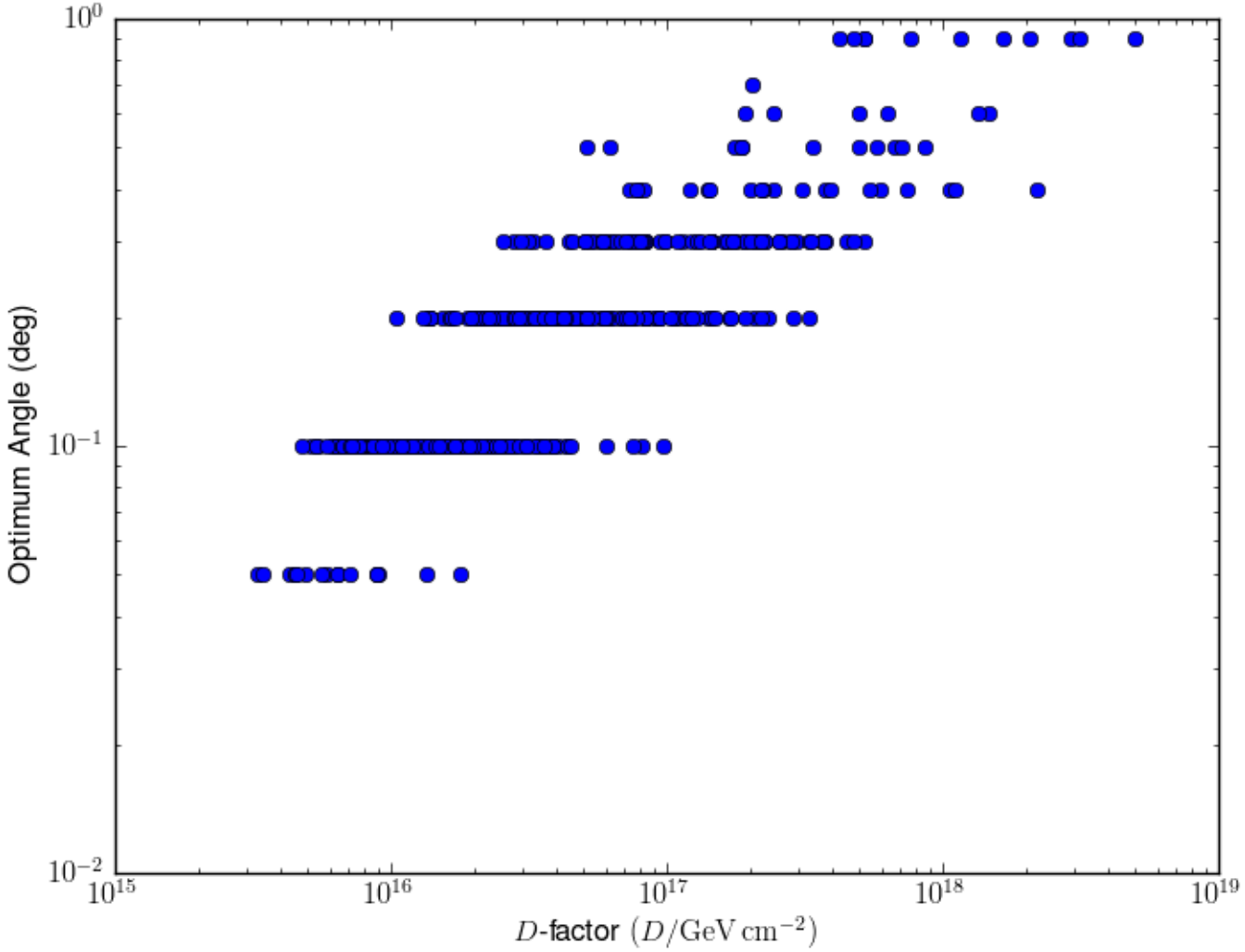
Result 3.2: The optimum angle count

- Most of the subhalos have the optimum angle at 0.10°.



Result 3.3: The correlation

- The brigther the subhalos, the wider the optimum angle.



Conclusions

- The sensitivity of 10 micro Crab is needed to resolve at least 1 subhalo in the searching area.
- A single FOV survey has a very low chance to observe a decay signal.
- The brightest subhalos of decaying dark matter are best observed at an aperture angle of 0.1^{o}.

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References

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Single FOV of annihilation (M. Hütten, 2015)