

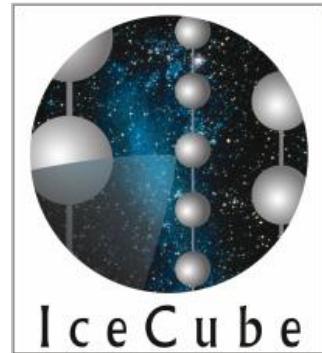
# IceCube Neutrino Observatory status report



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Department of Physics  
Chiba University

# Reference

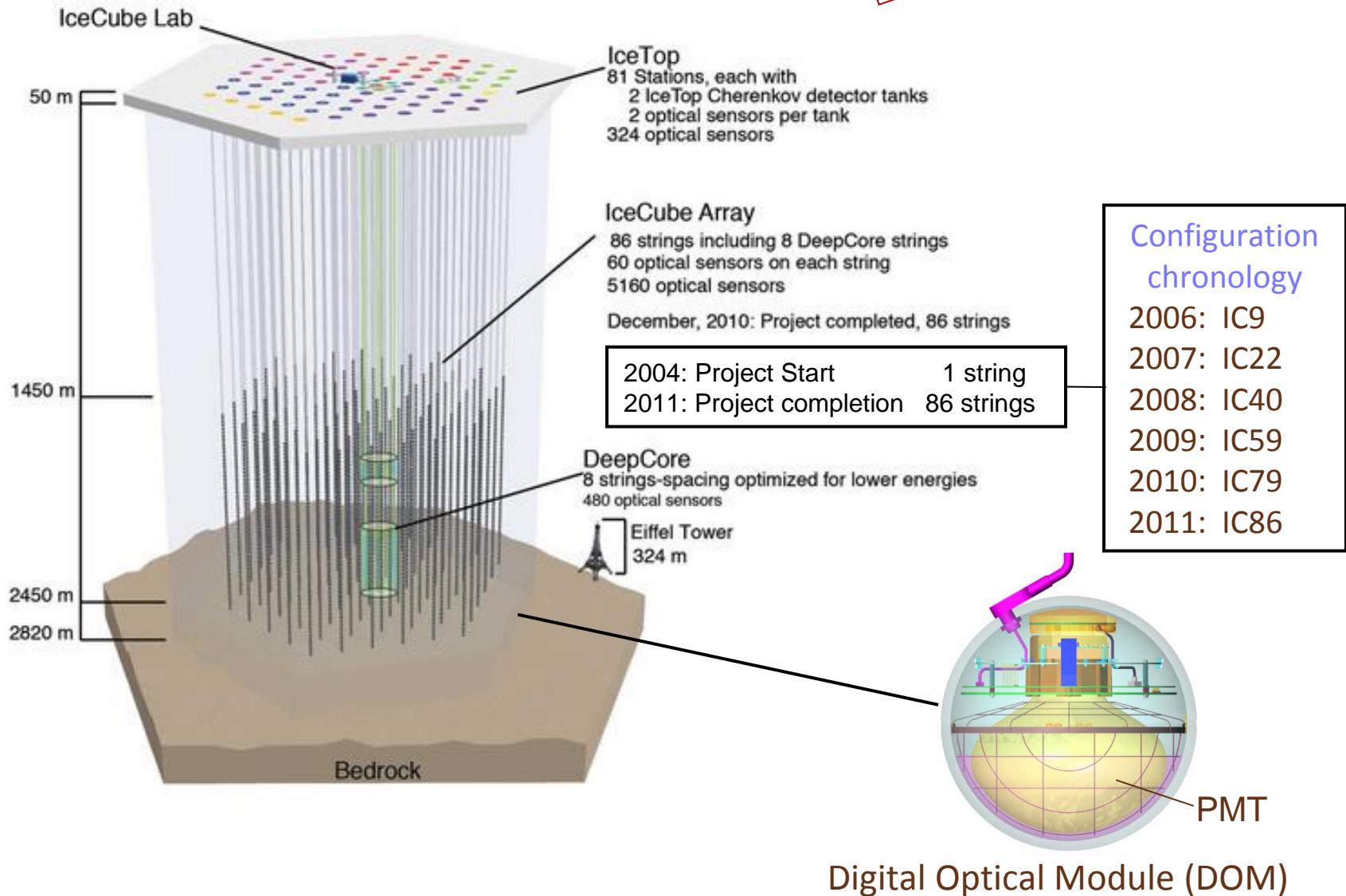
(related to UHE stuff – from the Japan group)



- Calculations of UHE  $\nu$  propagation and the tactics for their detection by IceCube  
[SY et al Phys.Rev.D 69 103004 \(2004\)](#)
- The detailed description of GZK  $\nu$  search by IceCube and the 1<sup>st</sup> results using 2007-2008 data  
[IceCube collaboration, Phys.Rev.D 82 072003 \(2010\)](#)
- The follow up results using 2008-2009 data: The world tightest limit as of today  
[IceCube collaboration, Phys.Rev.D 83 092003 \(2011\)](#)

# The IceCube Neutrino Observatory

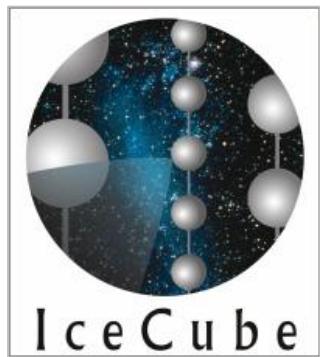
Completed: Dec 2010



# The IceCube Collaboration

<http://icecube.wisc.edu>

36 institutions, ~250 members



## Canada

University of Alberta

## US

Bartol Research Institute, Delaware  
Pennsylvania State University  
University of California - Berkeley  
University of California - Irvine  
Clark-Atlanta University  
University of Maryland  
University of Wisconsin - Madison  
University of Wisconsin - River Falls  
Lawrence Berkeley National Lab.  
University of Kansas  
Southern University, Baton Rouge  
University of Alaska, Anchorage  
University of Alabama, Tuscaloosa  
Georgia Tech  
Ohio State University

## Barbados

University of West Indies

## Sweden

Uppsala Universitet  
Stockholms Universitet

## UK

Oxford University

## Germany

Universität Mainz  
DESY-Zeuthen  
Universität Dortmund  
Universität Wuppertal  
Humboldt-Universität zu Berlin  
MPI Heidelberg  
RWTH Aachen  
Universität Bonn  
Ruhr-Universität Bochum

## Japan

Chiba University

## Belgium

Université Libre de Bruxelles  
Vrije Universiteit Brussel  
Universiteit Gent  
Université de Mons-Hainaut

## Switzerland

EPFL, Lausanne

## New Zealand

University of Canterbury

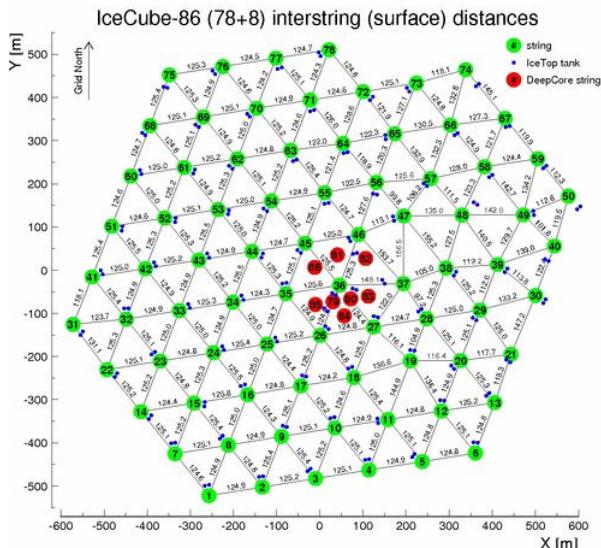
## ANTARCTICA

Amundsen-Scott Station

# Note: Different dataset

IC86 = full IceCube (2011~)

**IceCube**



IC79 (2010-2011)

**IceCube**

IC59 (2009-2010)

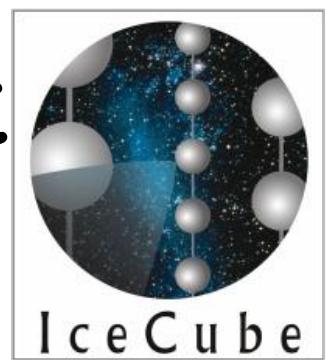
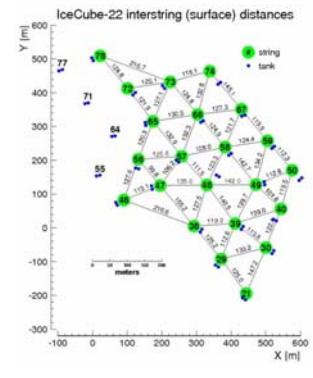
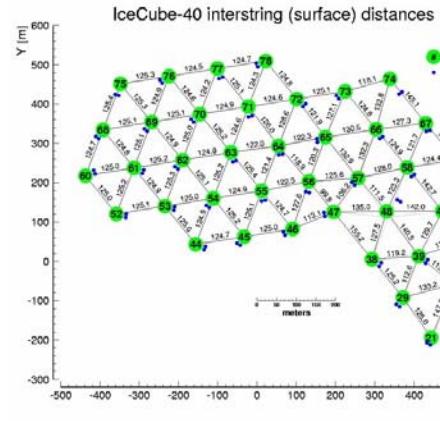
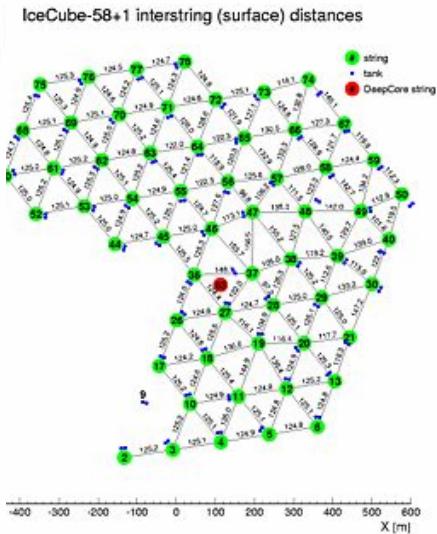
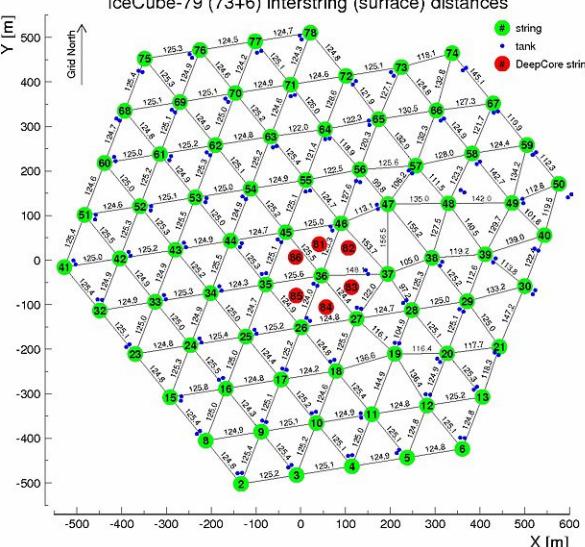
**IceCube**

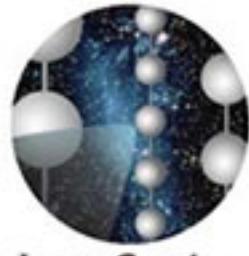
IC40 (2008-2009)

**IceCube**

IC22 (2007-2008)

**IceCube**





IceCube

# $\nu$ skymap

**IceCube + IceCube**

**IceCube Preliminary**

Hottest spot: RA 75.45 Dec -18.15  $-\log(p)=4.65$

~36 % probability with trial factors

up-going  $\mu$ 's w/ atmospheric  $\nu$  BG

+85°

+45°

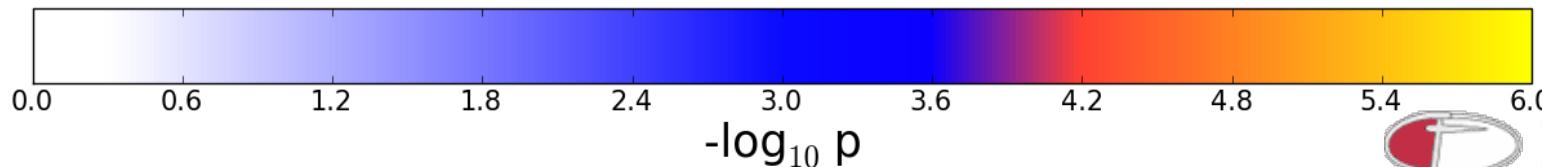
24h

0h

-45°

-85°

down-going PeV  $\mu$ 's w/ cosmic-rays BG



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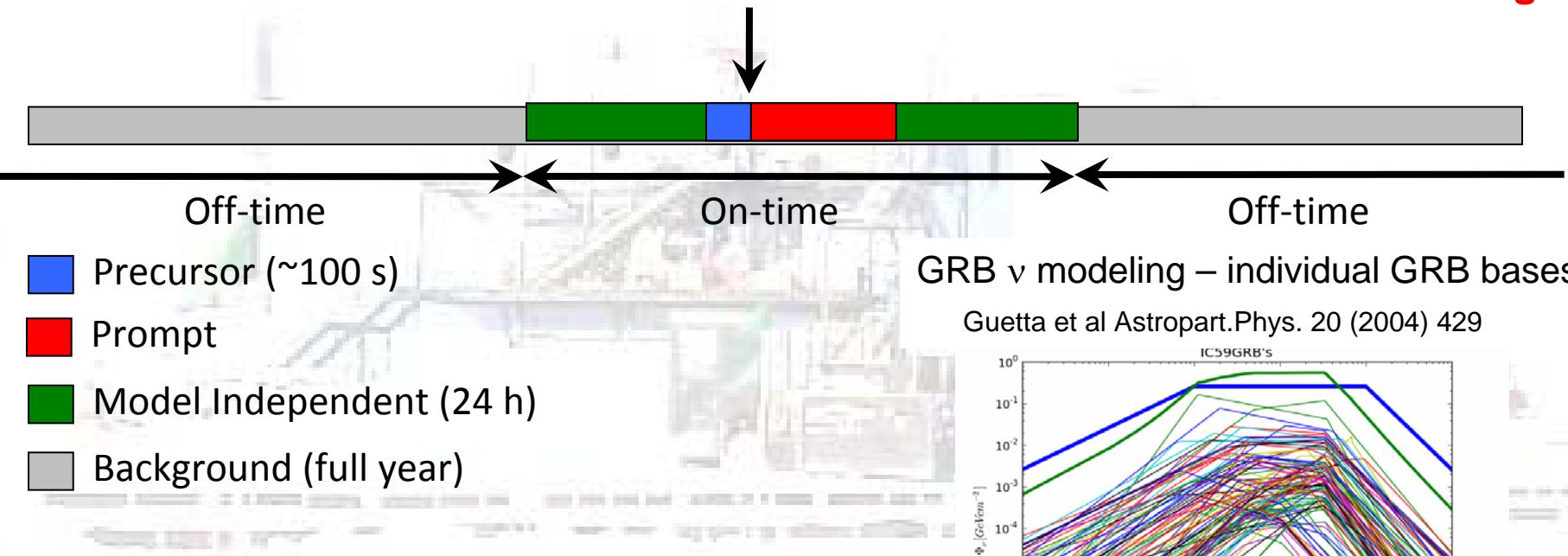
IceCube

# GRB Search

$\nu_\mu \rightarrow \mu$  base

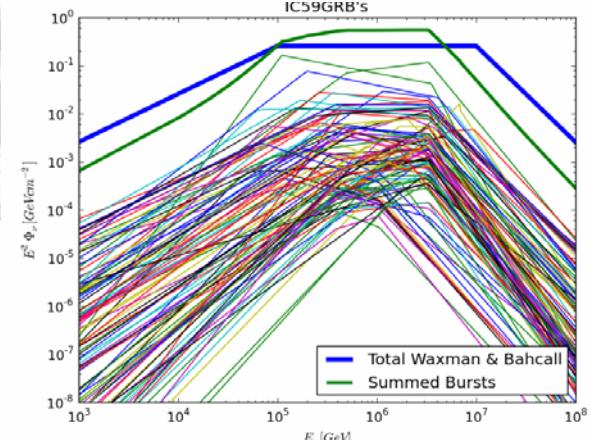
Zenith > 85 deg.

$T_0$ : From a satellite GCN

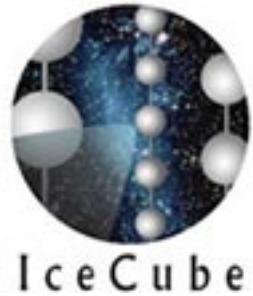


GRB  $\nu$  modeling – individual GRB bases

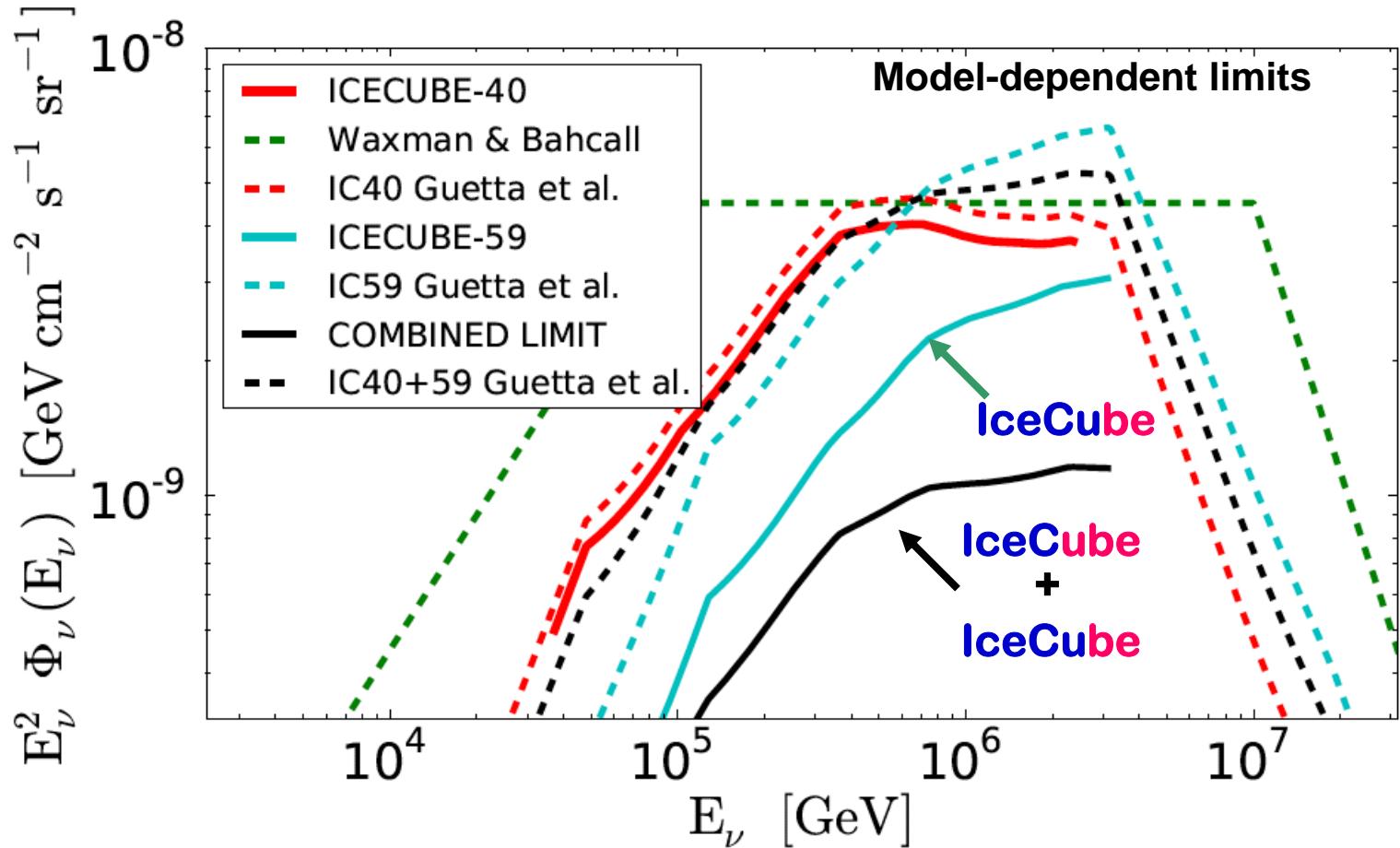
Guetta et al Astropart.Phys. 20 (2004) 429



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# No association of $\nu$ 's with GRB..

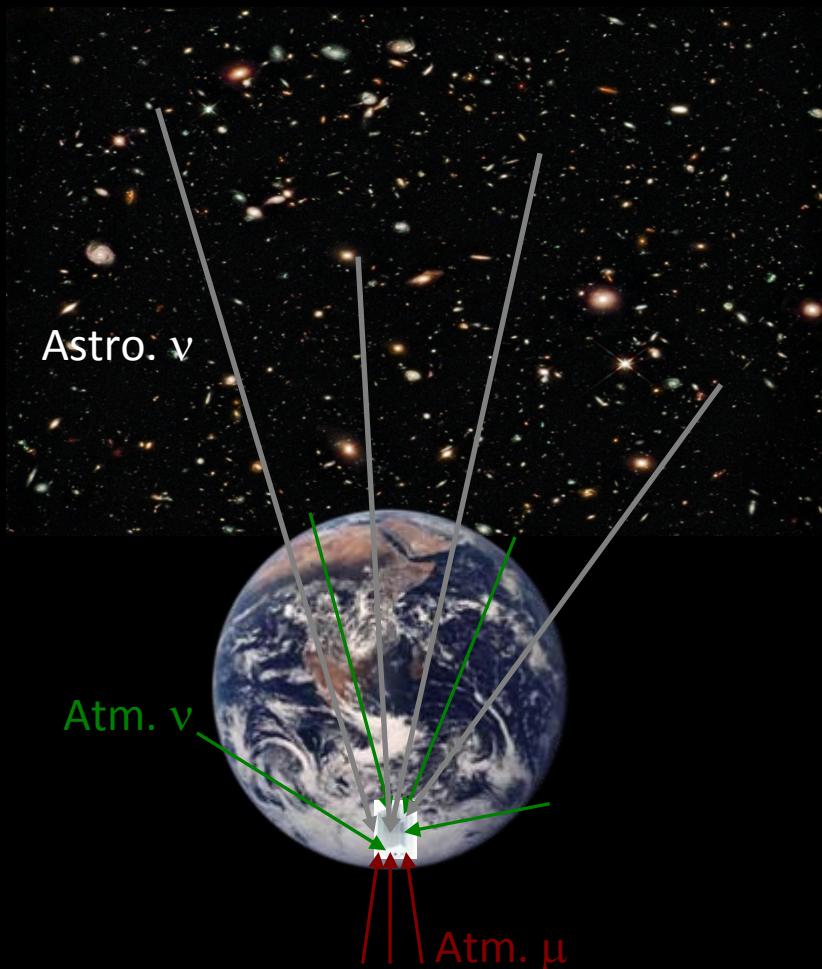


We are on the way to indicate GRBs are  
**unlikely** to be a major UHECR origin.

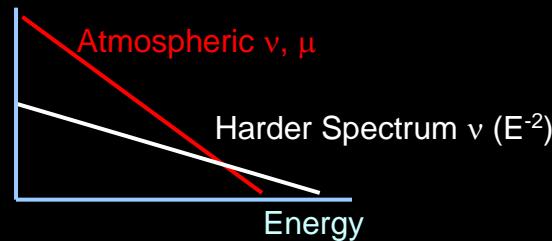
# Searches for a Diffuse Neutrino Flux

**Diffuse Flux** = effective sum from all (unresolved) extraterrestrial sources (e.g., AGNs)

Possibility to observe diffuse signal even if flux from any individual source is too weak for detection as a point source



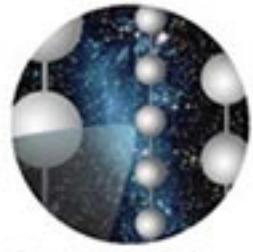
Search for excess of astrophysical neutrinos with a harder spectrum than background atmospheric neutrinos



Advantage over point source search:  
can detect weaker fluxes

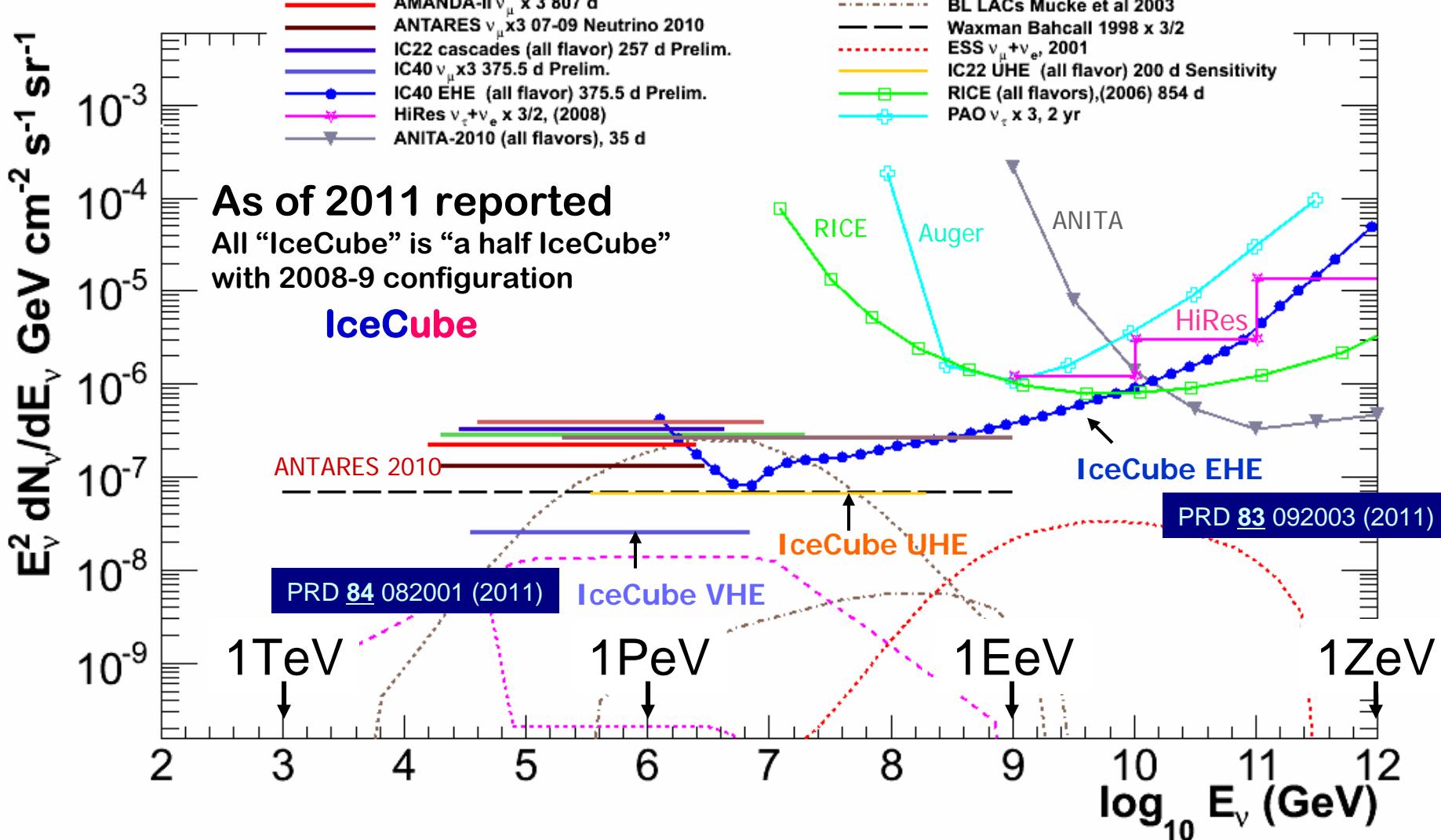
Disadvantages:  
high background  
must simulate background precisely

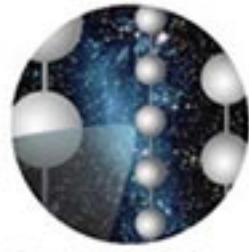
Sensitive to all three neutrino flavors in principle



# Diffuse $\nu$ limits – global picture

**IceCube**

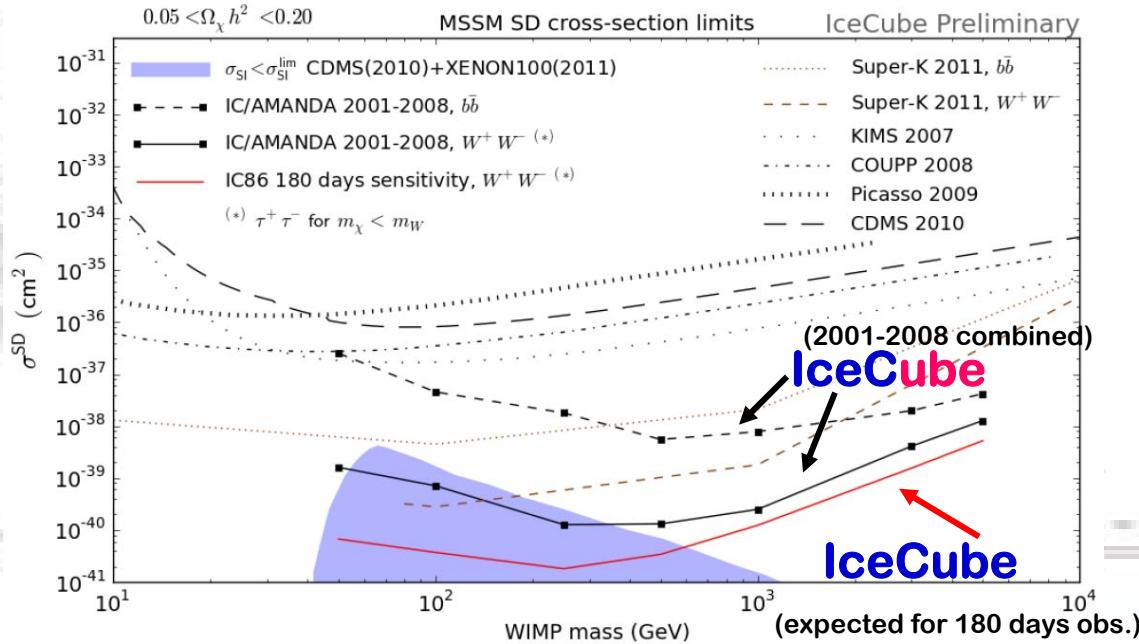




# Dark matter searches: Solar WIMPs

$\chi\chi \rightarrow b\bar{b}(\text{soft}), W^+W^- (\text{hard}), \dots \rightarrow \nu s$

- Determine the muon flux from the direction of the Sun
  - A few to  $10^3$  events per year
  - GeV to TeV energies
- Limit the neutrino-induced muons from WIMP annihilation
- A strong limit on SD cross-section and good potential



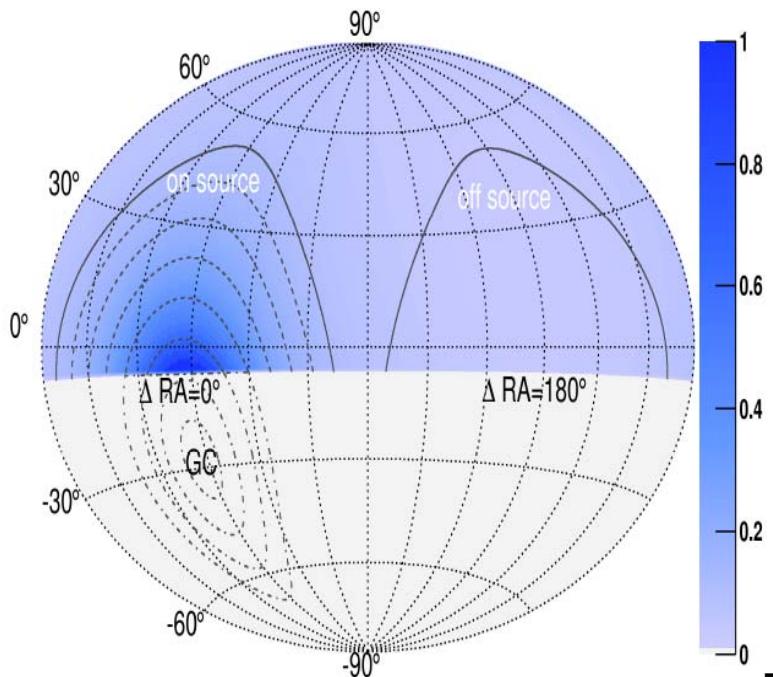


# Dark Matter from the Galactic Halo

IceCube

$$\frac{d\Phi_\nu}{dE} = \frac{\langle \sigma_A v \rangle}{2} J(\psi) \frac{R_{sc} \rho_{sc}^2}{4\pi m_\chi^2} \frac{dN_\nu}{dE}$$

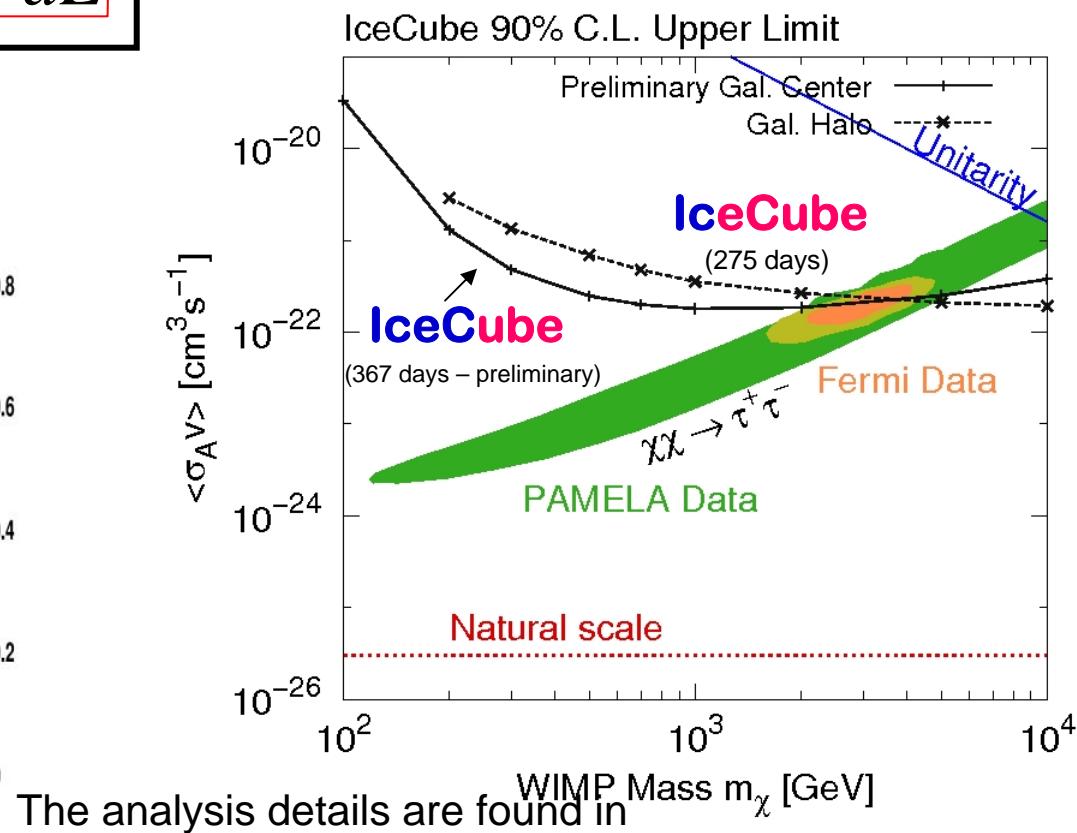
Measure or limit



Dark matter density profile

Dark matter model

IC40  
found no excess

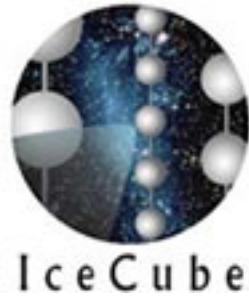


The analysis details are found in

PRD **84** 022004 (2011)



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# 最後に要望をさせてください

**IceCube** 共同利用の現在のメインである計算機利用に関して

限られた時間・または枠でよいですから、  
長時間 job を許していただけないでしょうか？

超高エネルギー宇宙線由来の Background MC は  
1イベントあたり非常に時間がかかるため。

例えば、job 管理システムに priority control をつける。

千葉大IceCube CPU cluster, ウィスコンシン大 IceCube CPU cluster  
では condor を job 分配システムに採用して、長時間 job が走りすぎる  
ことによる諸問題を解決している。

