http://w3.iihe.ac.be
http://icecube.wisc.edu

Astroparticle physics

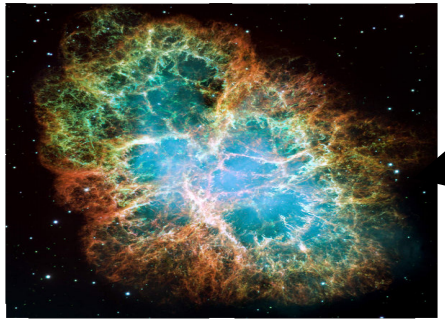
with

the AMANDA neutrino telescope

B.Baret I.I.H.E.-V.U.B. Brussels for the IceCube collaboration

Potential sources

Galactic



SNR ex:Crab nebula

Accelerators

Relativistic
Expanding shells

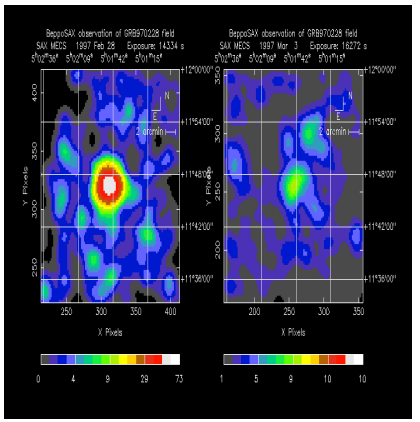
$$p + p$$
$$p + \gamma \rightarrow \Delta$$

$$X + \pi^0 \rightarrow \gamma + \gamma$$
$$X + \pi^- \rightarrow \mu + \nu_\mu$$
$$\hookrightarrow e + \nu_e + \bar{\nu}_\mu$$

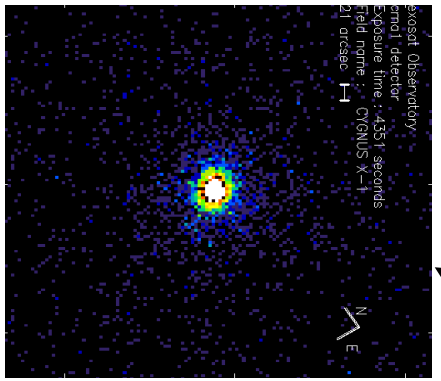
See E.Bernardini's plenary

Relativistic
Jets

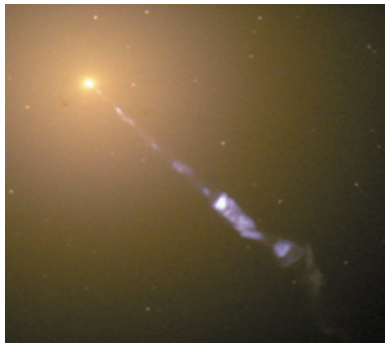
Extragalactic



G.R.B.



Xray binaries ex:
Cygnus X-1

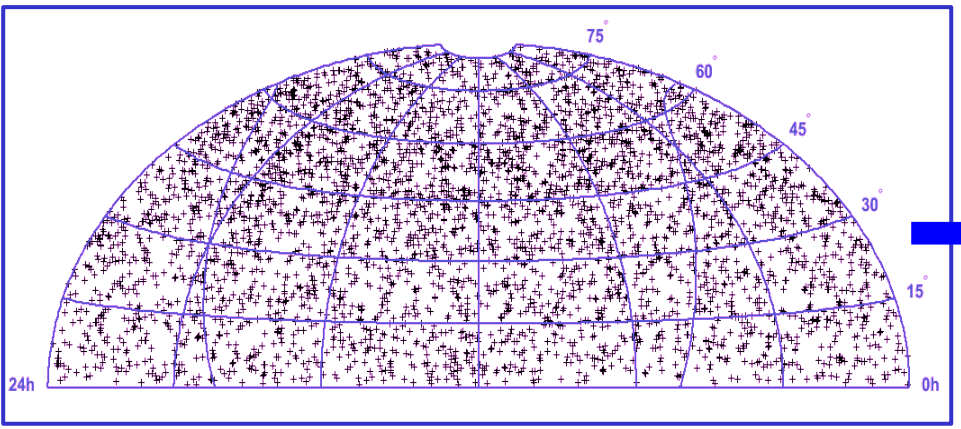


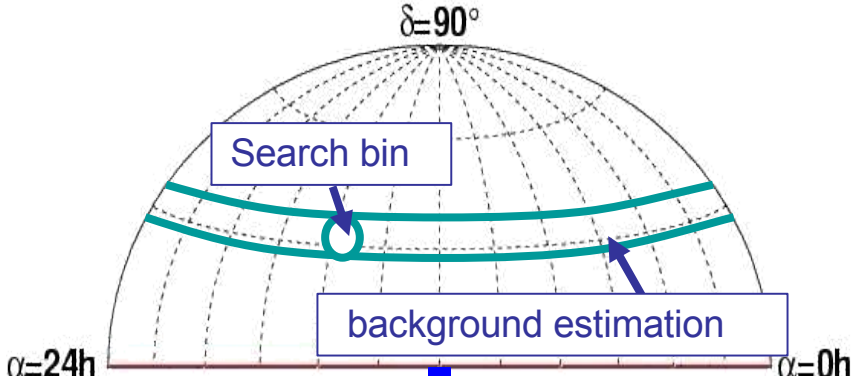
near AGN ex:
M87 (HST)

Steady point source search

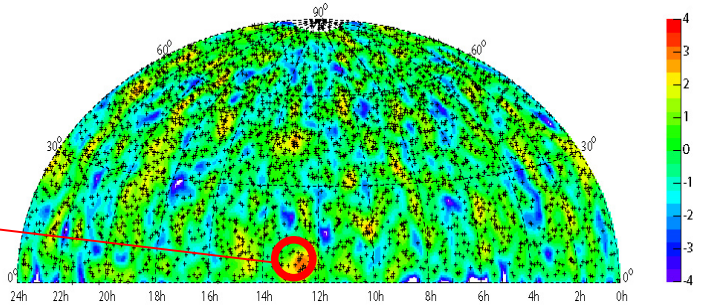
Skymap (2000-2004)

4282 ν

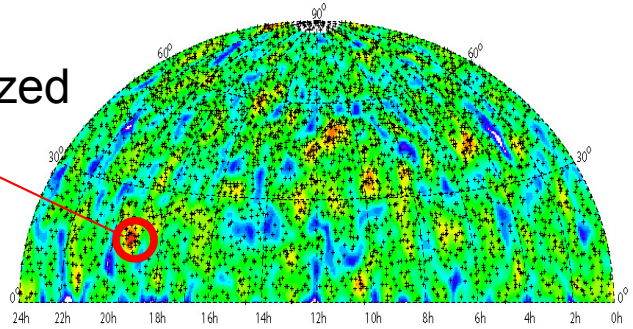




Real sky



Randomized MC sky



Significance maps

Highest excess=3.7σ
Statistical probability=69%

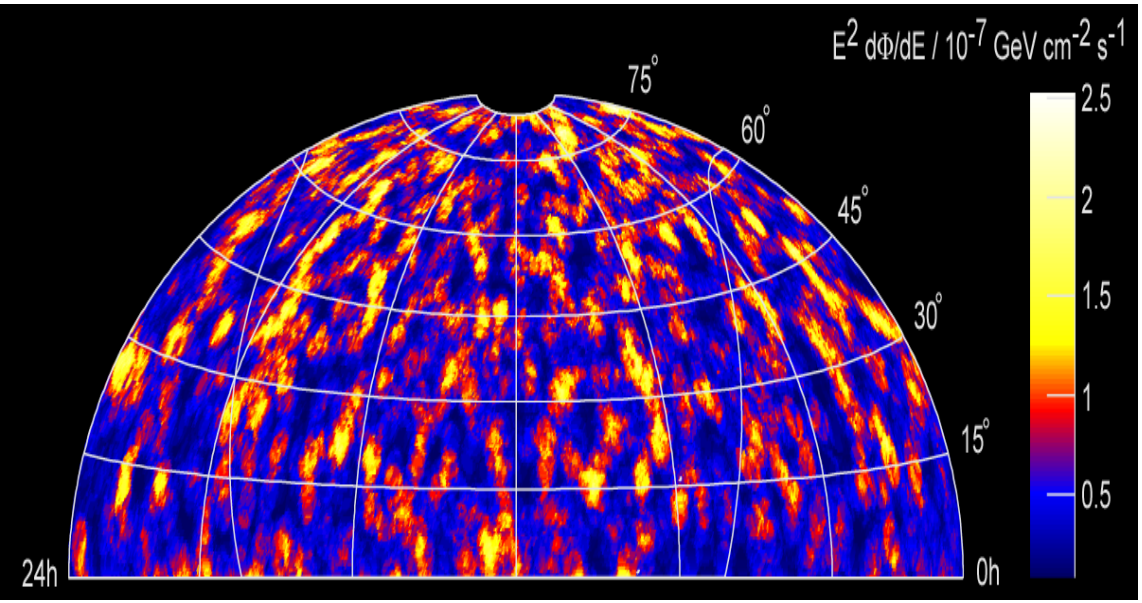
No source

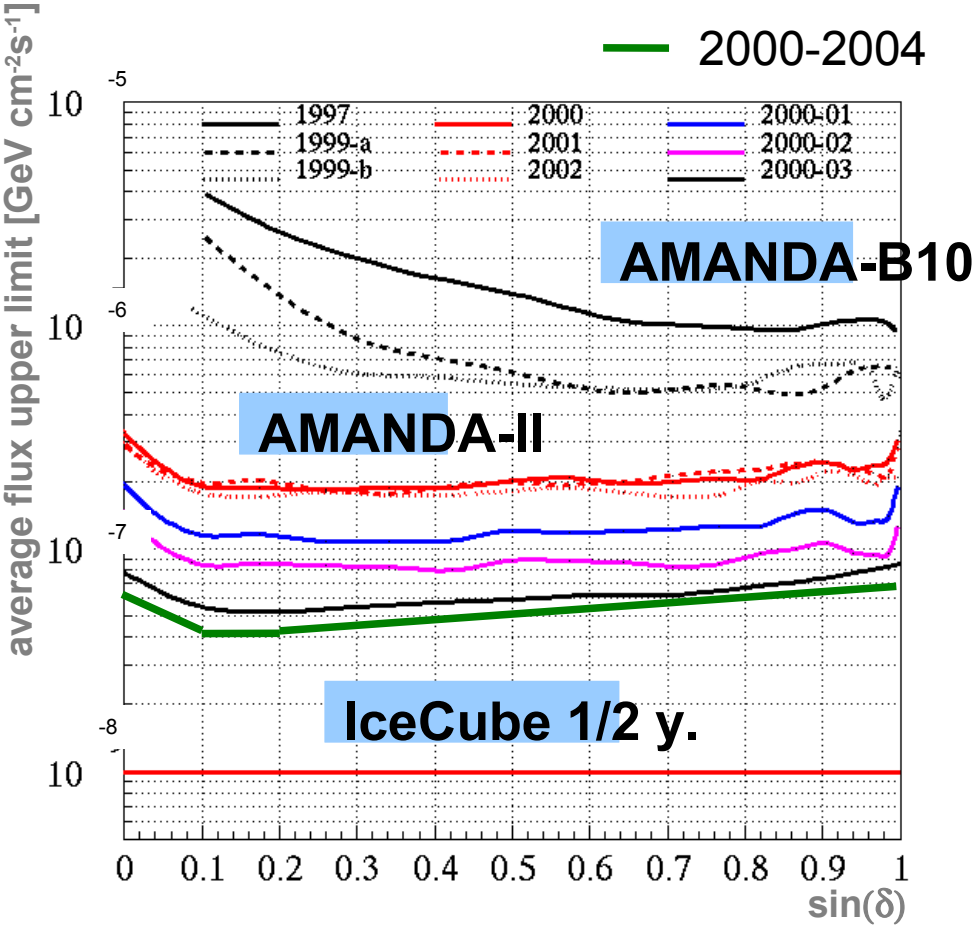
Limits

Sensitivity & limits

Hypothesis: E^{-2} flux

Steady point source sensitivity: average 90%C.L. upper limit

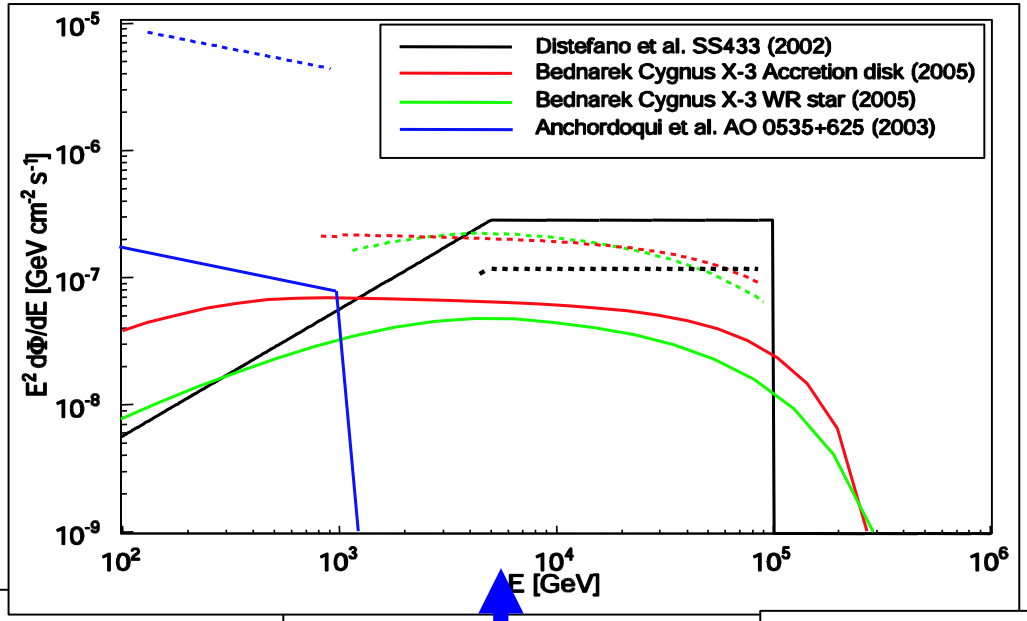




Known γ-ray sources:

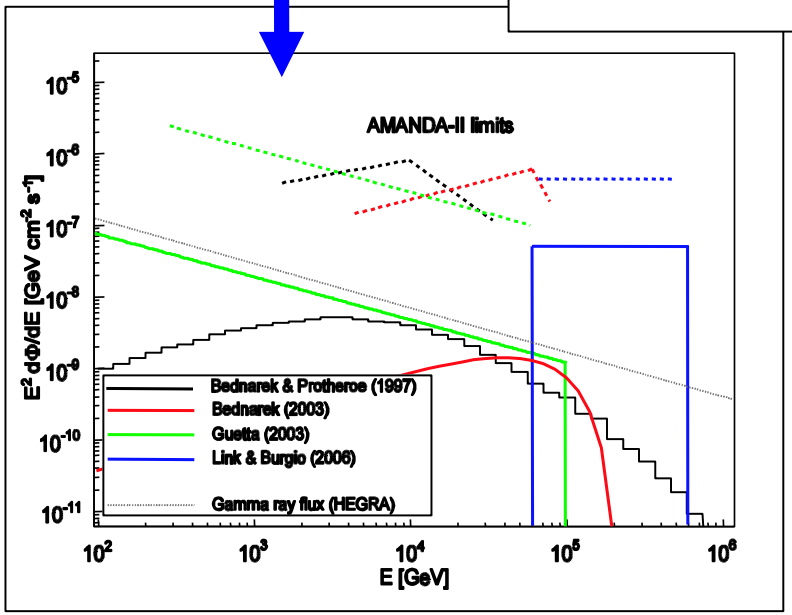
highest excess	AGN 3C273	(8evt/4.72 exp.)
highest count	Crab Neb.	(10evt/6.74 exp.)

More refined models



Crab nebula:

$N_{\nu exp}$:0.1-1.2

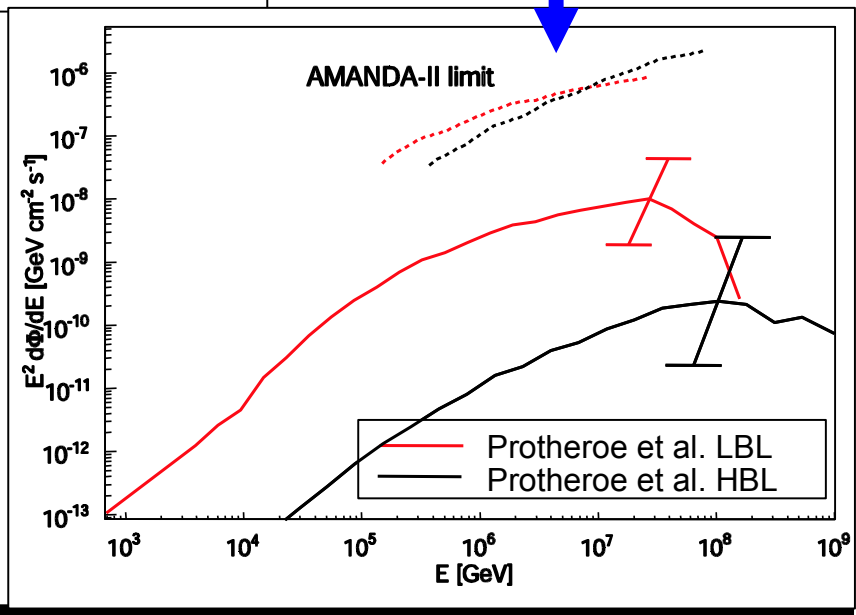


X-ray binaries:

$N_{\nu exp}$:0.1-8.

M87 AGN:

$N_{\nu exp}$<0.06

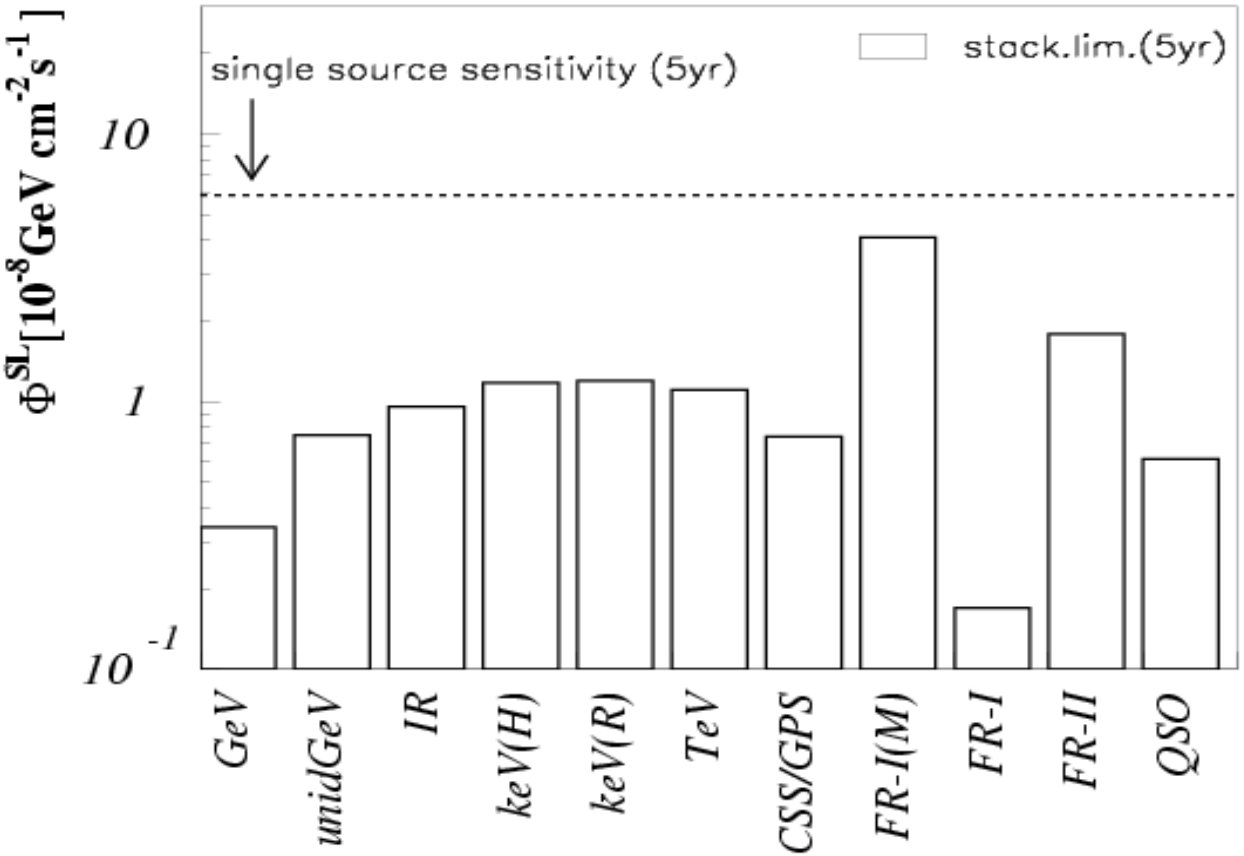


Stacked sources

Principle:
Sum up the contributions from same type of AGNs

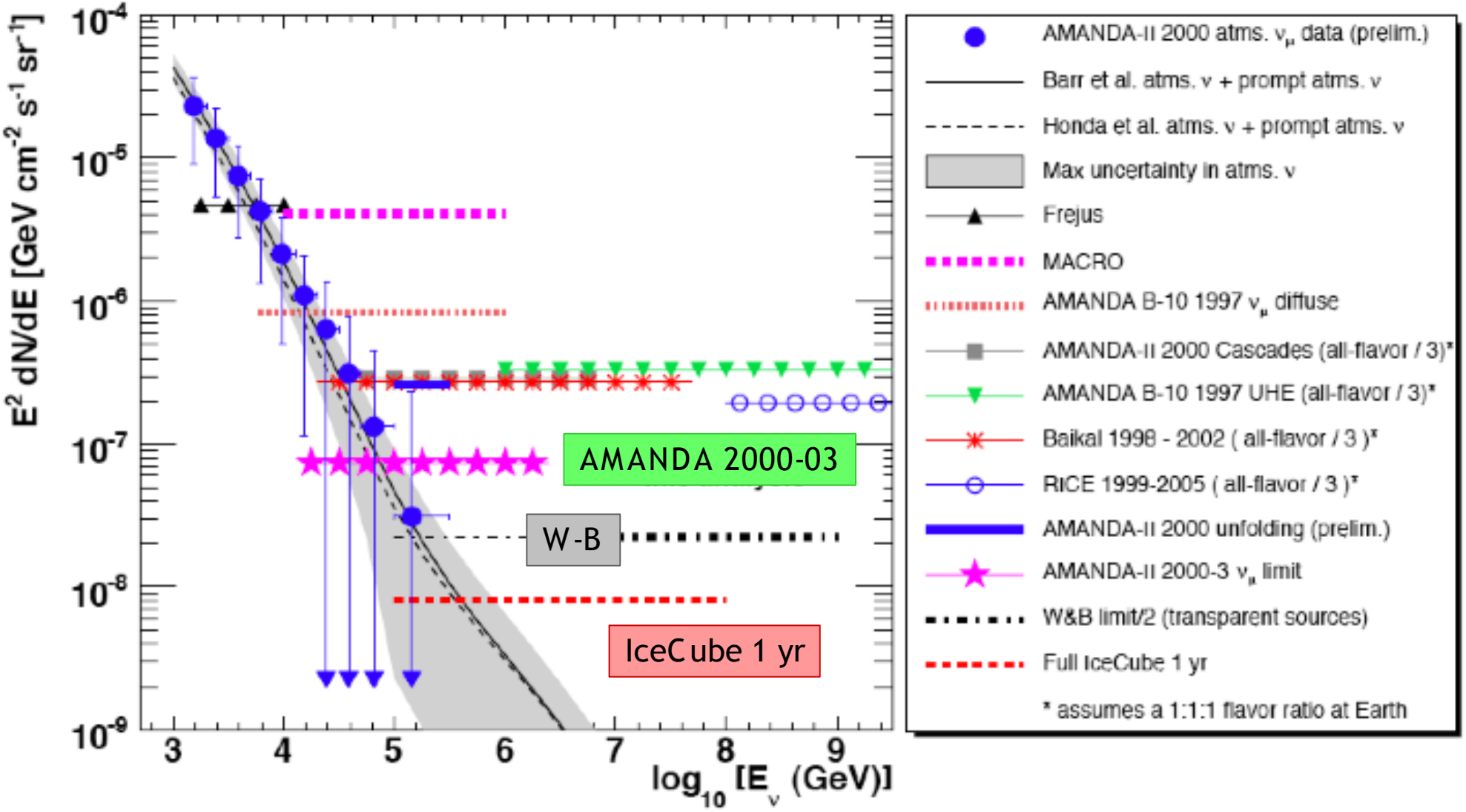
Background lowered

Signal enhanced



Astropart. Phys. 26 282-300 (2006)

Diffuse Search



Achterberg et al., astro- ph/0705.1315, acccepted PRD

GRB Search

μ channel, northern hemisphere:

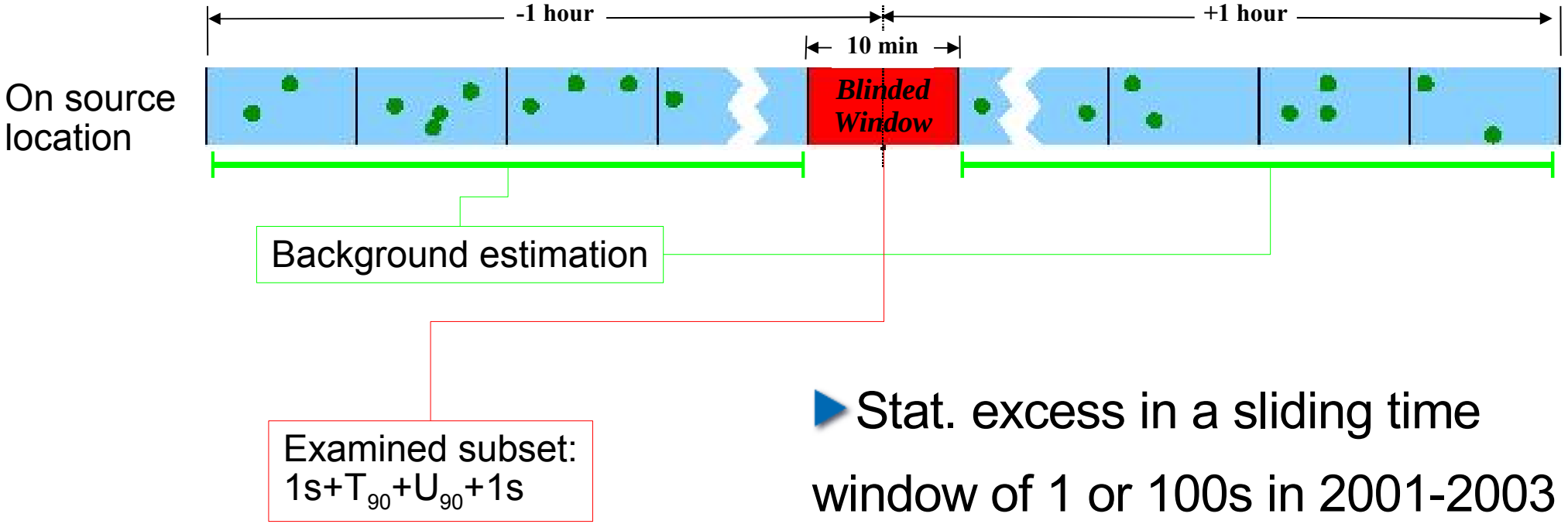
- Spatial & temporal coincidence

with 312 BATSE and 91 IPN bursts in 1997-2003

All sky all flavour cascade search:

- spatial & temporal coincidence

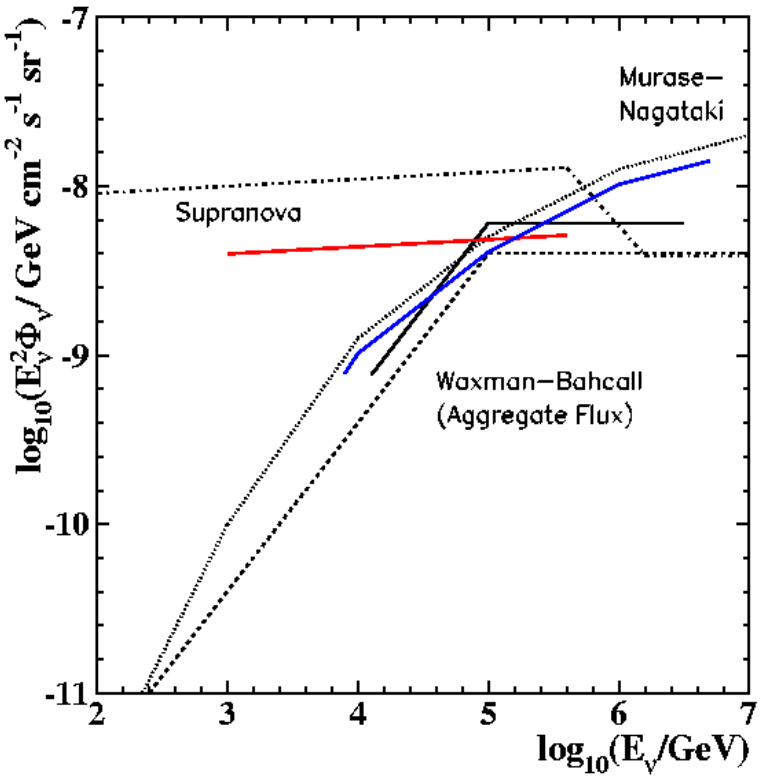
with 73 BATSE bursts in 2000



- Stat. excess in a sliding time window of 1 or 100s in 2001-2003 data

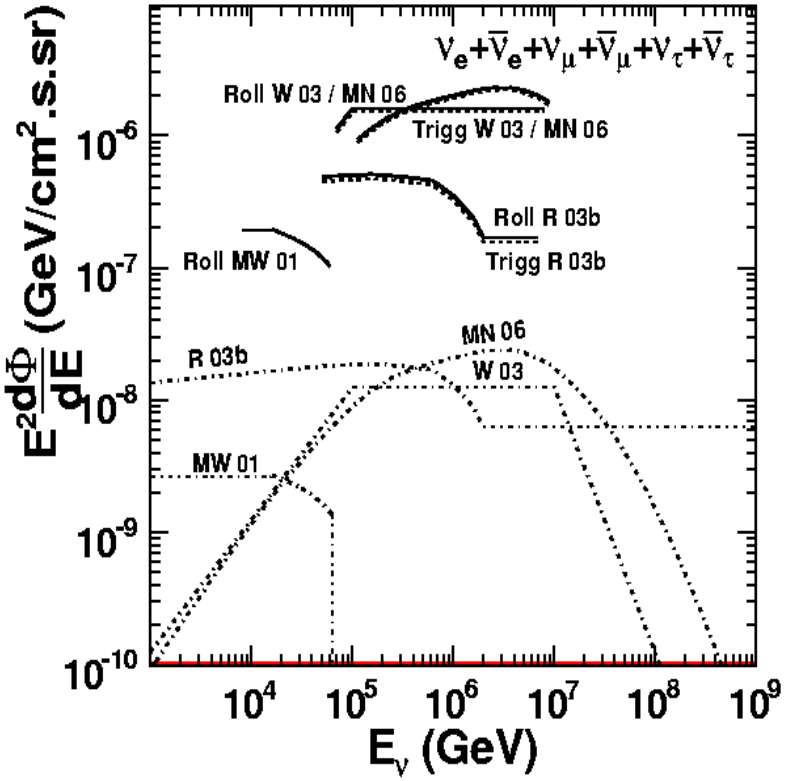
GRBs Limits

μ channel



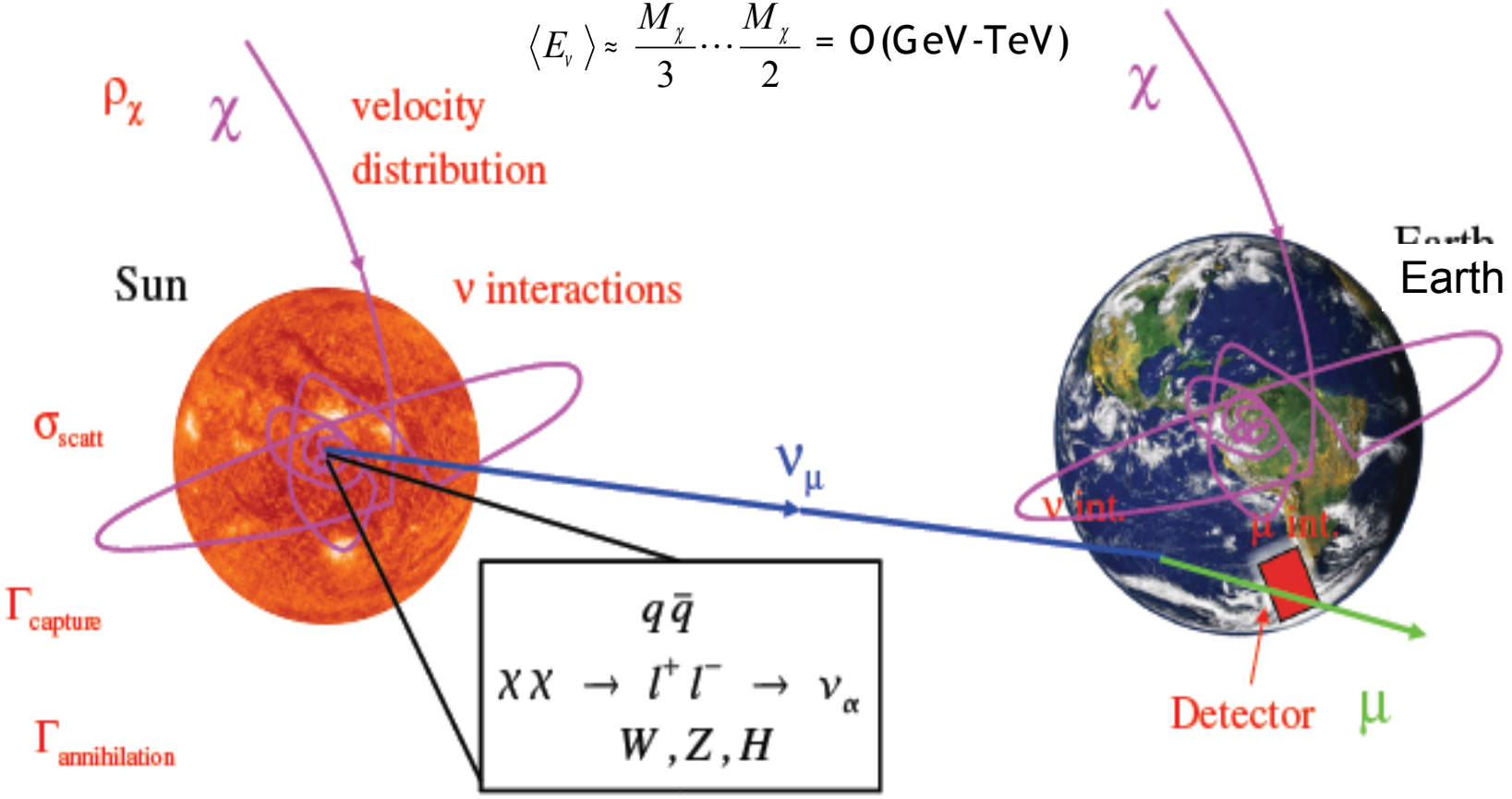
The IceCube Coll. and the IPN coll.
astro-ph/07051186

Cascades



A. Achtberg et al.
Astro-ph/0702265 accepted Astr. J.

Indirect Dark Matter Search



Signal: 50 GeV < M_χ < 5000 GeV

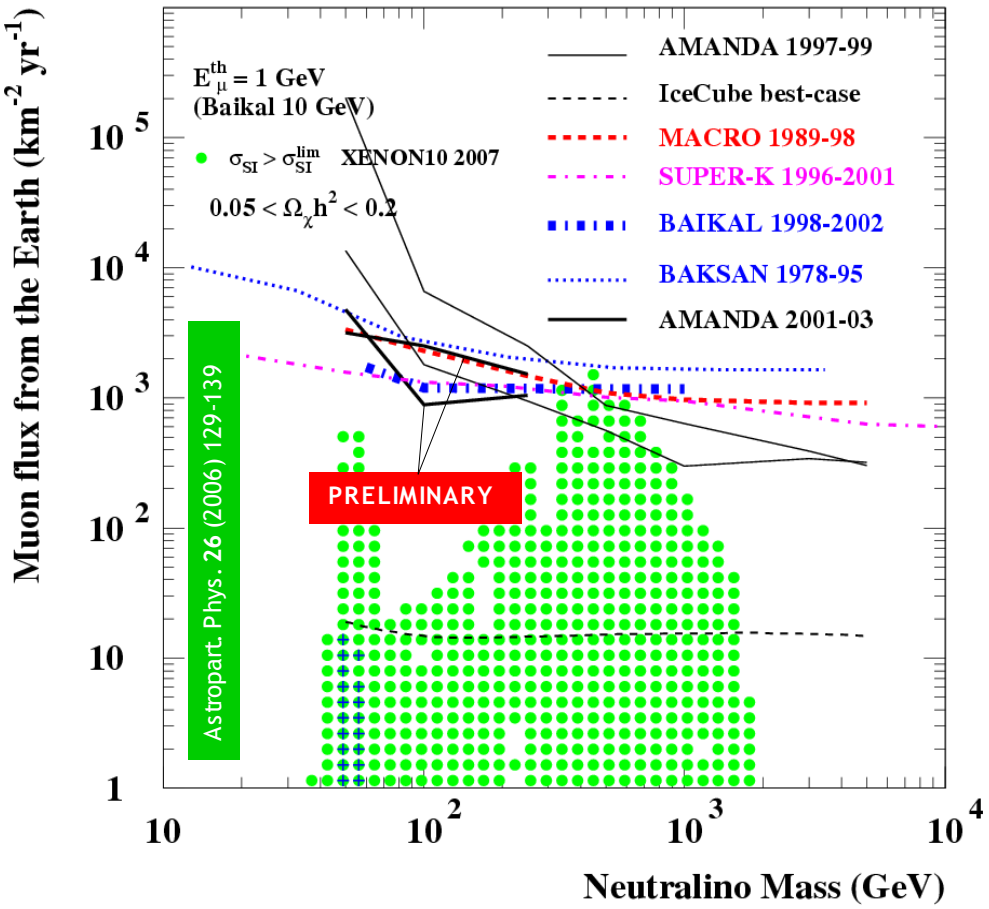
hard (W^+W^-) & soft (bb) annihilations

Background:

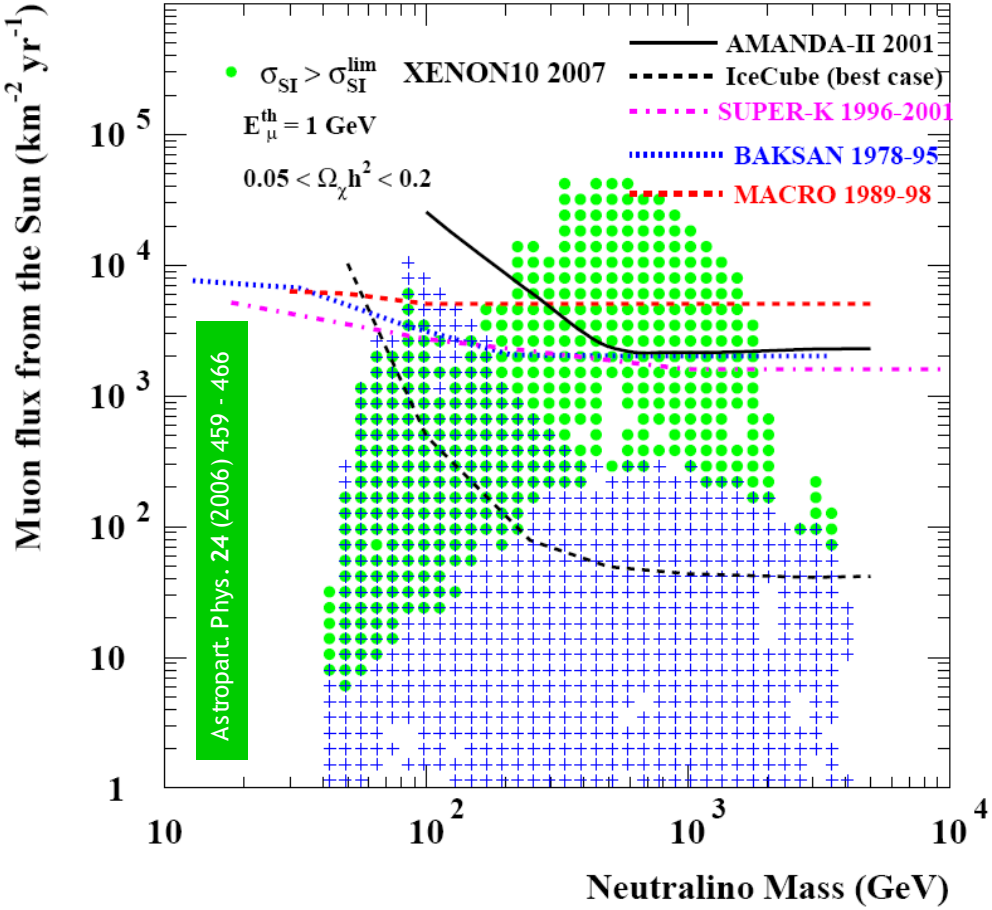
Earth: MC Sun:off-source data

WIMPs limits

Earth



Sun



Summary and outlook

- No extraterrestrial high energy neutrino detected yet
- AMANDA provides the best limits on high energy neutrino flux on a wide range of searches
- Continues to take data, sensitivity getting close to the expected signals
- Integrated in IceCube, now the biggest neutrino detector *
- IceCube, with its >30 times bigger effective area is a discovery instrument*
- Stay tuned!...

*See D.Cowen's talk (You just saw it!)