Imperial College London

Science & Technology Facilities Council

Proposal for a new Neutrino Panel

K. Long, 14 August, 2017

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ICFA Neutrino Panel

News

ICFA Neutrino Panel roadmap discussion document (May 7, 2016)

Mission

To promote international cooperation in the development of the accelerator-based neutrino-oscillation program and to promote international collaboration in the development of a neutrino factory as a future intense source of neutrinos for particle physics experiments.

Panel

- Membership
- Email the panel
- Terms of Reference
- Meetings

Established: Summer 2013

http://icfa.fnal.gov/panels/neutrino_panel/

ICFA Neutrino Panel – Membership

Members

Name	Institution
Jun Cao	IHEP/Beijing
Andre de Gouvea	Northwestern U.
Dominique Duchesneau	CNRS/IN2P3
Ricardo Gomes	University of Goias
Stephen Geer	Fermilab
Soo-Bong Kim	Seoul Nat. U.
Takashi Kobayashi	KEK
Kenneth Long	Imperial College – CHAIR
Michele Maltoni	Madrid
Mauro Mezzetto	Padova
Naba Mondal	TIFR
Masato Shiozawa	Tokyo
Jan Sobczyk	Wroclaw
Hirohisa Tanaka	IPP Canada
Morgan Wascko	Imperial College
Sam Zeller	Fermilab

ICFA Neutrino Panel's contributions

- Initial consultation with the neutrino community:
  - Americas: FNAL, 30th January 2014 to the 1st February 2014
  - Asia: Kavli IPMU, Kashiwa, Japan on the 13th November 2013
  - Europe: University of Paris Diderot on the 8th to 10th January 2014
- International Meetings for Large Neutrino Infrastructures
  - Jointly organised with APPEC, APPIC (and Neutrino Panel)
    - 23—24 June 2014, Paris
    - 20—21 April 2015, FNAL
    - 30—31 May 2016, KEK
- Presentations to peers at:
  - Neutrino 2014: to explain activities of the Panel
  - Neutrino 2016: to solicit input on the roadmap discussion document
- And, of course, presentations to stakeholders (ICFA, ECFA, …)

ICFA Neutrino Panel's contributions

- **Initial report from the ICFA Neutrino Panel**
  1405.7052v1
  - Made the case for an energetic future programme and pointed out the opportunities
  - Recorded the peer-group consultation carried out the Americas, Asia and Europe (roadmap foundations)
- **On the complementarity of Hyper-K and LBNF**
  1501.03918
  - Reviewed the complementarity of the J-PARC/Hyper-K andn LBNF/DUNE programmes
  - Made the case for the scientific benefits of mounting the two experiments
- **Roadmap for the international, accelerator-based neutrino programme: Discussion document**
  2016: http://icfa.fnal.gov/wp-content/uploads/2016-05-07-nuPanel-roadmap-Final.pdf
  - Reviewed the accelerator-based neutrino programme, including the supporting experimental, R&D and theory programmes
  - Presented interim conclusions and recommendation for discussion by peers and stakeholders

- **Roadmap for the international, accelerator-based neutrino programme**
  1704.08181
  - Revised the Roadmap discussion document in line with comments received
  - Presented final conclusions and recommendations

The accelerator programme; part of the field of neutrino-physics

- Eloquently argued by German community
- Essentially the same point was made in:
  - KEK (3rd Large nu Inf)
  - ECFA
  - Neutrino ('14) '16
  - And in discussions within the Panel
- Culminated at ICHEP'16 in discussion with IUPAP C11 Chair and co-chair
- Discussion (J.Fuster and others): possible "neutrino Panel" that would take an "holistic" view:
  - Consider synergy/impact of particle, astroparticle and nuclear physics

III. Physikalisches Institut B

RWTH AACHEN UNIVERSITY

Adresse

Prof. Ken Long
The ICFA Neutrino Panel
-- Chair --

Prof. Dr. Achim Stahl

III. Physikalisches Institut B
Physikzentrum
RWTH Aachen
52056 Aachen
GERMANY
Telefon: +49 241 80-27302
Fax: +49 241 80-22244

achim.stahl@rwth-aachen.de

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Dear Ken,

following-up on our phone conversation a few weeks ago, I would like to send you some comments on the discussion document on the "Roadmap for the international, accelerator-based neutrino programme". These comments have been circulated and discussed with some of my colleagues in Germany.
First let me thank you for the document. It summarizes the accelerator-based projects in neutrino physics quite nicely. It must have been a lot of work to get it into such a nice state. Nevertheless we have to send you some critical comments:

Many neutrino physicists are worried about a strategy (or even a strategy discussion) that is restricted to a certain technology. A meaningful strategy must be focused on the scientific goals of the field and take into account all possible approaches independent of their technology. Political arguments must not be mixed with the scientific discussion. A comparison between different approaches should consider the full potential of all projects, even if the potential extends beyond particle physics into astrophysics, cosmology or geo physics, and it should take into account the volume of the investments of each project and their schedules.

Neutrinos: synergies and impact

Examples … not an exhaustive list

- Physics programme of large “far” detectors:
  - Neutrino oscillations (accelerator and non-accelerator); astroparticle physics
- Accelerator-based long-baseline and short-baseline oscillations:
  - Impact on astrophysics and cosmology (MH, CPiV, mixing parameters)
  - Requires sufficiently precise knowledge of nuclear physics of neutrino-nucleus scattering
- Astroparticle physics experiments, e.g. ICECUBE, ANTARES, …
  - Exploit knowledge of properties of neutrinos from terrestrial measurements
  - Deliver measurements of oscillation parameters, PINGU, ORCA sensitivity to MH
- Reactor, solar and atmospheric neutrinos:
  - Give best constraints on, e.g. θ_{12}, θ_{13}
- Neutrinoless double-beta decay:
  - Nature of the neutrino; clear impact on particle physics and cosmology
  - Require good understanding of nuclear matrix elements
  - Next generation likely to require very large detectors (with comensurate scale of investment)
- Growing interest in nuclear-physics aspects of neutrino-nucleus interactions:
  - International collaboration, NuSTEC:
    - NuSTEC White Paper: Status and Challenges of Neutrino-Nucleus Scattering
      1706.03621
  - PP/NP theory/phenomenology/experiment discussions in, e.g., Spain, UK …
- …

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PARTICLE PHYSICS NEWS AND RESOURCES

World's smallest neutrino detector finds big physics fingerprint

DATE ISSUED

August 3rd, 2017

SOURCE

Oak Ridge National Laboratory

RELEASE TYPE

Press Release

OAK RIDGE, Tenn., Aug. 3, 2017—After more than a year of operation at the Department of Energy's (DOE's) Oak Ridge National Laboratory (ORNL), the COHERENT experiment, using the world's smallest neutrino detector, has found a big fingerprint of the elusive, electrically neutral particles that interact only weakly with matter.

The calculable fingerprint of neutrino–nucleus interactions predicted by the Standard Model and seen by COHERENT is not just interesting to theorists. In nature, it also dominates neutrino dynamics during neutron star formation and supernovae explosions.

"When a massive star collapses and then explodes, the neutrinos dump vast energy into the stellar envelope," said physicist Kate Scholberg of Duke University, COHERENT's spokesperson. "Understanding the process feeds into understanding of how these dramatic events occur."

Coherent elastic scattering is also relevant for detecting the enormous neutrino burst from a supernova. "When such an event occurs in the Milky Way, neutrinos of all flavors will bump into nuclei, and sensitive dark matter detectors may observe a burst of tiny recoils," she said.

"COHERENT's data will help with interpretation of measurements of neutrino properties by experiments worldwide," Scholberg concluded. "We may also be able to use coherent scattering to better understand the structure of the nucleus."

Personnal comments

- Neutrino Panel strengths:
  - Community consultation at each stage
  - Promotion of peer/stakeholder discussions
    - Contribution to discussions leading to creation of DUNE collaboration

- Issues:
  - Breadth of programme, level of resources
  - Continuing (even increased) need for discussion:
    - Peer group and peer group/stakeholder
  - Must seek conditions to optimise full programme:
    - E.g. investment in flagships vs investment in supporting programme

- A role for a properly constituted successor …

Proposal for a cross-committee neutrino working group

The International Committee for Future Accelerators, a standing committee of C11, set up a Neutrino Panel in 2013 with the mandate to "*…promote international cooperation in the development of the accelerator-based neutrino-oscillation programme…*". The Panel has produced a roadmap for the accelerator-based programme, completing its mandate. The field of neutrino physics is much broader than the accelerator-based programme, its impact running from particle physics to nuclear physics, astronomy, astrophysics and cosmology. This breadth of impact, combined with the wide variety of techniques used and the close relationship between nuclear, neutrino and astro-particle physics calls for a working group with a commensurately broad remit. We therefore propose that a working group be established to promote cooperation in the study of the properties of the neutrino, its interactions with nuclear matter and the development of neutrinos as a probe of the Universe.

Conceived as cross-commissionne Panel:

- **C4: Astroparticle-physics**
- **C11: Particles-and-fields**
- **C12: Nuclear-physics**

The ICFA Neutrino Panel 17 April 2017

J. Cao, A. de Gouvea, D. Duchesneau, S. Geer, R. Gomes, S.B. Kim, T. Kobayashi, K. Long, M. Maltoni, M. Mezzetto, N. Mondal, M. Shiozawa, J. Sobczyk, H.A. Tanaka, M. Wascko, G. Zeller

Neutrino Panel

- Conceived as working across:
  - C4: Astroparticle-physics
  - C11: Particles-and-fields
  - C12: Nuclear-physics