

NNN15

OCTOBER 28-31, 2015
SIMONS CENTER FOR GEOMETRY
AND PHYSICS
STONY BROOK UNIVERSITY,
NY, U.S.A.

International Workshop for the
Next Generation Nucleon Decay
and Neutrino Detectors

UD2

Unification Day 2

TOPICS:

- Discovery of proton decay
- Discovery of CP violation in the lepton sector
- Determination of the neutrino mass hierarchy
- Observation of neutrinos from core collapse supernovae
- Unification theories
- Leptogenesis
- NNN detector R&D

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Workshop Introduction

Chang Kee Jung
Oct. 29, 2015

Workshop for the
**Next Generation Nucleon Decay
 and Neutrino Detector (NNN99)**

September 23 - 25, 1999
SUNY at Stony Brook, NY, USA

Working Groups:

Nucleon Decay
Neutrino Oscillations
Neutrino Astrophysics

NNN99 International Advisory Committee

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For more information, please contact:

Joan Napolitano, *Conference Secretary*
 HEP group, Dept. of Physics and Astronomy
 SUNY at Stony Brook, NY 11794-3800, USA
 PHONE: 516-632-8095
 FAX: 516-632-8101
 EMAIL: nnn99@superk.physics.sunysb.edu

Further information and registration:

<http://superk.physics.sunysb.edu/NNN99/>

B.L. Hahn, *BNL*
 C.K. Jung, *Stony Brook (Co-chair)*
 T. Kajita, *ICRR*
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 C. Yanagisawa, *Stony Brook*

16 Years of NNN

NNN15

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 Leptogenesis
 NNN detector
 R&D

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 NNN15/UD2)
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 B. Viren, *BNL*
 M. Wilking, *Stony Brook U.*
 C. Yanagisawa, *Stony Brook U.*

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 H. A. Tanaka, *U. of B.C./IPP*
 Y. F. Wang, *IHEP*
 S. Wojcicki, *Stanford U.*

Charise Kelly, *Conference Secretary*
 HEP group, Dept. of Physics and Astronomy
 Stony Brook University, NY 11794-3800, U.S.A.

PHONE: 631-632-8098

FAX: 631-632-8101

EMAIL: nnn15@nnngroup.physics.sunysb.edu

FURTHER INFORMATION AND REGISTRATION:

<https://www.bnl.gov/nnn2015>



NNN99 Workshop Photo



NNN15/UD2 Workshop, October 29, 2015

C. K. Jung



Stony Brook University

NNN15 Workshop Photo

- Right after the morning session
 - At the ESS steps
- In case of rain, during the afternoon coffee break





NNN15 Participants, Co-hosts and Sponsors

- A total of ~160 participants
 - 25% students
 - 50 registration fee waivers
 - 29 lodging local supports
- Co-hosts
 - Brookhaven National Lab (BNL)
 - Stony Brook University (SBU)
 - Simons Center for Geometry and Physics (SCGP)
- Sponsors
 - U.S. Department of Energy, BNL, SBU, SCGP, Industry (Hamamatsu and CAEN)



Internet Access

- **WolfieNet-Guest**
 - Requires individual password
 - All participants should have received a password by e-mail
 - If you have not received one, go to the registration desk
- **eduroam**
 - A good alternative
- **If you have a problem, contact Dean Schamberger**
 - Physics Building, Rm D-115
 - Phone: 631-632-8094



Lunch

- SCGP Café (2nd fl)
 - Top-rated chef prepared food
 - Typically not found on college campuses
 - Discounted price (~\$14, regular price: ~\$21) for the workshop participants
 - Show your workshop name tag
- Jasmine Restaurant at the Wang Center
 - Asian food: Chinese, Indian, Japanese and Korean
- Student Activity Center (SAC) Cafeteria
 - Typical college cafeteria food, a wide variety of choices
- Green Cactus Mexican Restaurant and others...
 - The other side of the train track



Afternoon Sessions

- NNN15 Plenary
 - SCGP Auditorium
- UD2 Plenary
 - SCGP Lecture Hall, Rm 102



Welcome Reception and Poster Session

- 6:00 – 8:00 pm at the SCGP Café area
- Please participate in the poster presentations to encourage young people and to show your appreciation of their hard work
- After the poster session, transportation will be provided to Port Jefferson for dinner
 - If interested, sign up for the ride
<https://goo.gl/Tvku2l>
- **Reminder: Friday Session starts at 8:30 am and Saturday Session starts at 9:00 am**



The Nobel Prize in Physics 2002

*"for pioneering contributions to astrophysics,
in particular for the detection of cosmic neutrinos"*

*"for pioneering
contributions to
astrophysics, which
have led to the
discovery of cosmic
X-ray sources"*



photo PRB



photo PRB



photo NASA/CXC/SAO

Raymond Davis, Jr. Masatoshi Koshiba Riccardo Giacconi



The Nobel Prize in Physics 2015

“for the discovery of neutrino oscillations, which shows that neutrinos have mass”



Takaaki Kajita

(Super-Kamiokande)

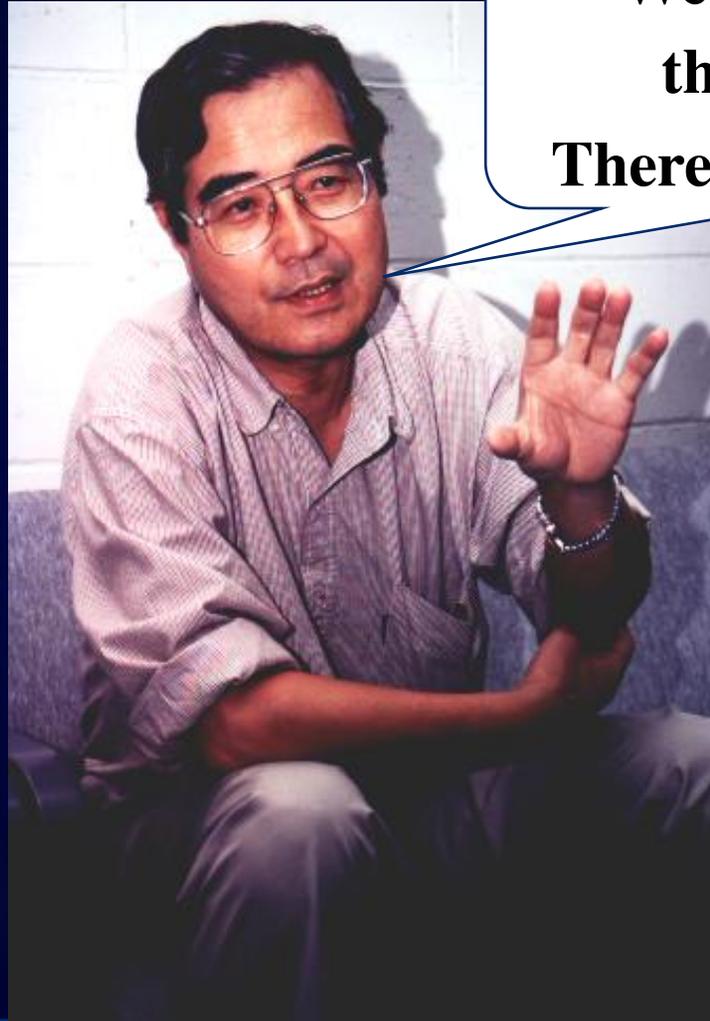


Arthur B. McDonald

(SNO)

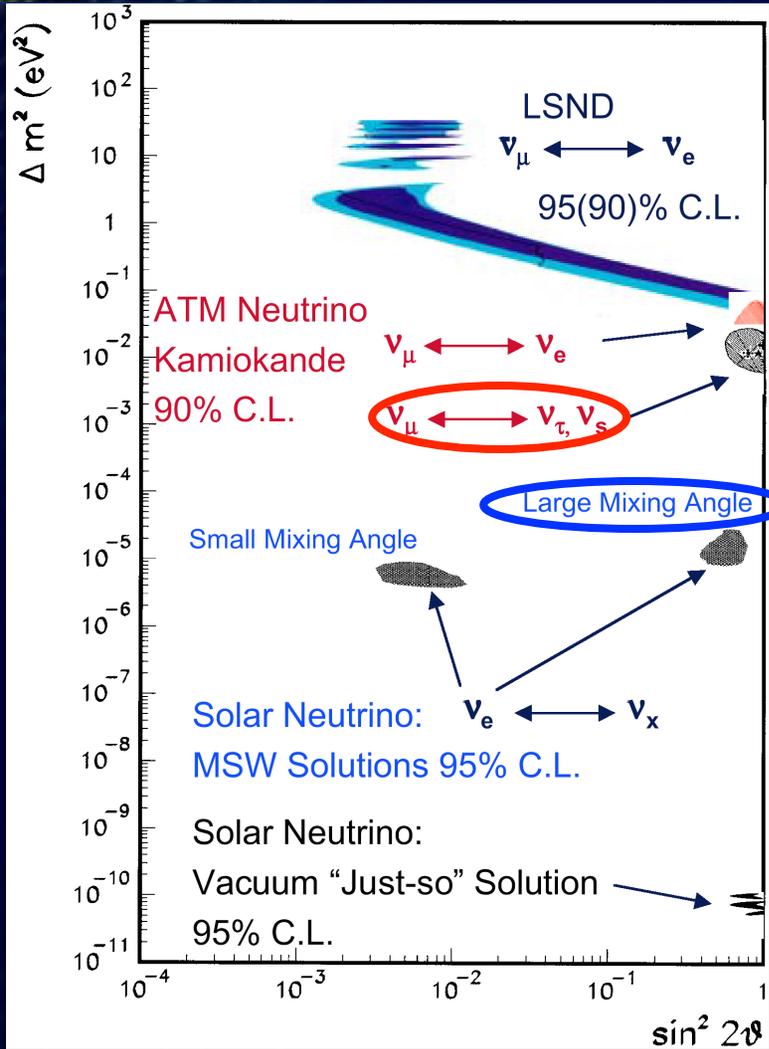


Late Yoji Totsuka soon after the 2001 accident...



**We will rebuild
the detector.
There is no question!**

Positive Experimental results indicating Neutrino Oscillations (Circa 1996)



3 independent Δm^2 values!!!
→ generally requires ν_s

Current Status of Neutrino Oscillation Parameter Measurements

- Remarkable progress!
- All mixing angles are now known
 - $\theta_{12} = 33.9^\circ \pm 1.0^\circ$
 - $\theta_{13} = 8.4^\circ \pm 0.4^\circ$
 - $\theta_{23} = 45^\circ \pm 6^\circ$ (90% C.L.)
→ largest uncertainty

All three angles are non-zero and relatively large

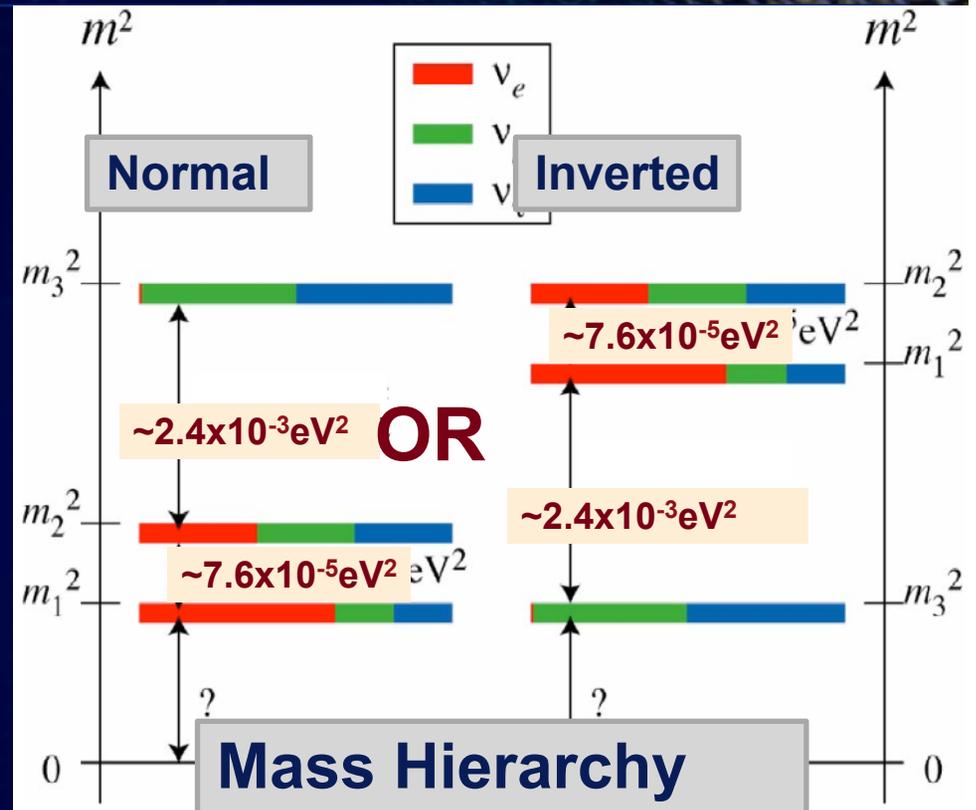
→ allows exploration of CPV in the lepton sector

$$P(\nu_\mu \rightarrow \nu_e)$$

\propto leading term + ...

+ term($\sin\theta_{12} \sin\theta_{23} \sin\theta_{13} \sin\delta_{CP}$)

Why is nature so kind to us?



Critical for the ν -less double- β decay searches that would determine the Majorana-nature of ν

CPV (Lepton)

Mount Everest (8848 m)

MH

Nuptse (7861 m)

Lysaar (8501 m)

Chotse Shan (7541 m)

Khumbu

al des Schwelgen

JUNO

T2K @ Camp 2

Global Race to Reach the Summit!

Khumbu Gletscher

NOvA near Camp 1

INO

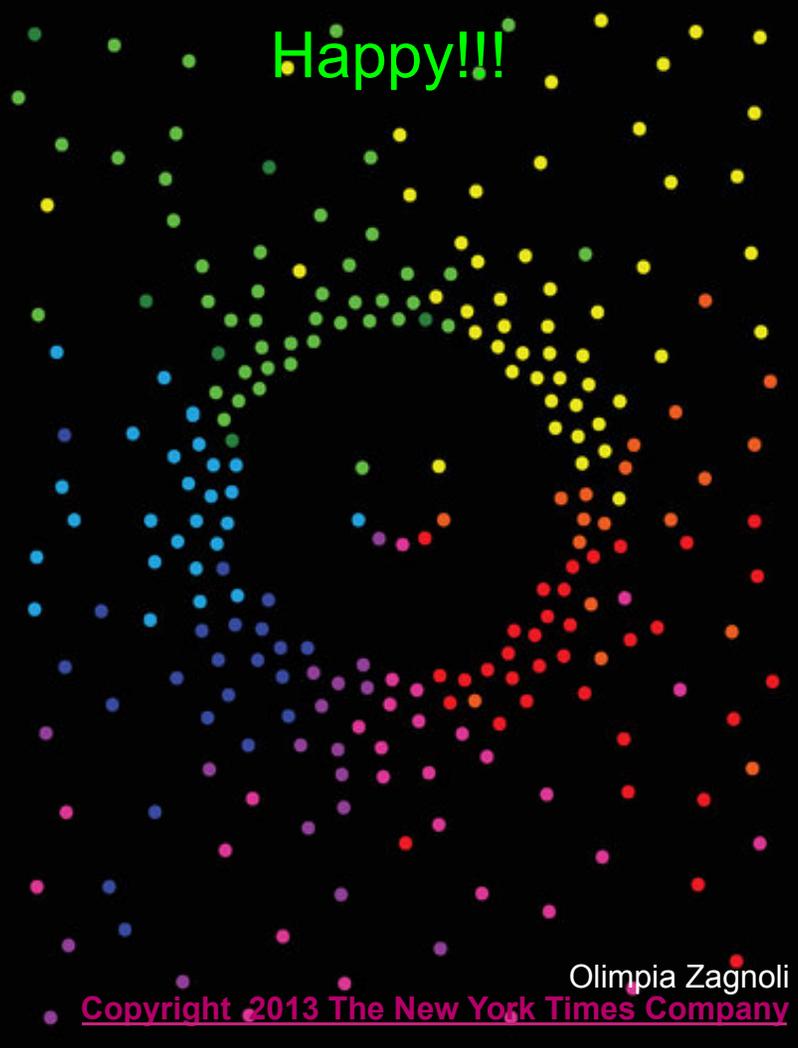
Base Camp

DUNE, HyperK

PINGU

State of Neutrino

Happy!!!



Olimpia Zagnoli

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**Let's celebrate the moment,
plan for exciting future discoveries
and
enjoy the workshop!**

