V Study
Dec 13, '03

Purpose and Method

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Neutrino Study

Purpose and Method

Our blessing—

Compelling evidence for neutrino mass and mixing.

Our opportunity—

To answer the open questions about the neutrino world.

Our purpose—

Let's not blow it!

A.11

What Would We Like to Know?

What physics is responsible for neutrino masses and mixing?

How many neutrino species are there?
Are there sterile neutrinos?

What is the neutrino mass spectral pattern?

What is the scale of neutrino mass?

Are neutrinos Majorana particles ($\bar{\nu} = \nu$)?

What is the leptonic mixing matrix?

Do neutrino interactions violate CP?

Is leptonic ~~CP~~ responsible for the baryon asymmetry in the universe?

Are there surprises?

- Rapid ν decay?
- Non-Standard-Model ν interactions?
- Towers of sterile neutrinos from extra dimensions?
- ???

Our Future

Many good ideas for answering the open questions.

Great enthusiasm !!!

BUT —

What is the best coherent strategy for answering the questions?

A clear, logical, unified plan that funding agencies can easily consider, seize, and promote.

- What measurements must be made?
- How do they relate to each other? Are they complementary?
- What facilities are required?
- What is the physics reach of each type of facility? (Working groups)
- To what extent do the different facilities complement each other?

There will be forks in the road.
For example —

- Are there more than 3 neutrinos?
- Is $\theta_{13} \sim \theta_{Cabibbo}$, or much smaller?

What is a sensible decision tree?

What is an intelligent sequence of facilities and experiments?

Our findings will guide the creation of the future neutrino program.

To quote our Charge—

"The Study will lay scientific groundwork for the choices that must be made during the next few years."

Method

The whole study will be driven by the open ν physics questions.

E-mail the organizing committee the questions to include.

(Address to be provided)

How to answer the questions will be studied by working groups, each focussed on a particular experimental approach.

Working Groups

Solar & atmospheric ν experiments
(J. Bahcall, J. Klein)

Reactor $\bar{\nu}$ experiments
(G. Barenboim, E. Blucher)

Superbeam experiments & development
(W. Marciano, D. Michael)

Neutrino factory and β beam experiments and development
(S. Geer, M. Zisman)

Neutrinoless ββ decay and direct ν mass searches
(S. Elliott, P. Vogel)

What cosmology/astrophysics and ν physics can teach each other
(S. Barwick, J. Beacom)

Theory coordinator: R. Mohapatra

Charge to each working group:

Analyze the physics reach of your experimental approach.

What can your approach contribute to answering the open questions?

Coordination between Groups

Crucial!

The working groups plus the organizing committee will act as a coordinating committee.

Participation in more than one group is encouraged.

Timetable

Driven by budget cycles.

Working groups operate via email, phone, and occasional meetings as necessary.

Mid-course correction: Late Mar/Early Apr

Second, final joint meeting of the study:
3-8 days in late May or in June

By the end of this meeting:

- The working group findings
- Final cross-working-group coordination
- Preliminary study conclusions

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Our Final Product

A ~ 300 page written report.

Contents —

- Contributions from individual working group members
- A summary for each working group
- An integrated summary of the study's findings, written by the working group leaders, the organizing committee, and a few additional generous study participants

Intended readership –

- Neutrino community
- Physics community
- Funding agencies

Outreach

A ν fest, with media presence, conveying the excitement in the ν world.

Thank you —

DAP DNP DPB DPF

for sponsoring
this study.

Thank you—

Study Organizing Committee

Stuart Freedman
Janet Conrad
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Paul Langacker
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Hamish Robertson
Lincoln Wolfenstein
Boris Kayser
Guido Drexlin
Takaaki Kajita
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Working Group Leaders

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