International Symposium on Neutrino Frontiers

lundi 16 juillet 2018 - jeudi 19 juillet 2018

ICISE, Quy Nhon, VN

Recueil des résumés

Contents

Opening session / **88**

Presentation of the guests and the Scientific Organizers

Opening session / **2**

Welcome address by ICISE center director

Auteur: Jean Tran Thanh Van[1]

[1] *IFIRSE & RDV*

Auteur correspondant jtrantv@gmail.com

Opening session / **1**

Welcome by the President of the province of Binh Dinh

Opening session / **89**

Welcome addresses by Nicolas Regnault, Ecole Normale Superieure, Paris

Opening session / **3**

Welcome address by Neutrino Symposium Chair

Auteur: Tsuyoshi Nakaya[1]

[1] *Kyoto University*

Auteur correspondant t.nakaya@scphys.kyoto-u.ac.jp

Opening session / **4**

Introduction to Vietnam Neutrino Group

Auteur: Van Nguyen T. H. [1]

[1] *IFIRSE & IOP*

Auteur correspondant nhvan@iop.vast.vn

Artificial Neutrino Sources / **5**

Overview of Neutrino Physics

Auteur: Boris Kayser[1]

[1] *Fermilab*

Auteur correspondant boris@fnal.gov

We review what has been learned about the neutrinos, and then discuss the open questions, explaining why they are interesting and how they may be answered through future experiments.

Artificial Neutrino Sources / **6**

New results from T2K and future prospects

Auteur: Anselmo Cervera[1]

[1] *IFIC, Valencia, Spain*

Auteur correspondant anselmo.cervera@cern.ch

Artificial Neutrino Sources / **8**

Results from MINOS and MINOS+

Auteur: Karol Lang[1]

[1] *The University of Texas at Austin*

Auteur correspondant lang@physics.utexas.edu

Artificial Neutrino Sources / **19**

Current Status and Upgrade of the Super-Kamiokande experiment

Auteur: Guillaume Pronost[1]

[1] *ICRR, Univ. of Tokyo*

Auteur correspondant pronost@km.icrr.u-tokyo.ac.jp

Super-Kamiokande (Super-K) is an already successful experiment in neutrino research, involved in the discovery of the neutrino oscillations, and performing analysis on a large spectrum of the neutrino physics: from atmospheric neutrinos to solar neutrinos, including neutrino produced by the J-PARC beam in the T2K experiment. The Super-K collaboration is now aiming at the detection of Supernova Relic Neutrino (SRN), a diffuse background of neutrinos produced by the past supernovae during the history of the universe. This SRN signal is expected to be $0.3sim1.5\ nu/\mathrm{cm}^2/\mathrm{s}$ (17.3 MeV threshold) but has not been observed so far due to the high background level. Its discovery would be an important key to understand the history of star formations in the universe.

Due to the energy and the cross-sections of supernova neutrinos, most of the SRN interactions in the Super-K detector are expected to be inverse $beta$ decay reactions ($overline_e + prightarrown + e^+$). The detection of the neutron, in coincidence with the e^+ uerenkov light, would be a clear signature of the SRN signal, helping reduce most of the background events affecting its detection. The Super-K collaboration is then planning to load 0.1% of Gadolinium in the Super-K water, in order to take benefit from its high thermal neutron capture cross-section and its clear neutron capture signal. In this presentation, the last results of the Super-Kamiokande experiment are briefly presented, as well as the last studies of the feasibility of the Gadolinium loading and its physics interests.

Artificial Neutrino Sources / **35**

Improvement of neutron-oxygen reaction model at Super-Kamiokande for neutrino neutral current interaction study

Auteur: Yosuke Ashida[1]

[1] *Kyoto University*

Auteur correspondant assy@scphys.kyoto-u.ac.jp

Deeper understanding of neutrino neutral current elastic interaction is desired for improving sensitivity in search for supernova relic neutrinos at Super-Kamiokande. Measuring the interaction with the T2K beam is a effective way, however, currently large systematic errors remain due to a poor model to describe neutron-oxygen reactions. To improve the current model, external experiments complementing insufficiency of the external libraries were conducted using a neutron beam. In this talk, the results from the beam tests and comparison with several libraries as well as the impacts on a neutrino cross section measurement are given.

Artificial Neutrino Sources / **9**

New results from MicroBooNE and future prospects

Auteur: Rachel Carr[1]

[1] *MIT*

Auteur correspondant recarr@mit.edu

MicroBooNE is a 170-ton liquid argon time projection chamber located in the Booster neutrino beam at Fermilab. Recently, the MicroBooNE collaboration produced its first measurements of neutrino scattering on argon, a key step toward the experiment's goals of clarifying neutrino-nucleus interactions and explaining the anomalous excess of electron neutrino-like events seen in MiniBooNE. We present the latest results and the outlook for future measurements.

Artificial Neutrino Sources / **12**

Latest Results from Daya Bay experiment

Auteur: Yongbo Huang[1]

[1] *IHEP, CAS*

Auteur correspondant huangyb@ihep.ac.cn

The Daya Bay Reactor Neutrino experiment has provided the most precise measurement of the sin22θ13 and |Δm2 ee| via a relative comparison of reactor antineutrino rates and energy spectra detected by eight identically designed liquid scintillator detectors placed at different baselines from six 2.9 GWth nuclear reactors. This talk presents the latest results from Daya Bay experiment.

Artificial Neutrino Sources / **14**

Recent results from RENO

Auteur: June Ho Choi[1]

[1] *Dongshin Univ.*

Auteur correspondant jhchoi-72@hanmail.net

The Reactor Experiment for Neutrino Oscillation (RENO) has been taking data from August, 2011 using the two identical near and far detectors at Hanbit Nuclear Power Plant in Korea. The neutrino mixing angle θ13 and the squared mass difference Δm2ee have been successfully measured by observing the energy dependent disappearance of reactor antineutrinos tagged by neutron capture by gadolinium. In this talk, we present improved results of θ13 and Δm2ee measurements and the first measured value of θ13 using neutron capture on hydrogen. We also report results on the evolution of reactor antineutrino flux and a search for light sterile neutrino mixing.

Artificial Neutrino Sources / **17**

Heavy Neutral Lepton Searches at the LHC

Auteur: Federico Scutti[1]

[1] *CERN*

Auteur correspondant federico.scutti@cern.ch

In the Standard Model of particle physics, the smallness of neutrino masses compared to other leptons might be a hint for presence of new physics. Models of new physics beyond the Standard Model predict the existence of heavy neutral leptons, like sterile neutrinos, which explain this phenomenon via the “See-Saw” mechanism. These models are also able to explain the nature of dark matter and the baryon asymmetry in our universe. Searches for the production of these heavy neutral leptons at the LHC are presented with data collected by the ATLAS and CMS experiments. Experimental signatures are considered with various lepton multiplicities in the final state as well as decay topologies with or without assiciated jets. A wide mass range is considered by these searches, probing masses as low as few GeV and as high as a few TeV. Datasets collected during Run-II of the LHC are used by the presented searches.

Artificial Neutrino Sources / **11**

The JSNS2 experiment to search sterile neutrino at J-PARC

Auteur: Jungsic Park[1]

[1] *KEK*

Auteur correspondant jspark@post.kek.jp

The JSNS2 (J-PARC Sterile Neutrino Search at J-PARC Spallation Neutron Source) experiment is to search sterile neutrino at 24m baseline with delta m square near 1 eV square. JSNS2 use intense neutrino beam from muon decay-at-rest from the collision of 3 GeV protons to mercury target at J-PARC. The experiment search neutrino oscillation of anti electron-neutrino from anti muon-neutrino, and anti electron-neutrino can be detected vis Inverse Beta Decay reaction inside of 17 tons of Gd loaded liquid scintillator detector as a neutrino target. We aim to start data taking at the end of JFY 2018, therefore we are making large effort for construction. In this talk, we will present the status of detector installation, slow monitoring, preparation of liquid scintillator, Monte-Carlo studies of detector calibration, related schedules and prospect.

Natural Neutrino Sources / **24**

Theoretical and Experimental aspects of the Electroweak-scale right-handed neutrino model with displaced vertices as distinct signatures

Auteur: Hung Pham Quang[1]

[1] *University of Virginia*

Auteur correspondant pqh@virginia.edu

New physics signals with displaced vertices have attracted the recent attention of the collider community (theoretical and experimental). In this talk, we will describe how a model of non-sterile right-handed neutrinos with masses being proportional to the electroweak scale (~246 GeV) naturally gives rise to long-lived particles with displaced vertices as characteristic signals. An interesting connection between the absolute neutrino mass and an axionless solution to the strong CP problem will be presented.

Natural Neutrino Sources / **38**

STEREO, Search for a light sterile neutrino at the ILL reactor

Auteur: Thomas Salagnac[1]

[1] *LPSC, in2p3, France*

Auteur correspondant salagnac@lpsc.in2p3.fr

Recent re-evaluations of antineutrino spectrum emitted by nuclear reactor have led to the observation of a ~7% deficit in neutrino flux at short distance from reactors with respect to predictions. This deficit, known as the Reactor Antineutrino Anomaly (RAA), could be the signature of an oscillation of antineutrino towards a light sterile neutrino with a mass scale of 1eV. However, it is not excluded that the flux prediction could be biased making this deficit totally artificial. The STEREO experiment aims at probing unambiguously the existence of an oscillation at short distance from reactor, at the Institut Laue-Langevin (ILL) in Grenoble. The STEREO detector, segmented in 6 identical cells filled with Gd-loaded liquid scintillator, allows to observe a possible relative deformation of the neutrino spectrum along the propagation axis. STEREO takes data since end of 2016 and started to produce constraining results on an active-sterile flavor oscillation. The talk will describe the STEREO experiment principles and will give the latest results of its data analysis.

Natural Neutrino Sources / **54**

Searches for sterile neutrinos at the DANSS experiment

Auteur: Natalia Skrobova[1]

[1] *ebedev Physical Institute, Moscow*

Auteur correspondant nata-skr@yandex.ru

DANSS is a one cubic meter highly segmented solid scintillator detector.
It consists of 2500 scintillator strips (100x4x1 cm3), covered with
gadolinium loaded reflective coating and read out with SiPMs via wave length
shifting fibers. Groups of 50 strips are also read out by conventional
PMTs. DANSS is placed under a 3 GW industrial reactor at the Kalinin NPP (Russia) on a movable platform. The distance from the reactor core center is varied from 10.7m to 12.7m on-line. The reactor building provides about 50 mwe shielding against cosmic background which is reduced drastically. The inverse beta decay (IBD) process is used to detect antineutrinos. DANSS detects about 5000 IBD events per day with the background from cosmic muons at the level of few percent.
The antineutrino spectrum dependence on fuel composition is clearly observed. Sterile neutrinos are searched for assuming a 4 neutrino model (3 active and 1 sterile neutrino). The exclusion area in the sterile neutrino parameter plane is obtained using a ratio of positron energy spectra collected at different distances. Therefore, the results do not depend on the shape and normalization of the reactor antineutrino spectrum, as well as on the detector efficiency. Results are based on one million antineutrino events. The excluded area covers a wide range of the sterile neutrino parameters up to $\sin^2 2\theta_{14} < 0.01$ in the most sensitive region. The Reactor Antineutrino Anomaly optimum point is excluded with a confidence level higher than 5σ.

Natural Neutrino Sources / **20**

Latest Phase-II results and Prospects of CNO neutrino detection with Borexino

Auteur: Ding Xuefeng[1]

[1] *GSSI L'Aquila*

Auteur correspondant xuefeng.ding@gssi.it

Borexino as the leading liquid-scintillator-based low background experiment has given opportunities for a vast number of physics programs. After extensive water extraction campaign during 2011, the purity of liquid scintillator is even better. With 1291.51 days of Borexino Phase-II data collected since then, we performed for the first time a global fit and simultaneous measurement of interaction rates of pp, 7Be, and pep solar neutrinos in an extended energy range (0.19–2.93) MeV. With enlarged exposure, we also updated the B8 solar neutrino analysis. What's more, after sequences of operations, we improved the stability of the detector temperature profile such that the convective circulation in the Inner Detector's liquid scintillator has been significantly reduced, particularly in the top center region, which is the main challenge of solar CNO detection. In this talk, I will review Borexino's physics result on geo-neutrinos and present the new analysis of solar neutrinos with Phase-II data and their physics impact, as well as prospects of solar CNO neutrino detection.

Natural Neutrino Sources / **21**

New results from IceCUBE and future prospects

Auteur: Erik Blaufuss[1]

[1] *U. of Maryland*

Auteur correspondant blaufuss@umd.edu

Natural Neutrino Sources / **28**

Physics of ultra-high energy neutrinos

Auteur: Phuoc Ha[1]

[1] *Towson University*

Auteur correspondant pdha@towson.edu

Ultrahigh energy (UHE) neutrinos may serve as important messengers that give us useful information about the origin of the Universe. Knowledge of UHE neutrino interaction cross sections is a necessary ingredient in any UHE neutrino measurement. A study of UHE neutrino-nucleon cross sections would also allow us to explore strong interactions at incredibly high energies. In this talk, I review our current knowledge of UHE neutrino cross sections and discuss some new physics with UHE neutrinos.

Young physicists talks / **29**

Final results from the OPERA experiment in the CNGS neutrino beam

Auteur: osamu sato[1]

[1] *resercher*

Auteur correspondant sato@flab.phys.nagoya-u.ac.jp

The OPERA experiment at the Gran Sasso Laboratory was designed to study nu_mu ⟶ nu_tau oscillations in appearance mode in the CERN-to-Gran Sasso neutrino beam. We report the final analysis of the full data sample based on looser selection criteria than in previous analyses and multivariate approach. Oscillation parameters have been determined with a reduced statistical uncertainty, and the discovery of tau neutrino appearance is confirmed with an improved significance level. The measurement of nu_tau CC cross-section was performed, and the direct observation of the nu_tau-lepton number is also reported. Moreover, the search for electron neutrino events has been extended to the full dataset exploiting an improved method for the
electron neutrino energy estimation. New limits have been set in the 3+1 neutrino model.

Young physicists talks / **30**

YP talk: Simulation and commissioning of the full setup of the WAGASCI experiment at J-PARC

Auteur: Kenji Yasutome[1]

[1] *Kyoto University*

Auteur correspondant yasutome.kenji.38r@st.kyoto-u.ac.jp

WAGASCI is an experiment to measure neutrino interactions at the J-PARC neutrino beam line. The central WAGASCI module has a 3-dimensional grid target structure made of scintillator and water.

The module is surrounded on either side by two side muon range detectors (MRD) and downstream by a magnetized MRD called Baby MIND. Baby MIND consists of iron-core magnet planes, with a magnetic field strength of 1.5 T, and scintillator tracking planes. It enables a reduction of the neutrino background for measurements with antineutrinos and vice versa. From March to May 2018, Baby MIND was commissioned with the J-PARC antineutrino beam. The physics run with the full WAGASCI setup is planed for 2019. Simulation work is ongoing to optimize the detector setup. In this talk, preliminary results from the Baby MIND commissioning will be reported, together with simulation studies of the full WAGASCI setup.

Young physicists talks / **31**

YP talk: Neutrino event generators

Auteur: Van Nguyen[1]

[1] *IFIRSE & IOP*

Auteur correspondant nhvan@iop.vast.ac.vn

Young physicists talks / **32**

YP talk: CP-violation in lepton sector with a combined analysis of T2K-II and NOvA experiments

Auteur: Ngoc Tran[1]

[1] *IFIRSE*

Auteur correspondant tranngocapc06@ifirse.icise.vn

In this talk, we will present the study about the combined sensitivities of T2K-II and NOvA, the world leading long-baseline neutrino oscillation experiments, to CP-violation in the lepton sector. By operating until the year 2026, T2K-II is expected to collect a total exposure of 20 x 10^21 protons-on-target. Meanwhile, NOvA experiment with significant improvement in electron (anti-) neutrino event classification can boost their search for CP-violation along with a sensational measurement on the neutrino mass hierarchy. By combining analyses of T2K-II and NOvA with an ultimate constraint from reactor, 4 sigma or higher significance can be achieved if $delta$ is close to $-pi/2$, which is indicated by the latest T2K data. It is also pointed out that by reducing the systematic uncertainties of both T2K-II and NOvA to a level of 2%, the sensitivity to CP-violation will remarkably increase. Understanding the systematics in neutrino oscillation experiments is therefore crucial for exploring CP-violation.

Young physicists talks / **33**

YP talk: Optical System of Beam Induced Fluorescence Monitor toward MW beam power at the J-PARC Neutrino Beamline

Auteur: Son Cao[1]

[1] *IPNS, KEK*

Auteur correspondant cvson@post.kek.jp

A Beam Induced Fluorescence (BIF) monitor is being developed as an essential part of the monitor update toward MW beam power operation at the J-PARC neutrino beamline, where a 30 GeV proton beam is extracted, bent and struck onto a 90-cm-long graphite target to produce an intense and nearly pure muon (anti-)neutrino beam for the Tokai-to-Kamioka long-baseline neutrino oscillation experiment. By measuring the fluorescence light from proton-gas interactions, the BIF monitor will be used as a continuous and non-destructive diagnostic tool for monitoring the proton beam profile spill-by-spill, with position and width precision on the order of 200um. The main challenge lies in collecting a sufficient amount of fluorescence light for the beam profile reconstruction while controlling the beam-induced noise with the current beamline configuration. Study results will be shown with particular focus on the optical system under development, which allows us to transport fluorescence light away from the high radiation environment near the proton beamline and detect the optical signal with a Multi-Pixel Photon-Counter-based fast readout.

Joint session / **36**

The vMSM, Dark Matter and Neutrino Masses

Auteur: Takehiko Asaka[1]

[1] *Niigata Univ.*

Auteur correspondant asaka.niigata.univ@gmail.com

Joint session / **34**

Overview and future of Lorentz and CPT invariance searches in the neutrino sector

Auteur: Benjamin Quilain[1]

[1] *IPMU, Univ. of Tokyo*

Auteur correspondant benjamin.quilain@ipmu.jp

The violation of Lorentz invariance is predicted by most of the theories beyond the Standard Model as string theories or quantum loop gravities. It arises as a consequence of merging the Standard Model with gravity, whose effects appear at the Planck mass scale. Therefore, the observation of the violation of Lorentz invariance (and CPT invariance) is searched as a very strong hint of physics beyond the Standard Model and the first sign of physics at the Planck mass scale.

In this talk, we will give an overview of the most recent searches of these effects in the neutrino sector. Indeed, through interferences between the neutrino mass states, neutrino oscillations are one of the most sensitive probe to this effect. However, the potential for discovery in this sector is limited by the impossibility to provide a joint fit of these different results, due to fundamental inconsistencies in the way the different experiments present their limit on the model parameters. We will propose one possible way to solve this issue in the future, through the example of the T2K search for Lorentz invariance violation. We will finally conclude on the exciting potential of the coming generation of neutrino oscillation experiments.

Joint session / **42**

Hyper-Kamiokande experiment

Auteur: Atsumu Suzuki[1]

[1] *Kobe University*

Auteur correspondant atsumu@kobe-u.ac.jp

Joint session / **37**

Leptogenesis

Auteur: Ryo Nagai[1]

[1] *Tohoku Univ.*

Auteur correspondant nagai@tuhep.phys.tohoku.ac.jp

Leptogenesis is an elegant scenario where the baryon asymmetry of the Universe is produced from a lepton asymmetry generated in the decays of a heavy right-handed neutrino. In this talk, I will briefly review on the novel mechanism and discuss whether we can test the scenario by current/future experiments. In the latter half of the talk, I would like to give you a concrete example of the (thermal) leptogenesis scenario which can be tested by the next generation of gravitational wave experiments (Ref.[1]).

Reference:
[1] "Leptogenesis explains little hierarchy",
Ryo Nagai, Fuminobu Takahashi, and Norimi Yokozaki
arXiv:1805.04243

Joint session / **47**

Panda-X: Dark matter and neutrino-less double beta decay

Auteur: Ke Han[1]

[1] *Shanghai Jiao Tong University*

Auteur correspondant ke.han@sjtu.edu.cn

The PandaX (Particle AND Astrophysical Xenon experiment) project, located at China JinPing underground Laboratory (CJPL), uses xenon Time Projection Chambers (TPC) to search for the dark matter particles as well as the Neutrinoless Double Beta Decay (NLDBD) of Xe-136 isotope. The second phase of the experiment, PandaX-II, is a 500 kg scale dual phase liquid xenon TPC and has been one of the leading dark matter direct detection experiments. The next phase dark matter experiment, PandaX-xT, aims to have 4 ton of liquid xenon in the active volume and reach a spin-independent WIMP-nucleon scattering cross section of 6E-48 cm2 after two years of running. Meanwhile, the PandaX-III experiment will search for NLDBD of Xe-136 using high pressure gaseous TPC. The first PandaX-III module will have 200 kg of 90% enriched Xe-136 and run at 10 bar.

Joint session / **55**

Impact of new physics in the context of long baseline experiments

Auteur: Poonam Mehta[1]

[1] *Jawaharlal Nehru University*

Auteur correspondant pm@jnu.ac.in

Future projects / **43**

DUNE experiment

Auteur: Anselmo Cervera Villanueva[1]

[1] *IFIC, Valencia*

Auteur correspondant anselmo.cervera@cern.ch

Future projects / **44**

Status of the JUNO Experiment

Auteur: Xuantong Zhang[1]

[1] *IHEP, CAS*

Auteur correspondant zhangxuantong@ihep.ac.cn

The Jiangmen Underground Neutrino Observatory (JUNO) is a multiple-purpose neutrino experiment with a 20 kilotons liquid scintillator (LS) detector. It is built at a depth of 700 meters from two nuclear power plants with a ~53 kilometers baseline. The main goal of JUNO is achieving an unprecedented 3% energy resolution at 1 MeV to determine the neutrino mass hierarchy in 6 years with a 3-4 sigma significance by precisely measuring the reactors anti-neutrino spectrum. Meanwhile, other neutrino physics measurements including but not limited to solar neutrino oscillation parameters, geo-neutrinos and supernova neutrinos are also conducted. The latest progress of the project will be also included in this talk.

Future projects / **25**

Current status and future prospects of KamLAND-Zen experiment

Auteur: Takahiko Hachiya[1]

[1] *Tohoku Univ.*

Auteur correspondant takahiko@awa.tohoku.ac.jp

KamLAND-Zen searches for neutrinoless double beta
decay of Xe-136 using Xe-loaded liquid scintillator(XeLS). The
experiment holds XeLS in the nylon-film vessel(inner balloon, IB) at the center of KamLAND, low-background 1-kton liquid
scintillator detector. First stage of the experiment, KamLAND-Zen 400 (Zen 400), has run with 380-kg of Xe until 2015 and
its result set the most stringent upper limit on effective Majorana neutrino mass.

Now we are moving on to KamLAND-Zen 800 (Zen 800) holding 750-kg of Xe in a new larger IB. Construction of IB has finished on March 2018 and its installation in KamLAND on May 2018. We

are now monitoring the status of the new IB with Xe-less liquid scintillator (dummy LS). After confirming non-defect in the IB and cleanliness of LS and IB, we will replace dummyLS with XeLS and start physics run.

R&D for the future project, KamLAND2-Zen, which aims to cover the inverted-mass hierarchy region is also ongoing. High quantum efficiency photomultiplier, light collecting mirror, and brighter liquid scintillator are being studied for improving energy resolution in order to reduce two-neutrino double beta decay background. New electronics for more efficient reduction of muon-spallation background is also in development.

Future projects / **39**

Neutrino Spectroscopy with atoms

Auteur: Hiraki Takahiro[1]

[1] *Oyama Univ.*

Auteur correspondant thiraki@okayama-u.ac.jp

Although recent oscillation experiments have advanced neutrino physics impressively by discovering finite neutrino masses along with their mixing, there still exist important uncovered neutrino properties such as absolute neutrino massesand the nature of neutrino masses, Majorana/Dirac distinction.The SPAN (SPectroscopy with Atomic Neutrino) group at Okayama University aims to uncover these neutrino properties by using de-excitation processes of atoms or molecules.
In processes emitting a single photon and a neutrino pair, which we call RENP (Radiative Emission of Neutrino Pair), energy spectra of the photon have information about these neutrino properties.One of the most serious problem when we use this process is its extremely small emission rate. In order to overcome this problem, our group proposed to amplify the emission rate by atomic coherence in macroscopic volume. In this talk, I will present the principle of this coherent amplification mechanism and recent experimental progresses.

Future projects / **48**

Search for Neutrino-less double beta decay with a high pressure Xe TPC detector

Auteur: Kazuhiro Nakamura[1]

[1] *Kyoto University*

Auteur correspondant nakamura.kazuhiro.74x@st.kyoto-u.ac.jp

The neutrinoless double beta decay, if it happens, is a very rare phenomenon. A detector with mass scalability up to ton scale and strong background rejection power is necessary to search for it.
We are aiming to achieve these requirements with a high-pressure xenon gas time projection chamber. Our detector, AXEL, has high energy resolution and tracking pattern detection, which are important for background rejection.
We will report the detector performance obtained with the 10 L prototype detector and the status of the construction of the 180 L prototype detector.

Future projects / **59**

Dirac vs. Majorana neutrino: how can we tell?

Auteur: Boris Kayser[1]

[1] *Fermilab*

Auteur correspondant boris@fnal.gov

We explain why determining whether neutrinos are Majorana particles, identical to their antiparticles, or Dirac particles, distinct from their antiparticles, is so challenging. We then discuss ways through which we can attempt to make this determination, including the primary approach, which is the search for neutrinoless double beta decay, and several alternative approaches.

Future projects / **46**

DsTau experiment and introduction to SHiP

Auteur: Osamu Sato[1]

[1] *Nagoya Univ.*

Auteur correspondant sato@flab.phys.nagoya-u.ac.jp

The knowledge about tau neutrino features is still rather poor comparing with muon or electron neutrino. One of the basic features, the tau neutrino cross-section, was only measured by DONUT in 2008 with large systematical error of 50% and also large statistical error of 33%.
In the future experiments, a large number of tau neutrino events will be collected for precise measurement on tau neutrino features. The DsTau experiment is going to provide precise information on tau neutrino beam in those future tau neutrino projects. The origin of tau neutrino beam is Ds meson decay to tau, Ds -> tau + nu_tau, and the cascade decay of the tau, tau -> x + nu_tau. DsTau will measure a Ds production differential cross-section in proton and tungsten interactions and this will reduce the systematical error of tau neutrino beam to 10% from 50%. The peculiar Ds cascade decay topology (”double kink”) in a few mm range will be detected by Nuclear Emulsion tracker thanks to its excellent spatial resolution (~50nm).
In 2016 and 2017, we made test beam exposures of Nuclear Emulsion modules to the CERN SPS 400GeV/c proton beam. A pilot run in August 2018 and physics run in 2021 are planned.
In this talk, the analysis status and prospects of the DsTau project will be presented with a future tau neutrino project SHiP.

Future projects / **52**

COBAND, Cosmic Background Neutrino Decay Search

Auteur: Yuji Takeuchi[1]

[1] *Univ. of Tsukuba*

Auteur correspondant takeuchi@hep.px.tsukuba.ac.jp

We present a status of COBAND project for an experimental search for COsmic BAckground Neutrino Decay. The cosmic background neutrino (CνB) is predicted in the standard cosmology, while the heaviest neutrino is expected to be able to decay to lighter neutrinos with photons in the FIR region. Neither the CνB nor the neutrino decay is, however, experimentally established yet. We, thus, search for photons come from the neutrino decays in the CνB. The photon spectrum from the neutrino decays in the CνB is expected to have an unique structure with sharp edge at a short wavelength end around 50um against the overwhelming zodiacal emission foreground as well as cosmic infrared background.
The detectors are required to measure the photon spectrum in the FIR region at 0.1% accuracy level to achieve a sensitivity in the order of 10^14 years to the heaviest neutrino lifetime for a 200-second

measurement with a sounding rocket experiment. We have been developing far-infrared photodetectors based on superconductor tunnel junction (STJ) sensors in combination with cryogenic amplifiers as the key technology in the project. In this talk, we focus on the status of the developments of STJ as well as the cryogenic amplifiers.

Future projects / **51**

Neutrino mass measurement in a CMB experiment

Auteur: Haruki Nishino[1]

[1] *KEK*

Auteur correspondant haruki.nishino@kek.jp

Since the first detection of Cosmic Microwave Background (CMB) in 1964,
the observations of CMB have been playing a big role to understand the history of the Universe and to establish the standard model of cosmology. The next frontier of the CMB cosmology is the polarization of CMB. In recent years, CMB experiments have been targetting to measure the polarization component of the CMB, in particular, for detecting curl-like (odd-parity) pattern called B-mode since the discovery of the degree-scale CMB B-mode polarization can be a decisive evidence for the primordial gravitational waves and the cosmic inflation. Another interesting science with the CMB polarization measurement is to measure the mass scale of neutrinos. The sub-degree scale CMB B-mode signal is expected to be generated by gravitational lensing effects from the cosmological large-scale structures. Due to the neutrino mass scale dependence of the large-scale structure evolution, it is possible to extract the neutrino mass information cosmologically with CMB polarization data. In this talk, I will talk on the current status of the CMB polarization experiments and their cosmological implications to the neutrino mass measurements. As an example of CMB experiments, I will focus on the POLARBEAR experiment. POLARBEAR is a ground-based CMB polarization experiment which started science observations in 2012 from the Atacama desert in Chile and is one of the CMB experiments that have detected the CMB B-mode signal originating from gravitational lensing effects. The achievements and prospects of the POLARBEAR experiment and its upgrade project called Simons Array will also be presented in this talk.

Future projects / **56**

Summary Talk

Auteur: Tsuyoshi Nakaya[None]

Auteur correspondant t.nakaya@scphys.kyoto-u.ac.jp

Young physicists talks / **58**

PROSPECT/ Reactor SBL

Natural Neutrino Sources / **23**

KATRIN experiment

Artificial Neutrino Sources / **7**

New results from NOvA and future prospects

Auteur: Dan Cronin-Hennessy[1]

[1] *University of Minnesota*

Auteur correspondant croni028@umn.edu

Artificial Neutrino Sources / **15**

New results from NEOS and future prospects

Artificial Neutrino Sources / **13**

New results from Double Chooz and future prospects

Natural Neutrino Sources / **22**

Results from ANTARES experiment and status of KM3NeT experiment

Natural Neutrino Sources / **26**

Search for neutrino-less double beta decay in NEMO-3 and SuperNEMO

Natural Neutrino Sources / **27**

Search for neutrino-less double beta decay in EXO-200/nEXO

Joint session / **40**

neutrino-nucleon interactions

Sato

Future projects / **45**

INO experiment

Joint session / **41**

Experimental and theoretical status of Neutrino-Nuclei interactions

Dr. Huma Haider,?

Joint session / **53**

Physics potential of ICAL with atmospheric neutrinos

Auteur: Md Naimuddin[1]

[1] *Univ. of Delhi*

Auteur correspondant nayeem@fnal.gov

Artificial Neutrino Sources / **16**

New results from COHERENT and future prospects

Future projects / **60**

MW accelerator-based neutrino beam: Prospects & challenging

Future projects / **50**

SMIRE experiment

Future projects / **49**

LEGEND experiment: Search for neutrino-less double beta decay

Artificial Neutrino Sources / **18**

Grand Unified Theory with neutrinos

Maekawa? May be too short?

Artificial Neutrino Sources / **10**

New results from MINERvA and future prospects

Joint session / **57**

The SNO+ experiment and the search for neutrinoless double beta decay

Auteur: Jack Dunger[1]

[1] *University of Oxford*

Auteur correspondant jack.dunger@physics.ox.ac.uk

The SNO+ experiment aims for world leading sensitivity to neutrinoless double beta (0vbb) decay using Te130, loaded into a kilotonne-scale liquid scintillator detector. The detector is now filled with ultra-pure water, which will be replaced with unloaded liquid scintillator in the coming months. These two preliminary phases will provide critical background contraints for 0vbb phase, as well as sensitivity to a broad range of low-energy physics. This talk will present initial measurements from the water phase and projected sensitivities for the future phases.