Indirect detection of dark matter near the galactic center

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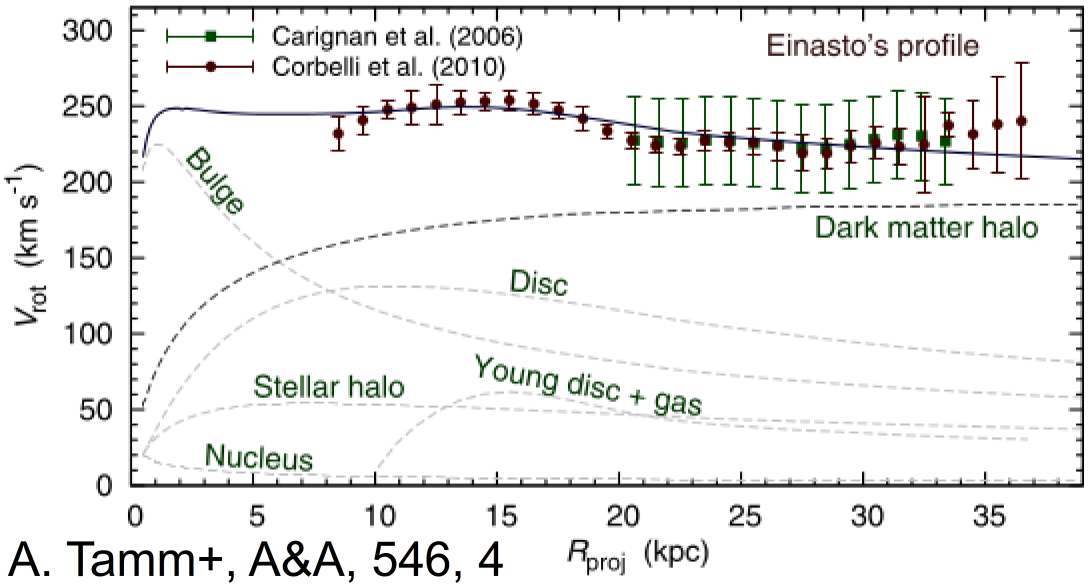
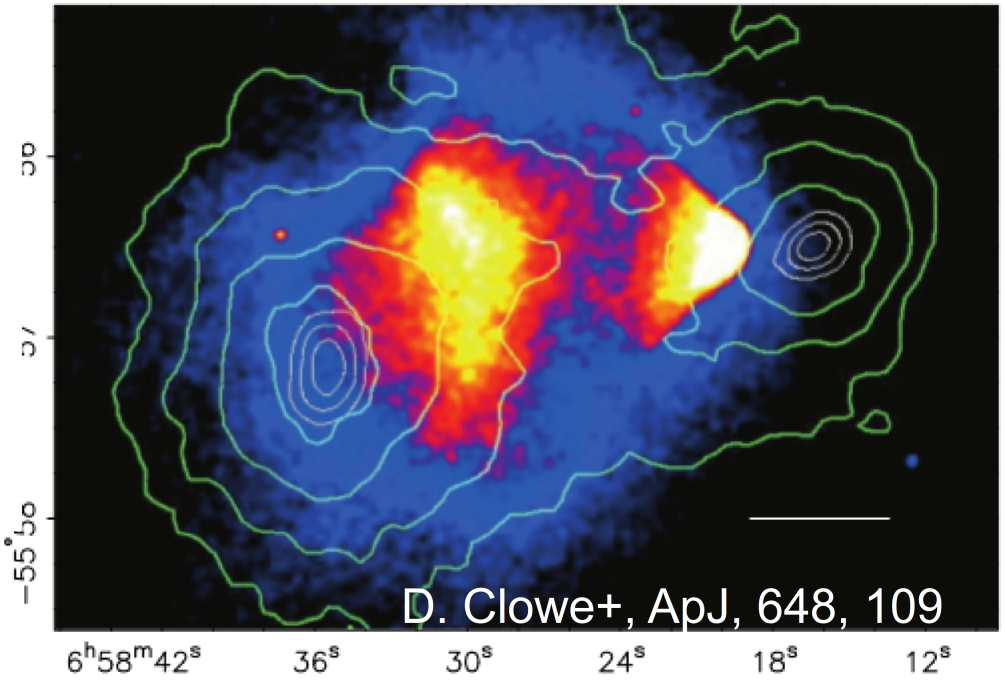
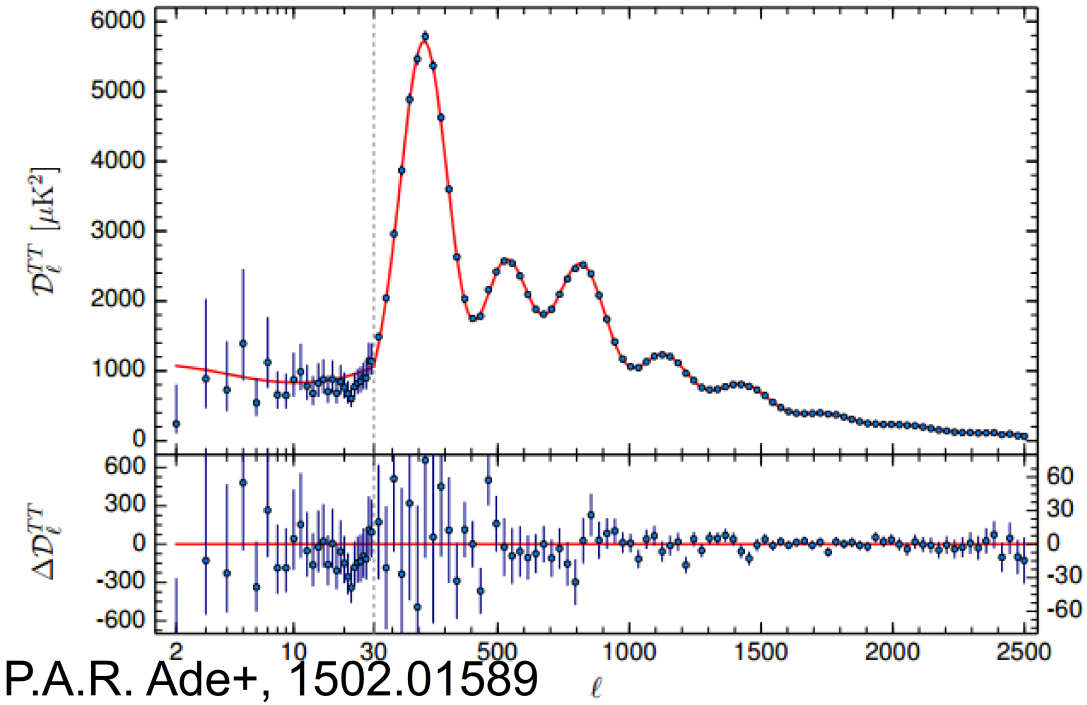
1.Introductions



A. Tamm+, A&A, 546, 4





P.A.R. Ade+, 1502.01589

and

- Gravitation Lensing
- Big Bang Nucleosynthesis
- Structure Formation
- ...

Dark Matter (DM) Candidates

Table 1 Summary of dark matter particle candidates, their properties, and their potential methods of detection

	WIMPs	SuperWIMPs	Light $\tilde{G}$	Hidden DM	Sterile ν	Axions
Motivation	GHP	GHP	GHP/NPFP	GHP/NPFP	ν Mass	Strong CP
Naturally Correct Ω	Yes	Yes	No	Possible	No	No
Production Mechanism	Freeze Out	Decay	Thermal	Various	Various	Various
Mass Range	GeV-TeV	GeV-TeV	eV-keV	GeV–TeV	keV	μeV–meV
Temperature	Cold	Cold/Warm	Cold/Warm	Cold/Warm	Warm	Cold
Collisional				√		
Early Universe		√√		√		
Direct Detection	√√			√		√√
Indirect Detection	√√	√		√	√√	
Particle Colliders	√√	√√	√√	√		

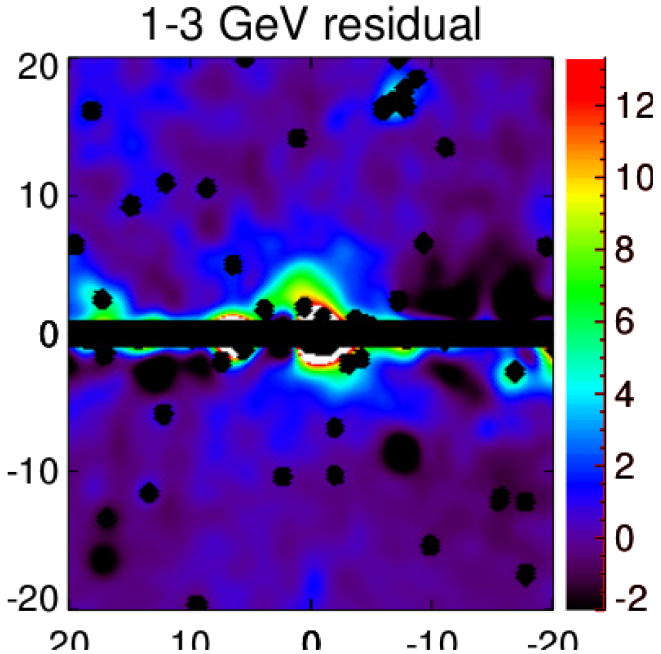
J. L. Feng, ARAA, 48, 495

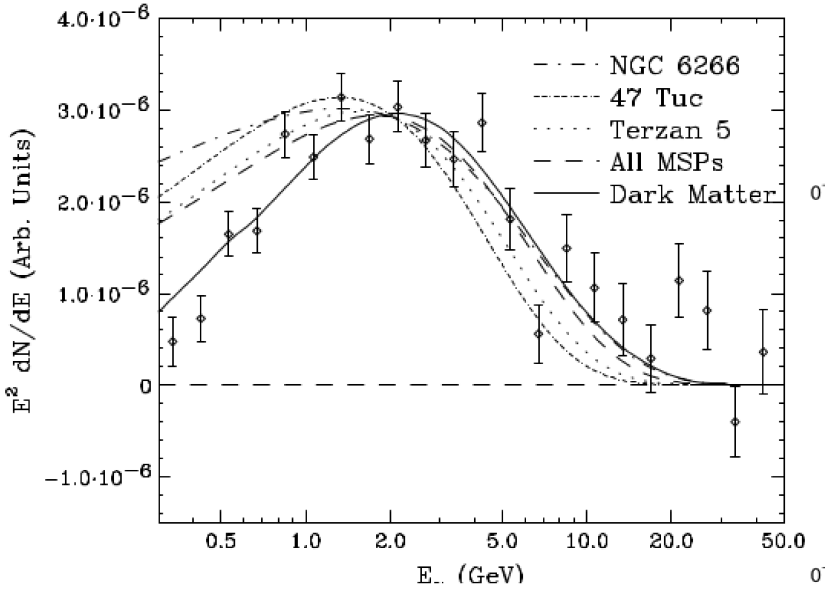
Weak Interacting Massive Particle (WIMP):

- ✓ Mass in GeV – TeV scale, interaction in electroweak scale
- ✓ thermal relic ($\langle\sigma v\rangle \sim 3\times10^{-26}$ cm^3 s^{-1})
- ✓ well-motivated in theory (SUSY, UED, …)

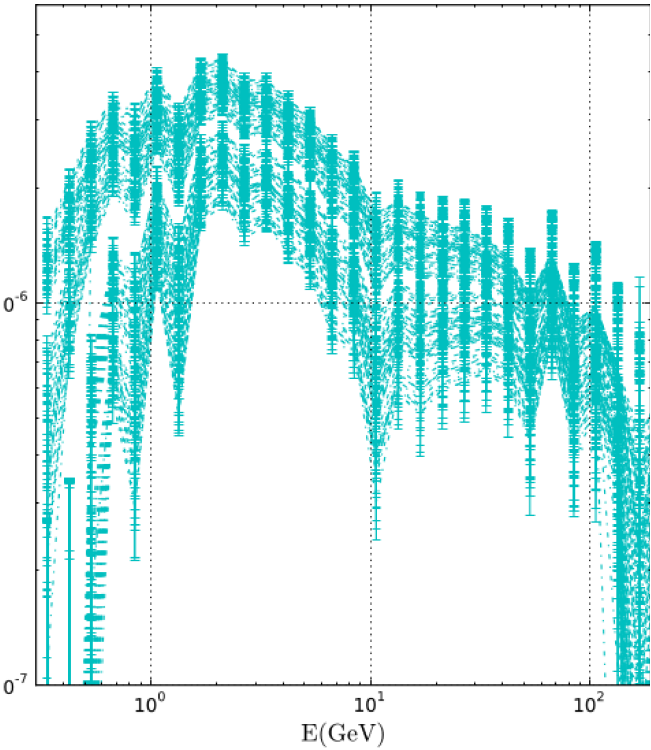
If DM particles annihilate (or decay), they may produce Standard Model (SM) particles. We are trying to detect DM by finding these SM particles (Indirect detection).

2.Galactic center excess (GCE)





T. Daylan+, PDU, 12, 1



B. Zhou+, PRD, 91, 123010

GCE is detected by many groups (e.g. Goodenough+ 2009, Abrazajian+ 2014, Calore+ 2014, Daylan+ 2016, Zhou+ 2015, Ajello+ 2016).

Some people argue that GCE results from DM annihilation (e.g. Daylan+ 2016), while some think millisecond pulsars dominant the GCE (e.g. Yuan+ 2014, Bartels+ 2016, Lee+ 2016).

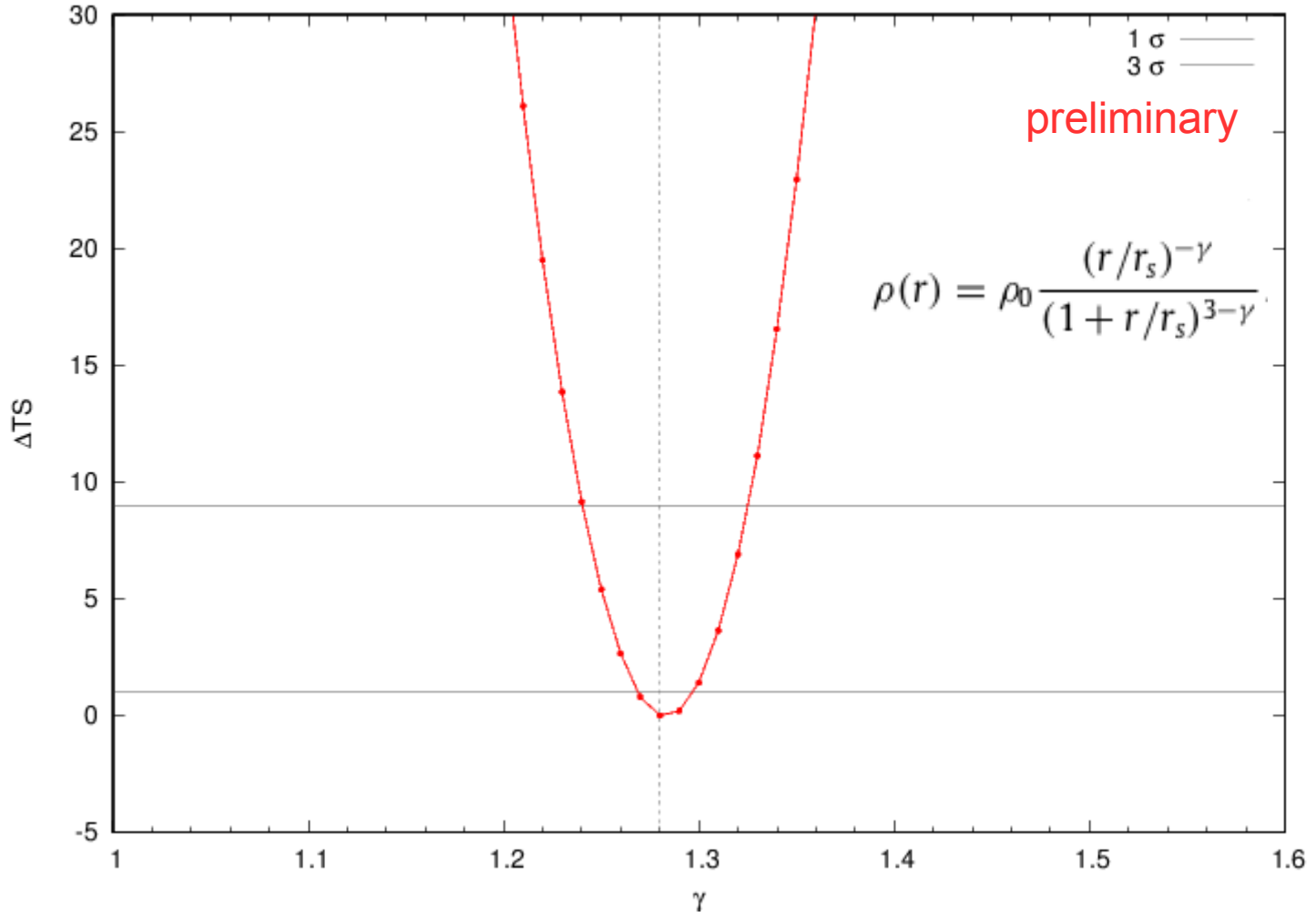
My ongoing work

1. Repeat the results of T. Daylan with Pass 8 data
2. Errr... I haven't decided yet

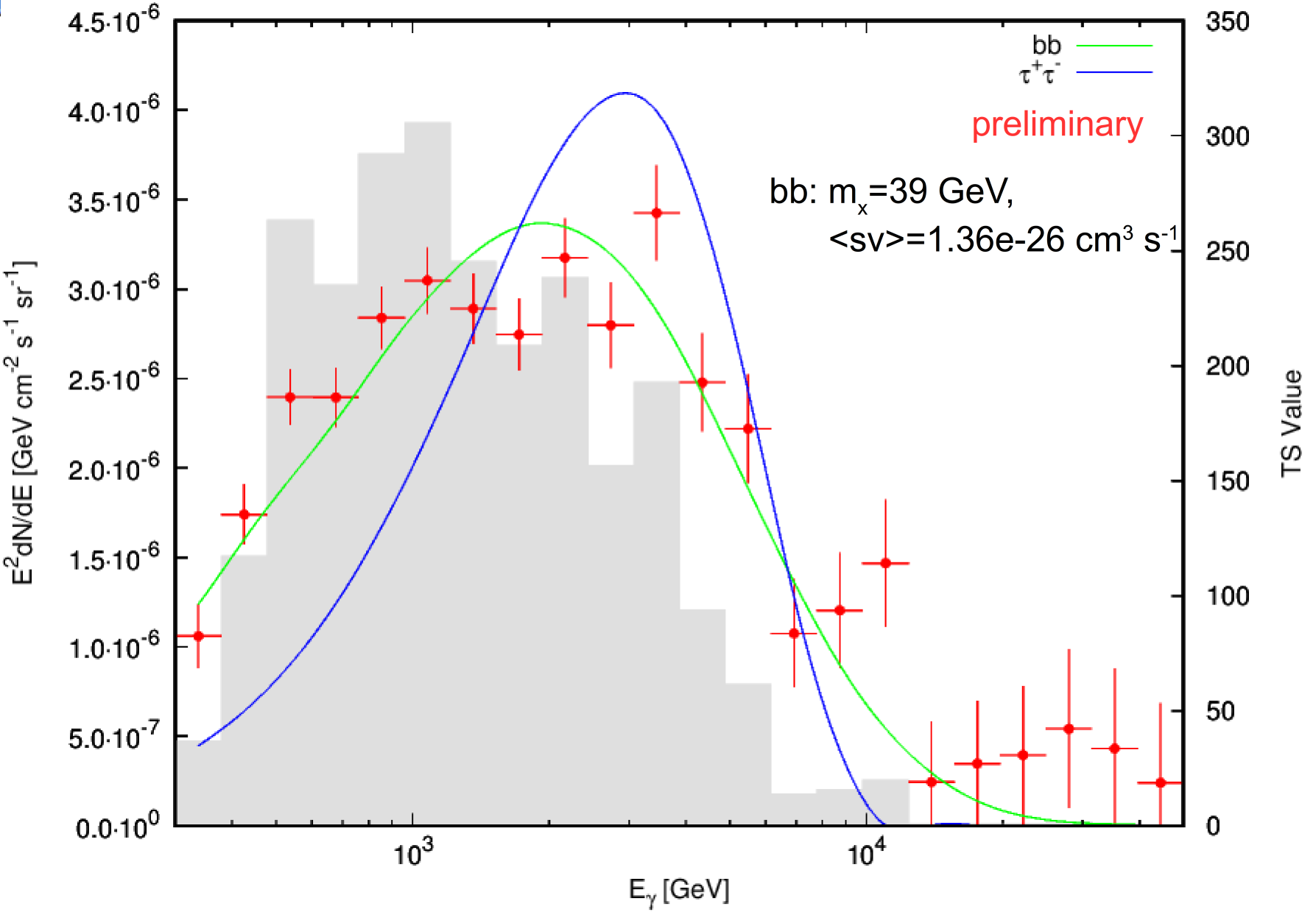
Data analysis

Time	2008 Oct. 27 - 2015 Dec. 10
Energy	300 – 50000 MeV, 22 energy bins
CCUBE size	40 deg x 40 deg, remove |b|<1 deg
Data/IRFs	P8R2_ULTRACLEANVETO_V6::PSF3
e.t.c.	• Mask 300 most bright sources and 300 most variable sources in 3FGL according to 95% containment; • Fit the data with Fermi Bubble Template (M. Su, 2010), gll_iem_v02_P6_V11, isotropic Template and J-factor templates bin-by-bin; • Fit the SED of J-factor template to get dark matter mass and annihilation cross section contours.

Preliminary Results(1)



Preliminary Results(2)



Thanks for your attention!