12^{th} **Rencontres du Vietnam**

NuFact 2016

Quy Nhơn August 21 - 27, 2016

Parallel Sessions

Abstracts

WG1

Neutrino Oscillation Physics

Parallel Session #2 Tuesday

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First Double-Detector Results from the Double Chooz Experiment

Adrien Hourlier (Laboratoire APC, Paris)

Double Chooz is a reactor neutrino experiment aiming to measure the neutrino mixing angle θ_{13}. The first non-zero indication of θ_{13} from a reactor experiment was provided by Double Chooz in 2011. A robust observation of θ_{13} was followed in 2012 by the Daya Bay and RENO experiments with multiple detectors. The final precision of θ_{13} by reactor experiment is of critical importance for current and future experiments to address the possible observation of CP violation in the neutrino sector. Systematic errors in reactor experiments are reaching the per-mill level, therefore, comparison of measurements from different experiments is crucial. In addition to the Far detector, the Near detector started operation since December 2014, which allows us to significantly improve the sensitivity of θ_{13}. In this talk, we will show the first double-detector results for θ_{13}, combining 1 year of double-detector and 2 years of single-detector data analysis.

RENO/RENO-50

Kyung Kwang Joo (Chonnam National University, Gwangju)

The Reactor Experiment for Neutrino Oscillation (RENO) is a reactor based neutrino oscillation experiment to measure the neutrino mixing, θ_{13}, using antineutrinos emitted from the Hanbit nuclear power plant in Korea. RENO has made a definitive measurement of θ_{13} in 2012. Recently more precise measurements have been obtained and presented on the mixing angle and the reactor neutrino spectrum, using about 500 live days of data to observe an energy dependent disappearance of reactor $\overline{\nu_e}$ by comparison of prompt signal spectra measured in two identical near and far detectors. Furthermore, other recent results (5MeV excess, absolute flux measurements, n-H analysis, etc) will be shown. A large liquid scintillator and multi-purpose neutrino experiment, RENO-50, is proposed to be built for playing a leading role in neutrino physics and neutrino astronomy. The detector will be located at the underground of Mt. Guemseong in Naju, 50 km distant from the Hanbit nuclear power plant. It will make high precision measurements of neutrino oscillation parameters (θ_{12}, Δm^2_{12}, and $|Deltam^2_{ee}$, and the neutrino mass ordering, etc). In this talk, latest RENO results and current status of RENO-50 will be presented.

Latest Results from the Daya Bay Reactor Neutrino Experiment

Juan Pedro Ochoa-Ricoux (Pontificia Universidad Católica de Chile)

The Daya Bay Reactor Neutrino Experiment was designed to measure θ_{13}, the smallest mixing angle in the three-neutrino mixing framework, with unprecedented precision. The experiment consists of eight functionally identical detectors placed underground at different baselines from three pairs of reactors, a unique configuration that minimizes systematic uncertainties and cosmogenic backgrounds. In 2012 Daya Bay made the first definitive observation of a non-zero value of θ_{13}, a result that opened the door for a rich program of future neutrino oscillation physics. With a growing dataset that constitutes the largest sample of reactor antineutrino interactions collected to date, Daya Bay is able to greatly improve the precision on θ_{13} and to make an independent measurement of the effective mass splitting in the electron antineutrino disappearance channel with a precision comparable to that from accelerator experiments. Daya Bay can also perform a number of other groundbreaking measurements, such as a high-statistics determination of the absolute reactor antineutrino flux and spectrum, as well as a search for sterile neutrino mixing, among others. The most recent results from Daya Bay will be discussed in this talk, alongside the current status and future prospects of the experiment.

Physics prospects and status of JUNO

Jian Tang (Sun Yat-Sen University in China)

The Jiangmen Underground Neutrino Observatory (JUNO) is a liquid scintillator detector aiming to determine the neutrino mass hierarchy and to perform precision measurements of the neutrino mixing parameters by detecting reactor antineutrinos at a baseline of 53km. JUNO physics programme also includes the detection of supernova neutrinos, geoneutrinos and solar neutrinos. The central detector is a 35.4 meter diameter acrylic sphere supported by steel struss, holding 20 kt liquid scintillator monitored by 17k 20" MCP-PMT, resulting in 75% photo-coverage. This design is tailored to reach an extremely high light yield (1200 PE/MeV) pivotal to achieve the unprecedented energy resolution of 3% at 1 MeV. Introducing 34K 3" PMTs brings the multi-calorimeter concept into the reality to help event reconstructions and reduction of impacts by the non-stochastic component in the energy response. In this talk we will update the recent progress in JUNO.

Oscillation Results from the NOvA Experiment

Christopher Backhouse (Caltech, Pasadena)

The NOvA experiment observes the oscillations that occur in a beam of muon neutrinos sent 810km from the source at Fermilab, IL to a 14kton detector in Ash River, MN. We present new oscillation results from the first two years of data-taking. The measurement of ν_μ disappearance allows precise measurements of the oscillation parameters $\sin^2\theta_{23}$ and Δm^2_{32}; the search for Neutral Current disappearance could provide evidence of oscillations involving a new sterile state; and the measurement of ν_e appearance sheds light on the neutrino mass hierarchy and the CP-violating phase δ_{CP}, and provides complementary information on $\sin^2\theta_{23}$

Electron-antineutrino appearance search at the T2K experiment

Benjamin Quilain (Kyoto University)

T2K is a long-baseline neutrino experiment that aims to measure θ_{23}, $\Delta - m^2_{32}$ and θ_{13} through muon-neutrino disappearance, electron-neutrino appearance and their antineutrino equivalent channels. In 2013, T2K observed electron-neutrino appearance in a muon-neutrino beam for the first time. Compared to the constraints on θ_{13} provided by the reactor experiments in the antineutrino sector, T2K observed a higher number of oscillated electron neutrinos, which tends to favour a maximal CP-violation effect.

T2K is currently taking data in antineutrino mode. In this presentation, we will show the latest results of electron-antineutrino appearance at T2K, using the full antineutrino data set. Both rate and rate+shape analyses will be presented. Finally, we will compare neutrino and antineutrino appearance results in order to show the latest constraint on the CP violation parameter.

Results from the OPERA experiment in the CNGS beam

Alessandro Paoloni (INFN - LNF)

The OPERA experiment at the Gran Sasso underground laboratory has recently established $\nu_\mu \to \nu_\tau$ oscillations in appearance mode with a significance of 5.1 σ thanks to the observation of five signal candidate events in a sample with a signal-to-background ratio of about ten.

The ν_τ data analysis will be discussed, with emphasis on the background constraints obtained by using dedicated data-driven control samples. The analysis of the $\nu_\mu \to \nu_e$ channel, formerly based on the first two years of run, has been extended over the full data set with a more than twofold increase in statistics. The implications of the tau neutrino and electron neutrino samples in the framework of the 3+1 sterile model will be discussed.

The Collaboration is also focusing on the characterization of ν_τ-like interactions failing the kinematical analysis defined in the experiment proposal to obtain a statistically enhanced, lower purity, signal sample. One such interesting neutrino interaction with a double vertex topology will be presented. Finally, topics in the analysis of the OPERA cosmic ray sample will be covered.

Neutrino Oscillation Study With Hyper-Kamiokande

Yoshihisa Obayashi (Kavli IPMU, The Univ. of Tokyo)

Hyper-Kamiokande is a next generation water Cherekov detector consisting of 2 tanks, each with 187 kton fiducial mass, to be built in a staged approach. Hyper-Kamiokande will detect neutrinos produced by the upgraded J-PARC accelerator complex, and search for CP violation with an order of magnitude more data than current long baseline experiments will collect. Hyper-Kamiokande will also make precision measurements of the phase δ_{CP} and the atmospheric mixing parameters. This talk will describe the Hyper-Kamiokande long baseline neutrino oscillation physics program. Recent studies of the option for building the second tank in Korea to probe mass hierarchy and the second oscillation maximum will also be presented.

DUNE

Daniel Cherdack (Colorado State University)

abstract not received

Complementarity Between Hyperkamiokande and DUNE

Osamu Yasuda (Tokyo Metropolitan University)

In this talk we investigate the sensitivity to the neutrino mass hierarchy, the octant of the mixing angle θ_{23} and the CP phase δ_{CP} in the future long baseline experiments T2HK and DUNE as well as in the atmospheric neutrino observation at Hyperkamiokande (HK). These three experiments have the excellent facility to discover the above mentioned neutrino oscillation parameters in terms of both statistics and matter effect. In our analysis we find that the sensitivity is enhanced greatly if we combine these three experiments. Our results show that the hierarchy sensitivity of both T2HK and HK are limited due to the presence of parameter degeneracy. But this degeneracy is removed when T2HK and HK are added together. With T2HK+HK (DUNE), the neutrino mass hierarchy can be determined at least at 5σ ($8\,\sigma$) C.L. for any value of true δ_{CP}. With T2HK+HK+DUNE the significance of the mass hierarchy increases to almost 15 σ for the unfavorable value of δ_{CP}. For these combined setup, octant can be resolved except $43.5^\circ < \theta_{23} < 48^\circ$ at 5σ C.L for both the hierarchies irrespective of the value of δ_{CP}. The significance of CP violation is around $10\,\sigma$ C.L. for $\delta_{CP} \sim \pm 90^\circ$. Apart from that these combined facility has the capability to discover CP violation for at least 68% fraction of the true δ_{CP} values at 5σ for any value of true θ_{23}. The precision by which a given δ_{CP} value can be measured is also excellent for this combined set up. We also find that, with combination of all these three, the precision of Δm^2_{31} and $\sin^2\theta_{23}$ becomes 0.3% and 2% respectively. This talk is based on arXiv:1607.03758 [hep-ph].

Super-K/Hyper-K

Jun Kameda (ICRR The University of Tokyo)

abstract not received

Recent IceCube/DeepCore results and the PINGU upgrade

Philipp Eller (Pennsylvania State University, University Park)

This talk will highlight atmospheric neutrino oscillation results obtained using the IceCube/DeepCore detector, such as muon neutrino disappearance, and limits on sterile neutrinos and non-stadard interactions. We will also cover the sensitivity of the proposed IceCube low energy extension, PINGU, to various neutrino oscillation effects, such as the neutrino mass ordering and tau neutrino appearance.

PACIFIC NEUTRINOS: towards a high precision measurement of CP violation ?

Claude Vallée (CPPM/DESY)

A remarkable conjunction has recently emerged from the establishment of Fermilab as a worldwide long term neutrino facility, the development of the deep sea environmental observatories NEPTUNE and OOI offshore of Vancouver and Seattle, and the maturation within the ANTARES/KM3NeT consortia of high granularity deep sea cerenkov detection technologies suited for neutrino measurements in the few GeV domain (ORCA option). In an attempt to exploit this conjunction, we will present an investigation of the potential of a o(10Mton) submarine neutrino cerenkov detector based on KM3NeT-like optical modules, implemented within the NEPTUNE/OOI infrastructure in a neutrino beam issued from FNAL. The study extrapolates from the LBNO study corresponding to a 25% shorter baseline, and from the ORCA detector sensitivity studies of the KM3NeT LOI. A possible roadmap towards a project will also be outlined.

WG2

Neutrino Scattering Physics

Parallel Session #1 Monday

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Parallel Session #10 Friday

Parallel Session #9 Friday

The latest CCQE-like analyses from the T2K near detectors

Stephen Dolan (University of Oxford)

T2K is a long-baseline neutrino oscillation experiment comprising of the J-PARC O(GeV) neutrino beamline, the ND280 near detector complex and a far detector (Super-Kamiokande) located 295 km away from J-PARC. In order to make precision measurements of neutrino oscillations a detailed understanding of both GeV-scale neutrino-nucleus scattering cross sec- tions and nuclear effects are essential. To achieve this, the latest CCQE-like analyses from the T2K near detectors utilise a wide variety of techniques including: water subtraction to obtain oxygen cross sections; joint neutrino/anti- neutrino fits and measurements of cross sec- tions in proton kinematics or composite proton-muon variables (such as transverse kinematic imbalance). Each of these new analyses will be presented, alongside current T2K CCQE-like results, with a view to demonstrating their potential to provide complementary precision cross-section measurements and innovative probes of nuclear effects.

MINERvA cross-sections

Jeff Nelson (College of William and Mary, Williamsburg)

MINERvA is a dedicated neutrino-nucleus scattering experiment sited in the NuMI neutrino beam Fermilab. MINERvA collected data in the NuMI low-energy configuration and more recently in a higher energy configuration. Using existing hadron production data, MINERvA has reevaluated the neutrino flux and its uncertainties yielding the smallest flux uncertainties in a multi-GeV broad-band beam. This flux was crosschecked using both neutrino atomic electron scattering and the low recoil flux method. Using these updated fluxes we have studied the QE-like channel and nuclear effects, which are compared to theories and show clear evidence of nuclear effects. MINERvA results on pion production, inclusive, and DIS results will be covered in Dr. Morfin's talk.

Recent Cross-section Results from NOvA

Jeremy Wolcott (Tufts University)

The NOvA experiment is an off-axis long-baseline neutrino oscillation experiment seeking to measure ν_μ disappearance and ν_e appearance in a ν_μ beam originating at Fermilab. In addition to measuring the unoscillated neutrino spectra for the purposes of predicting the oscillated neutrino spectrum in the far detector, the 293-ton near detector also enables high-statistics investigation into neutrino scattering in numerous reaction channels. This talk will discuss the various near detector analyses currently in progress, including inclusive measurements of both electron and muon neutrino charged-current interactions, semi-inclusive measurements of pion and proton production, studies of the nuclear medium

modifications to neutrino interactions, and efforts to constrain the off-axis NuMI flux using the elastic scattering of neutrinos from atomic electrons.

Quasielastic production of hyperons

Mohammad Sajjad Athar (Aligarh Muslim University)

We shall discuss $\overline{\nu_l}$ induced quasielastic charged current hyperon production from nucleons and nuclei. The inputs are nucleon-hyperon transition form factors determined from experimental data on quasielastic ($\Delta S = 0$) charged current (anti)neutrino–nucleon scattering and the semileptonic decay of neutron and hyperons assuming G–invariance, T–invariance and SU(3) symmetry. These processes are generally Cabibbo suppressed as compared to the Δ production process but could be important in the low energy region($\leq 1GeV$) of antineutrinos relevant to MicroBooNE, T2K and atmospheric antineutrino experiments. The results would be presented for the total scattering cross section σ, Q^2 distribution, etc. for $\overline{\nu_l}$ scattering off nucleon and nucleons bound in ^{12}C, ^{40}Ar, ^{56}Fe and ^{208}Pb nuclear targets, where a single hyperon is produced. The calculations are done using the local density approximation. The nuclear medium effects due to the Fermi motion and Pauli blocking, and the final state interaction effects due to hyperon–nucleon scattering have been taken into account. The hyperon produced inside the nuclei decay to pion and nucleon, and the decay width of pionic decay modes of hyperons is highly suppressed in the nuclear medium, making them live long enough to pass through the nucleus and decay outside the nuclear medium and thus less affected by the strong interaction of nuclear field. The pions arising due to hyperons, are compared with the pions being produced through the Δ production where due to the effect of Pauli blocking, Fermi motion of the nucleon, renormalization of Δ properties in the nuclear medium and the FSI of pions with the residual nucleus, the cross sections are reduced by more than 25% than the pions produced from Δ off free nucleon target at low energies. Therefore, for $E_{\overline{\nu_l}} \leq 1GeV$ energy region the pions produced from hyperons become compatible with the pions produced from the Δ. The results would be presented for Q^2-distribution, lepton energy distribution and the total cross sections. We shall also discuss the longitudinal ($P_L(Q^2)$) and perpendicular ($P_P(Q^2)$) polarizations of final hyperon(Λ, Σ) produced in the antineutrino induced quasielas- tic charged current reactions on nucleon targets. The sensitivity of axial dipole mass M_A, pseudoscalar form factor, neutron electric form factor, etc. on $P_L(Q^2)$ and $P_P(Q^2)$ would be discussed. We have compared the theoretical results with the available experimental results from CERN. Predictions for the flux aver- aged cross sections and polarization components have been made for the future experiments being done with antineutrino beams at T2K, MicroBooNE and MINERνA.

Nuclear medium effects in the deep inelastic charged lepton/neutrino-A scattering

Huma Haider (Aligarh Muslim University)

Deep Inelastic Scattering(DIS) experiments using charged lepton/neutrino as probe have been important tool to explore the partonic structure of nucleons and nuclei. Recently the importance of nuclear medium effects in the DIS region has been emphasized by several authors. In this talk, we shall discuss the effect of nuclear medium on electromagnetic $F_{iA}^{EM}(x, Q^2)$, $i = 1 - 2(A = nucleus)$ and weak $F_{jA}^{Weak}(x, Q^2), j = 1 - 3$, structure functions for a wide range of x and Q^2 using a microscopic nuclear model which takes into account the effects of Fermi motion, nuclear binding and nucleon correlations through a relativistic nucleon spectral function. The contributions of π and ρ mesons as well as shadowing effects are also included. The details are given in Refs.[1-2]. We shall present a comparison of $F_{1A}(x, Q^2)$ with $F_{2A}(x, Q^2)$ structure functions in several nuclei like carbon, argon, iron and lead, and to study the violation of Callan-Gross relation in nuclei. We shall compare these results with recent data of JLab [3]. A quantitative estimate of the nuclear medium effects in $F_{iA}^{EM}(x, Q^2), i = 1 - 2(A = nucleus)$ and $F_{jA}^{Weak}(x, Q^2), j = 1 - 3$, will be presented. Using these nuclear structure functions discussed above, we shall present the results for differential scattering cross sections in various nuclear targets such as carbon, argon, iron and lead, and compare them with the recent data available from MINERνA experiment for $\frac{\sigma^A}{\sigma^{CH}}$ (A= C, Fe, Pb) [4]. Presently parity vioalting asmmetry(A_{PV}) in the DIS of polarized electron beam from deuteron has been measured at JLab and there exist future plans to measure this assymmetry from nuclear targets. We shall present the results for A_{PV} in several nuclear targets. This study may provide the information about weak electron and quark couplings to the Z boson as well as the (anti)quark parton distributions in nucleons and thier modification in nuclei due to nuclear medium effects.

Bibliography

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3. https://www.jlab.org/research

4. J. Mousseau et al., Phys. Rev. D 93 (2016) 071101(R).

Isospin decomposition of the $\gamma^{(*)}N \to N^*$ transitions as input for constructing models of neutrino-induced reactions in the nucleon resonance region

Hiroyuki Kamano (KEK, Tsukuba)

Constructing an accurate model for neutrino-induced reactions in the nucleon resonance region assumes more importance in making a precise interpretation of the detected data in the future neutrino-oscillation experiments. One of the major unknown parts of the

neutrino-induced reactions in the nucleon resonance region is the matrix elements for the transition from the nucleon to a nucleon resonance induced by the weak current. However, the vector part of the weak-current matrix elements can be determined with the data of meson photo- and electro-production reactions off the nucleon, which are provided from the facilities such as ELSA, ELPH@Tohoku, JLab, MAMI, and SPring-8. In this talk, I will present our recent efforts to determine such vector-current matrix elements within a sophisticated coupled-channels framework.

First Measurement of Neutrino Interactions in MicroBooNE

Philipp Hamilton (Syracuse University)

MicroBooNE is a liquid argon neutrino detector, situated in the Booster Neutrino Beam at Fermilab. As part of a broad physics programme, MicroBooNE will measure neutrino cross-sections, as well as seeking to probe the MiniBooNE low-energy excess and improving operational understanding of liquid argon time projection chambers for future experiments (such as DUNE). This talk presents the first measurements of beamline neutrino interactions in MicroBooNE, and describes the techniques developed to obtain them.

LArIAT: World's First Pion-Argon Cross-Section

Philipp Hamilton (Syracuse University)

A complete understanding of neutrino interactions also requires us to understand the interactions of the daughter particles created in those interactions, both inside the target nucleus and after ejection. LArIAT is a small-scale liquid argon detector situated in the Fermilab test beam that looks to measure the interactions of charged particles in argon, in order to understand their cross-sections and to help develop their reconstruction in neutrino detectors. This talk presents the world?s first measurement of a pion cross-section on an argon target, made with the LArIAT detector.

Tuning Interaction Generators to Neutrino Cross-section Data

Patrick Stowell (The University of Sheffield)

In recent years a number of new theoretical models have been implemented into Monte-Carlo neutrino interaction event generators. Being able to compare multiple model predictions is invaluable to the field. It is unfortunately still unclear which one provides the best fit to the entire collection of neutrino cross-section data.

In this talk I review recent work to evaluate uncertainties on the neutrino cross-section models in each of the interaction event generators. I will cover the tuning of the free nucleon cross-section through fits to bubble chamber data, before discussing the use of MINERvA data to place constraints on nuclear effects present in neutrino-nucleus scattering.

Effects of neutrino mass on differential cross-section of elastic neutrino-electron scattering

Asan Damanik (Sanata Dharma University)

We investigate the effect of neutrino mass on differential cross-section of elastic neutrino-electron scattering and discuss its phenomenological consequences

Lepton production cross sections in quasielastic (anti)neutrino-nucleus scattering

Mohammad Sajjad Athar (Aligarh Muslim University)

no abstract received

T2K Recent Cross-Section Results

Erez Reinherz-Aronis (Colorado State University)

T2K is a long-baseline neutrino oscillation experiment where a muon (anti)neutrino beam is produced at the J-PARC facility located in Tokai, Japan, and, after traveling 295 km, is detected by the far detector Super-Kamiokande. The T2K near detector complex, which includes both on-axis and off-axis detectors, is located 280 meters downstream from the neutrino production target at the J-PARC laboratory. The T2K collaboration has a rich program to measure neutrino cross sections on various nuclei which are needed for precision neutrino oscillation experiments. We present here some of the recent neutrino cross-section

measurements on carbon, oxygen, iron and other materials utilizing the T2K on-axis, off-axis and far detectors.

MINERvA Cross Section and Nuclear Effects Studies Continued and NuSTEC Update

Jorge Morfin (Fermilab)

In this talk I will cover the MINERvA results on meson production; including comparisons of neutrino and antineutrino single pion production, NC diffractive π^0 production and charged and neutral current kaon production, as well as measurements of neutrino and antineutrino total cross sections and reminders of the inclusive and DIS nuclear target ratios. The talk will conclude with an update of the NuSTEC collaborations projects and plans for the next extended school on neutrino nucleus scattering physics.

Neutrino Induced Neutral Current Coherent Pi0 Production in The NOvA Near Detector

Hongyue Duyang (University of South Carolina)

The NOvA experiment is a long-baseline neutrino oscillation experiment designed to measure the rate of electron neutrinos appearance in a muon neutrino beam. It consists of two finely segmented, liquid scintillator detectors at 14 mrad off-axis in the NuMI beam. The NOvA Near Detector, located at Fermilab, provides an excellent opportunity to study neutrino-nucleus interactions which are important for neutrino oscillation measurements. This presentation will present one of the first such measurements from NOvA: neutrino-induced coherent-Pi0 production. Neutrinos can coherently interact with the target nucleus via neutral current exchange and produce a single, forward Pi0, which makes background to the NuE appearance measurement. The analysis measures the coherent-Pi0 kinematics and cross-section and compares to model predictions, and thusly also provides a data constraint on Pi0 production in the neutral current resonance and deep-inelastic interaction.

The Accelerator Neutrino Neutron Interaction Experiment (ANNIE) at Fermilab

Franck Krennrich (Iowa State University, Ames)

ANNIE is specifically designed to perform a measurement of the final-state neutron abundance in high-energy neutrino-nucleon interactions as a function of momentum transfer. The experiment uses the Booster Neutrino Beam (BNB) at Fermilab, which provides a controlled beam of dominantly muon neutrinos with a peak energy of 0.7 GeV and a spectrum similar to that of atmospheric neutrinos.

The two key components for studying neutrino-nucleon interactions are a volume filled with 23 tons of Gadolinium-doped water giving a high neutron detection efficiency, and the first use of Large Area Picosecond Photodetectors (LAPPDs) giving unprecedented track reconstruction accuracy in a water Cherenkov detector. A better understanding of the neutron multiplicity in neutrino-nucleon interactions is critical for reducing the systematic uncertainties in precision neutrino oscillation measurements arising from nuclear effects. The measurements will also help to understand the application of neutron tagging to reduce backgrounds from atmospheric neutrinos, which is important for improving the sensitivity of future proton decay experiments, and for achieving a better flux sensitivity for detecting the diffuse supernova neutrino background. Finally, the demonstration of LAPPDs in a physics measurement could prove groundbreaking for future water Cherenkov detectors.

A status report of ANNIE will be provided, including the construction and experience from first data taking in summer of 2016. An outlook for the next phases of the physics measurements will be given.

J-PARC T60: Precise measurement of neutrino-nucleus interactions with Nuclear Emulsion

Tsutomu Fukuda (Nagoya University)

We proposed a new experimental project which equips Emulsion Cloud Chamber (ECC) as a main detector in order to study low energy neutrino-nucleus interactions in detail. First of all, a test experiment (J-PARC T60) is implemented to check the performance of newly developed emulsion gel, optimize the detector structure, and demonstrate the neutrino analysis with ultimate position resolution. Anti neutrino beam was exposued to a 60kg steel target ECC at J-PARC. From this summer, the analysis based on several thousands of anti-neutrino interactions accumulated in ECC is started. In this talk, I will give the status of the measuremsnts and the future prospects.

Tau-neutrino production study at CERN SPS: Novel approach by the DsTau experiment

Osamu Sato (Nagoya University)

The tau-neutrino CC cross section has never been well measured. There has been only one measurement by the DONuT experiment with a systematic uncertainty larger than 50%, mainly due to uncertainties in the Ds differential production cross section in high energy proton interaction. The DsTau collaboration proposes to study tau-neutrino production and the energy distribution by analyzing Ds -> tau events in 400 GeV proton interactions. By employing the state-of-the-art emulsion particle detector technologies, we will analyze 10^8 proton interactions and detect the double kink topology of Ds -> tau -> X decays. Accomplishing this new measurement, we will re-evaluate the tau-neutrino cross section with the data from DONuT and test lepton universality in neutrino CC interactions. Furthermore, it will provide data useful for future tau-neutrino experiments. In this talk, we report an overview of the experiment and the planned prototype test in 2016.

WG3

Accelerator Physics

Parallel Session #1 Monday

Parallel Session #2 Tuesday

Parallel Session #3 Tuesday

Parallel Session #5 Thursday

Parallel Session #8 Friday

Parallel Session #9 Friday

Operational experience of T2K magnetic horns and future improvements toward 1.3 MW beam

Tetsuro Sekiguchi (KEK)

In 2014, after 12 million pulse operation, the first version of T2K magnetic horns were replaced with the second version with several upgrades incorporated. Since the replacement, the second version has been operated over 8 million pulses under 400 kW beam power at maximum. Operational experience of T2K magnetic horns will be presented. Beam power of J-PARC Main Ring will be upgraded toward 750 kW by 2019, and further upgrade toward 1.3 MW by 2026 has recently been discussed. Future improvements of T2K magnetic horns toward 1.3 MW are also presented in this talk.

Neutrino beamline prospects

Milorad Popovic (Fermilab, Batavia)

no abstract received

R&D superconducting half-wave resonators for high intensity proton driver

Gunn Tae Park (KEK, Tsukuba)

At High Energy Accelerator Research Organization (KEK), there is an ongoing discussion on building a new driver linac whose beam power is 10MW with 1mA beam current. A detailed description of the front-end structure of the driver is given. The designs of two f=325 MHz superconducting half-wave resonators with beta=0.13 and beta=0.24 is also presented.

Status of J-PARC neutrino beamline operation and future upgrade plan

Ken Sakashita (KEK)

J-PARC neutrino beam-line produces a high intensity muon neutrino beam using 30 GeV protons from the J-PARC Main Ring (MR) accelerator. This neutrino beam is used for

T2K long base-line neutrino oscillation experiments as well as other test experiments at the neutrino facility. The current beam power is 400kW while it is still being increased. Further beam power improvement is planned with upgrading MR magnet power supply, RF systems and collimators. The upgrade of MR magnet power supply is planned in 2018 and the beam power after the upgrade will be increased to the design power of 750kW and beyond, to 1.3 MW. Upgrade of the neutrino beam-line such as the proton beam monitors, DAQ/control system, horns and radioactive material handling, is also planned. In this talk, status of J-PARC neutrino beam-line operation and future upgrade plan will be presented.

High-power target operation at J-PARC

Shunsuke Makimura (KEK)

Japan Proton Accelerator Research Complex, J-PARC consists of a series of world-class proton accelerators and the experimental facilities that utilize the high-intensity proton beams. J-PARC is a multi-purpose facility where the variety of secondary-particle beams are produced and are used in a wide range of scientific fields, such as fundamental nuclear and particle physics, materials and life science, and nuclear technology. Neutron, pion, muon, kaon and neutrino beams are produced through collisions between the high-power proton beams and target materials. Requirement to increase the intensity of the proton beam is getting higher and higher for further advanced researches. Consequently, the thermal load and the irradiation effect to the target materials are also getting severer. Simultaneously, cooling methods to remove the thermal load are restricted by requirements from physics experiment. In addition, these targets must be handled by remote handling, since they are highly activated. So, each target is designed considering the individual conditions. Present status of the high-power target operation at J-PARC will be described in this presentation.

High power beam operation at J-PARC: status and future.

Yoichi Sato (J-PARC / KEK)

The main ring (MR) of the Japan Proton Accelerator Research Complex (J-PARC) has been providing 30 GeV proton beams for particle and nuclear physics experiments since 2009. At present, high intensity beams of 2.2e14 protons per pulse (ppp) at beam power of 420kW with cycle time 2.48s are delivered to the neutrino oscillation experiment. The beam power has been steadily increased by 50% in last 2 years, following progression in beam tuning and hardware improvements. Main efforts in the beam tuning are to minimize beam losses and to localize the losses at collimator section. Recent improvements are corrections of resonances near operation setting of betatron tune, and adopting 2nd harmonic rf operation to reduce space charge effect with a larger bunching factor. Beam instabilities has been sufficiently suppressed with controlling chromaticity correction pattern and transverse feedback systems. The overview of recent progress in the beam tuning are presented. We plan to achieve the target beam power of 750 kW in 2018 by shortening the cycle time down to 1.3s. To achieve faster cycle, major upgrades of power supplies of main magnets, rf cavities, injection and extraction devices, and collimator capacity, are undergoing. We briefly report the status of these upgrades. Extensive beam studies to achieve the beam intensity beyond 2.2e14 ppp have been conducted with new betatron tune settings. Acceleration of two bunches holding 3.4e13 protons per bunch, which corresponds to 2.7e14 ppp with eight bunches, was successfully demonstrated. We present a new scenario toward the target beam power of 1.3 MW.

Studies for the MOMENT and EMuS target system

Nikolaos Vassilopoulos (IHEP CAS, Beijing)

We describe the latest studies for the pion/muon capture system at MOMENT (a muon-decay medium-baseline neutrino beam facility). It uses a high-power proton beam of 15 MW from a continuous wave linac that poses a radiation challenge for the target system which consists of a liquid mercury jet immersed inside a superconducting solenoid. Topics include updated studies of the pion/muon capture and the radiation effects induced by the high power. Then we continue with studies for the target system of EMuS (an experimental muon source) project at China Spallation Neutron Source (CSNS) that uses a proton beam of 4 kW at 1.6 GeV in order to produce an intense muon beam. Similar to MOMENT, it consists of a graphite target inside a superconducting capture solenoid. Topics include optimization of the capture system parameters for muons and pions, the latter in order to examine the possibility of a short-baseline neutrino experiment.

ESSnuSB- The ESS neutrino facility for CP violation discovery

Nikos Vassilopoulos (IHEP CAS, Beijing)

The comparatively large value of the neutrino mixing angle θ_{13} measured in 2012 by neutrino reactor experiments has opened the possibility to observe for the first time CP violation in the leptonic sector. The measured value of θ_{13} also privileges the 2nd oscillation maximum for the discovery of CP violation instead of the usually used 1st oscillation maximum. The sensitivity at the 2nd oscillation maximum is about three times higher than at the 1st oscillation maximum implying a significantly lower sensitivity to systematic errors. Measuring at the 2nd oscillation maximum necessitates a very intense neutrino

beam with the appropriate energy. The world's most intense pulsed spallation neutron source, the European Spallation Source, has a proton linac with 5 MW power and 2 GeV energy. This linac also has the potential to become the proton driver of the world's most intense neutrino beam with very high potential for the discovery of neutrino CP violation . The physics performance of that neutrino Super Beam in conjunction with a megaton Water Cherenkov neutrino detector installed ca 1000 m down in a mine at a distance of about 500 km from ESS has been evaluated. In addition, the use of such a detector will make it possible to extent the physics program to proton–decay, atmospheric neutrinos and astrophysics searches. The ESS proton linac upgrade, the accumulator ring needed for proton pulse compression, the target station optimization and the physics potential are described. In addition to the production of neutrinos, this facility will also be a copious source of muons which could be used to feed a low energy nuSTORM facility, a future neutrino factory or a muon collider. The ESS linac, under construction, will reach full operation at 5 MW by 2023 after which the upgrades for the neutrino facility could start. This project is now supported by the COST Action CA15139 "Combining forces for a novel European facility for neutrino-antineutrino symmetry-violation discovery" (EuroNuNet) as well as by EU Regional Structural Funds in the region in Sweden where the neutrino detector will be located.

Biography

A Very Intense Neutrino Super Beam Experiment for Leptonic CP Violation Discovery based on the European Spallation Source Linac: A Snowmass 2013 White Paper, E. Baussan et al., Nuclear Physics B, Volume 885, August 2014, Pages 127-149.

MuCool Test Area Experimental Program Summary

Alexey Kochemirovskiy (The University of Chicago)

Muons have a potential of producing well-characterized neutrino beams for precise, high sensitivity studies as well as being a candidate particles for collider reaching multi-TeV energies. To efficiently cool the muon beam, some designs require high gradient operation of RF cavities in strong external solenoidal focusing magnetic field. It was experimentally shown that the problem of RF breakdown is aggravated if external magnetic field is applied. The MuCool Test Area (MTA) is a unique accelerator R&D facility, built specifically to test RF components for a muon ionization cooling channel in external multi-Tesla solenoidal field with and without the presence of a beam. As a part of MTA experimental program, high-gradient performance of 805 and 201MHz cavities as well as dielectric loaded high-pressure 805MHz cavities was tested. This talk will cover a review of MTA experimental program and will discuss the most interesting and promising results.

Progress towards a neutrino factory

Milorad Popovic (Fermilab, Batavia)

no abstract received

Progress towards a Higgs factory

Ben Freemire (Illinois Institute of Technology, Chicago)

Bright muon sources offer the potential to study neutrinos, the Higgs boson, and search for new physics at the energy frontier. The Muon Accelerator Program (MAP) in the United States began in 2010, with the goal of proving the feasibility of building such a machine. MAP's efforts are nearing completion, and a great deal of progress has been made on each of the accelerator's subsystems. A Higgs factory allows for s-channel production of the Higgs, amounting to 13,500 Higgs produced per 10^7 seconds, while providing a beam energy spread on the order of 0.004% with which to measure the Higgs width. A Higgs factory relies on a high power proton driver and suitable target, significant six dimensional cooling, and moderate reacceleration. The foreseen requirements and current status for each of these systems will be outlined.

Progress towards a multi-TeV muon collider

Alan Bross (Fermilab, Batavia)

no abstract received

Measurement of emittance

François Drielsma (Université de Genève)

The Muon Ionization Cooling Experiment (MICE) collaboration will demonstrate the feasibility of ionization cooling, the technique by which it is proposed to cool the moun beam at a future neutrino factory or muon collider. The muon beam emittance is measured on a particle-by-particle basis. Measurements are made before and after the cooling cell using a high precision scintillating-fibre tracker in a solenoidal field. A pure muon beam is selected using a particle identification system that can reject efficiently both pions and electrons. The emittance of the MICE muon beam has been measured for the first time using the

scintillating-fibre tracking system. The two spectrometers were powered together with the focus coil module in July 2016 and muons tracks were measured up and downstream the cooling cell. The performance of the tracking and the analysis techniques required for this precision measurement are shown. Also presented is the expected emittance change to be observed for different lattices used in the ongoing MICE Step IV.

Multiple Coulomb Scattering Measurements of Muons in MICE

Ryan Bayes (University of Glasgow)

Multiple coulomb scattering is a well known electromagnetic phenomenon experienced by charged particles traversing materials. However, from recent measurements by the MuScat experiment it is known that the available simulation codes, specifically GEANT4, overestimate the scattering of muons in low Z materials. This is of particular interest to the Muon Ionization Cooling Experiment (MICE) which has the goal of measuring the reduction of a muon beam emittance induced by energy loss in low Z absorbers. Multiple scattering induces positive changes in the emittance in contrast to the reduction due to ionization energy loss. It therefore is essential that MICE measures multiple scattering for its absorber materials; lithium hydride and liquid hydrogen; and validate the multiple scattering against known simulations. MICE took data with magnetic fields off suitable for multiple scattering measurements in the spring of 2016. The results of these measurements and comparison of the da ta to available simulations will be discussed. Further measurements of multiple scattering with magnetic fields on are planned and the impact of the increased angular acceptance on the resulting measurements will also be discussed.

Ionization cooling demonstration

Yordan Karadzhov (University of Geneva)

Muon beams of low emittance provide the basis for a detailed study of the neutrino avour physics at a Neutrino Factory and for lepton- antilepton collisions at energies of up to several TeV at a Muon Collider. Ionization cooling provides the only practical solution for reduction of the muon beam emittance, because it is fast enough to cool the beam within the short muon lifetime. The emittance reduction is achieved by passing the muons through a low-Z material (absorber), in which they lose energy via ionization, reducing both their longitudinal and transverse mo- mentum. The longitudinal component is restored by accelerating cavities, providing a net reduction of the beam emittance. The international Muon Ionization Cooling Experiment (MICE) aims to build a section of a cool- ing channel that can demonstrate the principle of ionization cooling. A major revision of the scope of the project was carried out over the summer of 2014. The revised project plan will be described and the capability of delivering a demonstration of ionization cooling will be discussed

LBNF target optimization

Eric Zimmerman (University of Colorado, Boulder)

no abstract received

LBNF beamline

Eric Zimmerman (University of Colorado, Boulder)

no abstract received

Design and Performance of Muon Storage Ring for the Neutrino Factory based on NuMAX Facility

Jaroslaw Pasternak (Imperial College, London)

no abstract received

WG4

Muon Physics

Parallel Session #1 Monday

Parallel Session #2 Tuesday

Parallel Session #4 Wednesday

Parallel Session #5 Thursday

Parallel Session #8 Friday

Final results of the MEG experiment

Marco Venturini (Scuola Normale Superiore, INFN Pisa)

The MEG experiment at the Paul Scherrer Institut searched for the lepton-flavour violating decay $\mu \to e\gamma$, practically forbidden in the Standard Model but strongly enhanced in many of its extensions. With the analysis of half of the collected statistics, the MEG collaboration set the most stringent upper limit on the branching ratio of the decay to be 5.7×10^{-13} at 90% confidence level, with an associated sensitivity of 7.7×10^{-13}. In this contribution the analysis of the full dataset collected from 2009 to 2013 will be presented: with a doubled statistics and an improved analysis technique, the resulting associated sensitivity is 5.3×10^{-13}. The implications of the MEG result in the context of lepton flavour violation will also be discussed and promising future directions will be highlighted.

MEGII and Mu3e

Angela Papa (PSI, Villigen)

no abstract received

COMET

Ye Yuan (Institute of High Energy Physics CAS, Beijing)

Charge Lepton Flavor Violation(CLFV) is forbidden in Standard Model(SM), so the discovery of it will be a clear signal of new physcis beyond SM. Since 1947, the pursuit of probe CLFV are continuosly carry on by experiments around the world. Current best limit has reached 10^{-13} order.

The newest attempt come from COMET, a COherent Muon to Electron Transition experiment will be run on J-PARC, Japan. COMET aims to improve the single event sensitivity of CLFV by 4 more orders. As phased approach, phase-I of COMET aims at 3×10^{-15} and is under construction. The updated progress of construction and R&D from COMET will be reported in this talk.

Status and future prospects for charged Lepton flavor violation (cLFV) searches at LHCb

Federica Lionetto (Zurich, UZH)

In the Standard Model the different lepton families couple universally to gauge bosons. Therefore, the ratio of branching fractions of decays with different lepton flavours is predicted with a very good accuracy. The universality of lepton couplings has been tested using the LHCb Run 1 dataset, resulting in some tensions with respect to the predicted values. Lepton non-universality would be a major departure from the Standard Model and may also be accompanied by lepton flavour violation. Recent tests of lepton flavour universality and searches for lepton flavour violation decays at LHCb will be presented.

Searches for Charged Lepton Flavor Violation with the ATLAS detector at the LHC

Marc Bret (Shanghai Jiao Tong University)

Charged lepton flavor violation is a clear hint of new physics, providing a clue to address questions for flavor dynamics and particle generations. The CLFV searches on the tau-lepton and other SM and BSM particles including Higgs boson at ATLAS are reviewed. The SUSY searches for LFV in RPV scenarios are also covered in this talk. Future prospects and experimental challenges for the CLFV searches at the LHC are examined.

Searches for heavy neutrinos and lepton number violation at the LHC using the CMS detector

Un-ki Yang (Seoul National University)

Searches for heavy neutrino motivated by the discovery of neutrino oscillations became realistic at the LHC. Many searches for heavy neutrinos and lepton number violation channel (Majorana neurons) have been performed at the LHC using the CMS detector. We present the results on the searches, and results are interpreted in terms of the Left-Right Symmetrical model, Type-I, and the Type-III seesaw mechanism.

Kaon experiments at CERN: recent results and prospects

Giuseppina Anzivino (University of Perugia)

In the first part of the talk, recent results from the NA48/2 and NA62 experiments at CERN are presented. After some highlights on the measurement of R_K, searches for lepton number violation and resonances in the $K^{\pm} \to \pi\mu\mu$ decays are reported; a new upper limit on the rate of the decay $K^{\pm} \to \pi^{\mp}\mu^{\pm}\mu^{\pm}$ has been established, improving by more than an order of magnitude the limits set by previous measurements. Searches for two-body resonances in the $K^{\pm} \to \pi\mu\mu$ decays in the accessible range of masses and lifetimes are also presented. The second part of the talk is devoted to the present status of the search for $K^{+} \to \pi^{+}\nu\overline{\nu}$ at NA62. $K^{+} \to \pi^{+}\nu\overline{\nu}$ is one of the theoretically cleanest meson decay where to look for indirect effects of new physics, complementary to LHC searches. The NA62 experiment at CERN SPS is designed to measure the Branching Ratio of this decay with 10% precision. The performance of the sub-detectors of the experiment and the quality of the data collected in two pilot runs (2014 and 2015), acquired in view of the final measurement, are presented.

Status and future prospects for cLFV searches at BESIII

MingGang Zhao (Nankai University)

Here we present the latest results of cLFV searches at the BESIII experiment. The prospects and challenges with the future data are also discussed.

Development of the muon linac for the muon g-2/EDM experiment in J-PARC

Ryo Kitamura (University of Tokyo)

The muon anomalous magnetic moment (g-2) has a difference of approximately three standard deviations between the measured value by the BNL E821 experiment and the standard model (SM) prediction. More precise measurement is required since it might imply an evidence of the physics beyond SM. The J-PARC E34 experiment aims to measure muon g-2 with a statistical uncertainty of 0.1 ppm and search for the muon EDM with novel techniques. The muon acceleration is one of the most important techniques for our measurement. The muon-dedicated linac which consists of RFQ followed by several types of RF cavities, is being developed. The muon deceleration with a thin metal foil and an electro-static lens are required in order to demonstrate the muon RFQ acceleration which will be first case in the world. First, the conventional surface muons with an energy of 4 MeV are injected to the foil and decelerated to sub-keV. Then the decelerated muons are extracted and accelerated to 5.6 keV by the electro-static lens. Finally the muons will be injected to the RFQ and accelerated to 0.34 MeV. We succeeded in the muon deceleration and electro-static acceleration in February 2016 at J-PARC MLF and we are ready for the muon acceleration with RFQ. This talk presents the current status of the experimental components, especially the muon acceleration developments.

The Muon g-2 Experiment at Fermilab

Wesley Gohn (University of Kentucky)

A new measurement of the anomalous magnetic moment of the muon, $a_\mu \equiv (g-2)/2$, will be performed at the Fermi National Accelerator Laboratory with data taking beginning in 2017. The most recent measurement, performed at Brookhaven National Laboratory and completed in 2001, shows a 3.3-3.6 standard deviation discrepancy with the standard model value of g-2. The new measurement will accumulate 20 times those statistics using upgraded magnet, detector, and storage ring systems, enabling a measurement of g-2 to 140 ppb, a factor of 4 improvement in the uncertainty the previous measurement. This improvement in precision, combined with recent improvements in our understanding of the QCD contributions to the muon g-2, could provide a better than 5σ discrepancy from the standard model, a clear indication of new physics.

Microwave Spectroscopy of the Muonium Atom at Zero and a High Magnetic Field.

Hiroyuki A. Torii (University of Tokyo)

The muonium is a hydrogen-like atom composed of a positive muon and an electron. Purely leptonic feature of this exotic atom allows rigorous test of bound-state QED (quantum electrodynamics) as well as precise determination of the magnetic moment of muon and hence its mass. The ratio of magnetic moments between muon and proton is an indispensable input parameter in deducing the anomalous magnetic moment (g - 2), an important physical quantity for the test of the Standard Model and beyond. MuSEUM Collaboration aims at a precision microwave spectroscopy of the ground state of the muonium atom at J-PARC in Japan. High-intensity pulsed muon beams will be stopped in a krypton gas target in a microwave cavity to form muonium atoms. Resonant spin-flip transitions between hyperfine sublevels of the atom will then be detected by observation of positrons emitted favorably in the direction of the muon spin at the time of the muon decay. The center frequency of the resonance will be determined at an ultimate relative precision of the order of 10 ppb (10^{-8}). We are planning our measurement under two complementary conditions: one at a high magnetic field of 1.7 T, and another at zero field. The major source of the uncertainty was statistics in the past experiments, which can be reduced with the high-intensity beam, while systematic uncertainties will be minimized by various improvements in our experimental setup and careful considerations with computer simulations. Extensive studies have been done for uncertainties arising from microwave power fluctuations, magnetic field inhomogeneity, muon stopping distribution and gas-density shift of resonance frequencies. Our recent progresses and results will be presented in the oral talk.

New DC muon beamline, MuSIC : present status of beamline commissioning and prospects

Dai Tomono (Osaka University)

We have been developed a new DC muon beamline, MuSIC (MUon Science Innovative muon beam Channel) at Research Center for Nuclear Physics (RCNP), Osaka University. The MuSIC beamline consists of the world's most efficient DC muon beam source using the first pion pion capture solenoid system, and successive muon beam transport magnets to the experimental port. We have been already demonstrated to provide 10^8 positive and 10^7 negative muons at the solenoid exit. Recently, we have been succeeded in transporting 3x10^4 surface muons at the experimental port. Then, we have performed commissioning with beamline apparatus, and beam feasibility tests for further applications of scientific programs, such as muonic X-ray measurements for nuclear physics, chemistry, and astrophysics, and muSR measurements for condensed matter physics, and so forth. In our presentation, we will show a present status, beamline commissioning test, some results of the beam intensity, profile and spin measurements and the plan and prospects at MuSIC beamline.

The experiment to search for the muon to electron conversion at J-PARC MLF

Daiki Nagao (Osaka University)

Muon to electron conversion (μ-e conversion) is one of the charged lepton flavor violation (cLFV) processes, which is forbidden in the Standard Model of the particle physics (SM). However, theories beyond the SM predict the existence of the cLFV signature at the observable branching ratio. Therefore, the discovery of μ-e conversion is a clear evidence of the new physics beyond the SM.

DeeMe is an experiment to search for μ-e conversion at J-PARC Material and Life Science Experimental Facility (MLF). DeeMe utilizes the 3-GeV 25-Hz pulsed proton beam from Rapid Cycling Synchrotron (RCS). The signal electrons from μ-e conversion are produced in the muon production target and transported to the magnetic spectrometer by H Line. These electrons are directly emerged from the target with mono-energy and delayed timing, therefore they can be easily identified by momentum and time analysis. The single event sensitivities achieved by DeeMe for 1-year data acquisition are estimated to be 1×10^{-13} and 2×10^{-14} with graphite and Silicon-Carbide target. DeeMe is expected to improve the current limit by two orders of magnitude. The current upper limits of mu-e conversion are 4.3×10^{-12} for Ti and 7×10^{-13} for Au.

DeeMe already has the Stage-2 approval from PAC under KEK-IMSS (Institute of Materials Structure Science), and we are aiming to start this experiment in 2016. In this talk, the recent status of DeeMe will be reported.

PRISM/PRIME

Jean-Baptiste Lagrange (Imperial College, London)

no abstract received

WG5

Neutrinos Beyond PMNS

Parallel Session #2 Tuesday

Parallel Session #3 Tuesday

Parallel Session #5 Thursday

Parallel Session #6 Thursday

Parallel Session #10 Friday

Lepton mixing and neutrino masses from A5 and CP

Andrea Di Iura (Roma Tre University)

Some properties of lepton mixing and neutrino masses can be computed under the assumption of A5 and CP as a symmetry in the leptonic sector. The results show that four mixing patterns accommodate well the oscillation data, i.e. all the mixing angles are in the 3sigma confidence region. We also introduce an explicit realization of this framework in the case of the Weinberg operator where the neutrino mass spectrum can be computed.

Mass limit for light flavon in neutrino flavor model

Yusuke Shimizu (Hiroshima University)

no abstract received

Sterile Neutrino Dark Matter Production from Scalar Decay

Michael Schmidt (University of Sydney)

Sterile neutrinos with a mass in the keV range form a good candidate for dark matter. They are naturally produced from neutrino oscillations via their mixing with the active neutrinos. However the production via non-resonant neutrino oscillations has recently been ruled out. Sterile neutrino dark matter production from scalar decay is an attractive possibility to circumvent astrophysical constraints. I will discuss sterile neutrino DM production from scalar decay and its implications for small-scale structure. In particular I will focus on the neutrinophillic two Higgs doublet model, where neutrino mass is generated via the radiative seesaw or the usual seesaw mechanism with an additional suppression from a vev seesaw.

IceCube Events from Heavy DM decays through the Right-handed Neutrino Portal

Yong Tang (Korea Institute for Advanced Study)

The recent IceCube PeV events could come from astrophysical source or due to heavy decaying dark matter. We propose a scenario where dark matter decay through the right-handed neutrino portal interaction. The resulting dominant channels are three-body decays. The model is constructed with a dark sector with an additonal gauge symmetry to

stablize dark matter

New Physics in Astrophysical Neutrino Flavor

Jordi Salvado (Instituto de Fisica Corpuscular, Valencia)

no abstract received

Testing the Dark Matter Scenario for PeV Neutrinos Observed in IceCube

Ranjan Laha (KIPAC, Stanford University)

Late time decay of very heavy dark matter is considered as one of the possible explanations for diffuse PeV neutrinos observed in IceCube. We consider implications of multimessenger constraints, and show that proposed models are marginally consistent with the diffuse gamma-ray background data. Critical tests are possible by a detailed analysis and identification of the sub-TeV isotropic diffuse gamma-ray data observed by Fermi and future observations of sub-PeV gamma rays by observatories like HAWC or Tibet AS+MD. In addition, with several-year observations by next-generation telescopes such as IceCube-Gen2, muon neutrino searches for nearby dark matter halos such as the Virgo cluster should allow us to rule out or support the dark matter models, independently of gamma-ray and anisotropy tests.

Review on theoretical and experimental prospects on Neutrinoless Double Beta Decay

Stefano Dell'Oro (INFN Gran Sasso Science Institute, L'Aquila)

no abstract received

On neutrinoless double beta decay in the nuMSM

Hiroyuki Ishida (Shimane University, Matsue)

We consider the Standard Model (SM) extended by three right-handed neutrinos with the masses below the electro-weak scale, which is called the nuMSM. The seesaw mechanism for the tiny active neutrino masses works even in this case by taking the very suppressed neutrino Yukawa couplings. In this model the dark matter can be the lightest right-handed neutrino and the baryon asymmetry of the universe can be explained by other two heavier right-handed neutrinos by invoking the mechanism via neutrino oscillations. We examine the neutrino less double beta decay in the nuMSM. We show analytically that the effective mass of the neutrino less double beta decay can exceeds the SM prediction without loss of the successful baryogenesis. Especially, we show that the effective mass can be three times larger than the SM prediction when the active neutrino masses follow the inverted hierarchy.

Leptonic CP Violation Predictions from Discrete Flavour Symmetry Approach

Arsenii Titov (SISSA)

Work done in collaboration with I. Girardi and S.T. Petcov

In the reference 3-neutrino mixing scheme leptonic CP violation can be caused by the Dirac, δ, and/or Majorana, α_{21} and α_{31}, CP violation phases present in the unitary neutrino mixing matrix U. Using the fact that $U = U_e^\dagger U_\nu$, U_e and U_ν being unitary matrices which diagonalise the charged lepton and neutrino mass matrices, respectively, we consider in a systematic way forms of U_e and U_ν allowing us to derive sum rules for $\cos\delta$, α_{21} and α_{31}, i.e., to express them in terms of the measured neutrino mixing angles present in U and the angles (and phases in the case of sum rules for α_{21} and α_{31}) contained in U_ν, whose values are fixed by discrete flavour symmetry (generalised CP symmetry). We consider several concrete forms of U_ν, including bimaximal, tri-bimaximal, golden ratio mixing forms. For each of these forms and forms of U_e allowing to reproduce the measured values of the neutrino mixing angles, we obtain numerical predictions for δ, α_{21} and α_{31}. We then perform a statistical analysis of the predictions for δ. Finally, using the obtained values of the CP violation phases, we present predictions for the effective Majorana mass in neutrinoless double beta decay. Our results, in particular, show that the measurement of δ along with improvement of the precision on the neutrino mixing angles can provide unique information as regards the possible existence of a new fundamental symmetry in the lepton sector.

Based on arXiv:1410.8056, arXiv:1504.00658 and arXiv:1605.04172.

Searching for neutrinoless double beta decay with bolometers

Ke Han (Shanghai Jiao Tong University)

Neutrinoless double beta decay is the only practical probe to the Majorana nature of neutrinos. Large mass bolometer arrays offer superb energy resolution, versatility in isotope choice, and large isotope mass at a reasonable cost. The CUORE experiment will search for neutrinoless double beta decay of Te-130 using a ton-scale bolometer array with 5 keV resolutions. It will be sensitive to an effective neutrino mass of 40-100 meV and one of the most competitive experiments under construction. CUPID, a future bolometer array with photon readout will push the sensitivity by another factor of 5 to cover the inverted mass hierarchy phase space. In this talk, I will present the latest status and physics reach of CUORE as well as conceptual design and R&D effort towards CUPID.

The Status of NEXT

Ben Jones (University of Texas at Arlington)

For experiments searching for neutrinoless double beta decay, the capability to effectively reject backgrounds from radioactivity is be pivotal for success. Gaseous xenon TPC detectors offer unique background rejection capabilities over solid- and liquid-phase technologies. The NEXT-NEW detector is being commissioned in the Laboratorio Subterráneo de Canfranc (LSC) to begin operation in 2016, and will be followed by the NEXT-100 neutrinoless double beta decay search. This talk will describe the status of the NEXT program and present updates on the commissioning of NEXT-NEW. It will also describe R&D towards ultra-low-background xenon gas detectors, including the development of a barium daughter tagging scheme based on single molecular fluorescence imaging.

Search for neutrinoless-double-beta decay with EXO-nEXO

Guofu Cao (Institute of High Energy Physics CAS, Beijing)

no abstract received

Testing the Direct and Indirect Unitarity Violation at a Neutrino Factory

Jian Tang (Sun Yat-Sen University in China)

The mixing of existing active neutrinos with possible light or heavy sterile ones is defined as direct or indirect unitarity violation of the effective 3x3 leptonic mixing matrix. Sensitivity potential of unitarity violation parameters with a neutrino factory is presented in a minimal hybrid framework with one light and one heavy sterile neutrinos. Possibility of discriminating between the direct and indirect unitarity violation is discussed and non-trivial sources of leptonic CP violation are illustrated. Finally we stress that probing the generic feature of unitarity violation and origin of leptonic CP violation could constitute the driving force for the neutrino factory.

Will atmospheric neutrino experiment at Hyperkamiokande see non-standard interaction effects?

Osamu Yasuda (Tokyo Metropolitan University)

It has been pointed out that the values of the mass squared difference from the solar and KamLAND experiments are different, and one of the possible explanations for the difference is due to the non-standard flavor dependent interaction in propagation of neutrinos. We show that the future atmospheric neutrino experiment at Hyperkamiokande has a chance to see signals of such a non-standard interaction at some significance, if the difference between the two values of the mass squared difference is caused by the non-standard interaction.

Viable models for large Non-Standard neutrino interaction

Yasaman Farzan (IPM, Tehran)

It has been recently shown that in the presence of non-standard neutrino interaction with matter, even with an effective coupling as small as 0.01 times the Fermi constant, the proposed long baseline experiments may lose their ability to extract the yet-unknown neutrino parameters such as the Dirac CP-violating phase or the octant of θ_{23}. We introduce models based on new $U(1)$ gauge symmetries with a sub-GeV gauge boson that give rise to both lepton flavor conserving and violating neutral current neutrino interaction with matter. We discuss various experimental constraints and suggest observations to test these models.

WG1

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WG2

Parallel Session #5 Thursday

1. Hadron Production Measurements with NA61/SHINE for Neutrino Experiments
   Katarzyna Kowalik (NCNR, Warsaw) 28
2. DUNE Near Detectors
   Hongyue Duyang (University of South Carolina) 28
3. HK and T2K Upgrade Near Detectors
   Mark Rayner (University of Geneva) 28

Parallel Session #6 Thursday

1. Impact of systematic uncertainties on neutrino oscillation analysis
   Erica Vagnoni (INFN & Università degli Studi Roma Tre) 28
2. T2K Near Detector Constraints
   Leïla Haegel (University of Geneva) 28
3. NOvA Near Detector Constraints
   Greg Pawloski (University of Minnesota, Minneapolis) 28

Hadron Production Measurements with NA61/SHINE for Neutrino Experiments

Katarzyna Kowalik (National Centre for Nuclear Research, Warsaw)

We present latest results on hadron production in proton-carbon interactions at 31GeV/c measured by the NA61/SHINE experiment at CERN SPS. Data have been taken with a thin 2cm carbon target and with a 90 cm long replica of the T2K target. They aim at improving the precision of neutrino flux predictions in the T2K long baseline experiment. Recently published new measurements for the thin target are based on the largest dataset and include spectra of charged hadrons $\pi^{\pm}$, $K^{\pm}$ and protons as well as neutral hadrons Λ^0 and K^0_s. Results combine different analysis techniques to provide a better precision in the region measured so far and to extend the coverage in momentum and polar angle in the region of interest to T2K. We also report on the new published $\pi^{\pm}$ results for the T2K replica target. Measurements with the replica target have the advantage to cover at the same time particles originating from primary interactions as well as particles from hadron re-interactions inside the target. The dedicated method that has been developed to include these measurements in the T2K flux simulations will be discussed followed by published and an ongoing analysis results for the large dataset taken with the replica target that is expected to further improve the precision of flux predictions. The success of the NA61/SHINE measurements for T2K resulted in the approval of similar program for Fermilab neutrino physics and here plans for the next few years will be discussed.

DUNE Near Detectors

Hongyue Duyang (University of South Carolina)

no abstract received

HK and T2K Upgrade Near Detectors

Mark Rayner (University of Geneva)

no abstract received

Impact of systematic uncertainties on neutrino oscillation analysis

Erica Vagnoni (INFN & Università; degli Studi Roma Tre)

Modern experiments aimed at measuring neutrino oscillation parameters have entered the age of precision. The determination of these parameters strongly depends on the ability to reconstruct the energy distributions of neutrino beams. I discuss two different energy reconstruction techniques: the reconstruction based on the kinematic of the outgoing lepton and the one based on the calorimetric method, including realistic detector capabilities. Furthermore, I will also present the results of a study aimed at quantify how the oscillation analysis is affected by the uncertainties associated with the description of the neutrino-nucleus cross section in the 2p2h sector.

T2K Near Detector Constraints

Leïla Haegel (University of Geneva)

The T2K experiment is a long-baseline accelerator neutrino experiment using a near detector complex ND280 and a far detector, Super-Kamiokande. Neutrino interactions are detected by Cherenkov light in Super-Kamiokande in order to measure neutrino oscillation parameters. The accuracy of the oscillation parameter measurements depends on our knowledge of neutrino interactions, the neutrino flux and the detector response. ND280 is composed of a tracker and several sub-detectors designed to characterise the neutrino beam before oscillation, which allows us to constrain the uncertainties on the neutrino interaction and the accelerator flux models. In this talk we present the result of a fit on the ND280 data, as well as a study of the robustness of the fit to the choice of neutrino interaction model. The constraint obtained on the oscillation parameters is also discussed.

NOvA Near Detector Constraints

Greg Pawloski (University of Minnesota, Minneapolis)

no abstract received

WG1

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WG2

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WG3

Parallel Session #7 Thursday

1. NuPIL Overview
   Alan Bross (Fermilab, Batavia) 30

2. MOMENT Overview
   Jingyu Tang (Institute of High Energy Physics CAS) 30

3. EMuS in CSNS
   Ye Yuan (IHEP, Beijing) 30

4. The ERC ENUBET Project: high precision neutrino flux measurements in conventional neutrino beams
   Francesco Terranova (Univ. di Milano Bicocca and INFN) 30

NuPIL Overview

Alan Bross (Fermilab, Batavia)

no abstract received

MOMENT Overview

Jingyu Tang (Institute of High Energy Physics CAS)

MOMENT is designated as the third development stage of neutrino oscillation experiments following Daya Bay Neutrino Experiment (DYB) and Jiagnmen Underground Neutrino Observatory (JUNO) in China, or a long-term project probably in late 2020s. It employs the most powerful proton accelerator of an ADS-like linac as the proton driver to produce a very intense and medium-energy neutrino beam mainly for the leptonic CP violation phase measurement. Another key property of the MOMENT scheme is the use of muon decays for the production of neutrinos in a long decay channel by superconducting solenoids. The talk overviews the recent progress of the project study, and also some relevant study such as the companion project – Experimental Muon Source at China Spallation Neutron Source.

EMuS in CSNS

Ye Yuan (IHEP, Beijing)

MuSR is a useful tool which use muons as magnetic probes in matter. There are several MuSR running around world. Now a R&D program named EMuS had been approved to setup a new MuSR in China.

The EMuS will be located in CSNS, Dongguan. Use 4KW/20KW 1.6GeV proton beam from CSNS hit target to generate surface muons and pions, then secondary particels will be collected and transfered. Besides polarized muons used as MuSR, neutrinos decayed from pions and muons are planned to be used to do various experiments.

Unlike those previous MuSR, EMuS adopted adiabatic particle capture system concept from Neutrino Factory and COMET, so a higher intensity muon beam is expected to be achieved. This would make EMuS a place with good competitiveness for material analysis and neutrino physics. The layout of the project, design of the proton beamline, target station, MuSR beamline, neutrino muon beamline and MuSR will be reported.

The ERC ENUBET Project: high precision neutrino flux measurements in conventional neutrino beams

Francesco Terranova (Univ di Milano Bicocca and INFN)

The challenges of precision neutrino physics require measurements of absolute neutrino cross sections at the GeV scale with exquisite (1%) precision. This precision is presently limited to by the uncertainties on neutrino flux at the source. A reduction of this uncertainty by one order of magnitude can be achieved monitoring the positron production in the decay tunnel originating from the K_{e3} decays of charged kaons in a sign and momentum selected narrow band beam. This novel technique enables the measurement of the most relevant cross-sections for CP violation (nue and antinue) with a precision of 1% and requires a special instrumented beam-line. Such non-conventional beam-line will be developed in the framework of the ENUBET Horizon-2020 Consolidator Grant, recently approved by the European Research Council. In this talk, we will present the Project, the first experimental results on ultra-compact calorimeters that can embedded in the instrumented decay tunnel and the advances on the simulation of the beamline. We also discuss the detector and accelerator activities that are planned in 2016-2021.

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Parallel Session #1 Monday

1. Non-Standard neutrino interactions at running reactor and beam-based neutrino oscillation facilities
   David Vanegas Forero (Virginia Tech) 32
2. New Physics Searches at ESSnuSB
   Mattias Blennow (Royal Institute of Technology, Stockholm) 32
3. New Physics Searches at DUNE
   Kevin Kelly (Northwestern University, Evanston) 32

Parallel Session #8 Friday

1. Impact of sterile neutrinos on CP and mass hierarchy at long baselines
   TBD 32
2. eV Scale Sterile at LBL & SBL (Exp.)
   Roxanne Guenette (University of Oxford) 32
3. eV Scale Sterile at SBL (Exp.)
   Alessandro Minotti (CEA Saclay) 32

Parallel Session #9 Friday

1. Results of the Search for Sterile Neutrinos with IceCube
   Ben Jones (University of Texas at Arlington) 32
2. Non-Unitarity of the PMNS matrix
   Mark Ross-Lonergan (IPPP Durham University) 32
3. Neutrino Oscillations in Matter with Direct and Indirect Unitarity Violation in the Lepton Mixing Matrix
   Shu Luo (Xiamen University) 33

Non-Standard neutrino interactions at running reactor and beam-based neutrino oscillation facilities

David Vanegas Forero (Virginia Tech)

After the measurement of the reactor mixing angle, there are two main unknowns in the three neutrino standard oscillation framework, namely the neutrino mass ordering and the establishment of CP violation in the neutrino sector. At the same time, Non-Standard neutrino interactions (NSI) provides a model independent Beyond the Standard Model scenario that can be probed in neutrino oscillations measured at different facilities. Along this talk I will introduce the NSI framework with some emphasis in the current NSI constraints and the NSI modifications to the Standard oscillation probabilities. After that I will give two examples of the NSI effects that can be tested at current reactors and accelerator-based facilities. Finally, I will comment on the NSI implications for the future neutrino program devoted to measure the mentioned unknowns.

New Physics Searches at ESSnuSB

Mattias Blennow (Royal Institute of Technology, Stockholm)

no abstract received

New Physics Searches at DUNE

Kevin Kelly (Northwestern University, Evanston)

no abstract received

Impact of sterile neutrinos on CP and mass hierarchy at long baselines

TBD

My talk will be based upon 1. JHEP 1511 (2015) 039 and 2. an upcoming paper. With the Deep Underground Neutrino Experiment (DUNE) as an example, we show that the presence of even one sterile neutrino of mass ∼1 eV can significantly impact the measurements of CP violation and mass hierarchy in long baseline experiments. Using a probability level analysis and event rate calculations, we discuss the large magnitude of these effects, and show how they translate into significant deviations on the chisquare level at DUNE and also at NOvA, T2K and T2HK. Our results demonstrate that measurements which, when interpreted in the context of the standard three family paradigm, indicate CP conservation at long baselines, may, in fact hide large CP violation if there is a sterile state. Similarly, any data indicating the violation of CP cannot be properly interpreted within the standard paradigm unless the presence of sterile states of mass O(1 eV) can be conclusively ruled out. Our work underscores the need for a parallel and linked short baseline oscillation program and a highly capable near detector for DUNE, in order that its highly anticipated results on CP violation in the lepton sector may be correctly interpreted.

eV Scale Sterile at LBL & SBL (Exp.)

Roxanne Guenette (University of Oxford)

no abstract received

eV Scale Sterile at SBL (Exp.)

Alessandro Minotti (CEA Saclay)

no abstract received

Results of the Search for Sterile Neutrinos with IceCube

Ben Jones (University of Texas at Arlington)

The IceCube neutrino telescope at the South Pole has measured the atmospheric muon neutrino spectrum as a function of zenith angle and energy. Sterile neutrinos with eV-scale mass, as motivated by anomalies in short-baseline experiments, would be expected to cause significant changes in the $\overline{\nu_\mu}$ survival probability due to resonant, matter enhanced oscillations. For a 1 eV^2 sterile neutrino these effects would be strongest at energies around 3 TeV, where the statistics of the IceCube sample are high. This allows us to search for sterile neutrinos with small mixing angles in the mass range of interest. In this talk I will present the first results of this search.

Non-Unitarity of the PMNS matrix

Mark Ross-Lonergan (IPPP Durham University)

no abstract received

Neutrino Oscillations in Matter with Direct and Indirect Unitarity Violation in the Lepton Mixing Matrix

Shu Luo (Xiamen University)

no abstract received

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Parallel Session #6 Thursday

Targets for high-intensity muon sources for cLFV experiments

Satoshi Mihara1 (KEK, Tsukuba)

Physical stability of the pion production target is indispensable for producing high-intensity muon beam for the use in cLFV experiments. Different kinds of materials have been investigated for this purpose along with suitable cooling methods. Recently light material such as graphite has been used in many facilities thanks to its stability at high temperature while a new composite material, silicon carbide (SiC) is also being studied. Silicon carbide is as refractory as graphite and has a density larger than graphite. We report our R&D plan of silicon carbide to be used as a pion production target at J-PARC.

Status and future prospects for charged Lepton flavor violation searches at B factories and Belle-II

Tomoyuki Konno (KEK IPNS, Tsukuba)

Lepton Flavor Violating (LFV) tau decays are strongly suppressed in the Standard Model while some of New Physics models indicates the branching fractions of several tau LFV decay modes are observable in the B factory experiments. Belle has studied 48 LVF tau decay modes and set 90% C.L. upper limits on the branching fractions, which are several orders of magnitude larger than the prediction. And then the experiment is in an upgrade to increase statistics of the data sample by a factor of 50. In this presentation, we review the current tau LFV studies and discuss future prospects in the Belle II experiment.

MuCool at PSI

Angela Papa (PSI, Villigen)

no abstract received

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Parallel Session #4 Wednesday

Accelerator developments for SHiP and FCC
Linda Stoel (CERN, Geneva)

The CERN SPS fixed target progamme in the so-called North Area uses a third order slow extraction to extract a 400 GeV proton beam onto experimental targets in a few seconds. The proposed SHiP experiment (Search for Hidden Particles) will demand record numbers of slow-extracted protons for fixed target physics at 400 GeV. Without improvement of the extraction efficiency this would induce hihger levels of activation making hands-on maintenance of the extraction hardware prohibitive. The main challenges and developments towards these improvements are presented. For the further future (physics data could possibly start in 2035) a Future Circular Collider is under study. This is based on a 100 km pp-collider at 100 TeV centre of mass, which might be preceded by a 100 km e+e–collider. This study, and in particular the high energy proton booster ring needed for it, may also provide an interesting opportunity for fixed target experiments at roughly 1.5-3.3 TeV proton energy. The physics challenges for such a project are outlined together with some of the possible future developments that could ensure the slow extraction of such a beam onto a target.

Neutrino physics discovery potential at the FCC
Marcin Chrzaszcz (University of Zurich)

The European Laboratory for Particle Physics, CERN, is presently studying a Future Circular Collider Complex (FCC), which includes a 100 TeV pp collider as ultimate goal, and high-luminosity Z, W, H and top e+e- factory ($\sqrt{s}$ = 90-370 GeV) as a possible first step. The extremely large rates of Z and W production at both machines open the possibility to observe the right-handed partners of the neutrinos. The sensitivity as a function of mass and couplings is extends all the way down to the see-saw limit for the mass range between 20 and 80 GeV. The complementarity of observations in Z decays and in W decays is discussed.

Physics and Experimental Development towards IsoDAR@KamLAND
Jose R Alonso (MIT)

The high endpoint $\overline{\nu_e}$ energy (13 MeV) from the beta decay of Li-8 provides for a high-sensitivity Isotope Decay-At-Rest probe for sterile neutrinos in the $\delta m^2 \sim 1$ to 10 eV^2 region. The First-generation IsoDAR experiment places a Li-8 source approximately 16 meters from the center of the 1 kton liquid scintillator KamLAND detector, providing the opportunity for observing few-meter wavelength oscillations directly in the fiducial volume of KamLAND. This experiment can also make precision electroweak measurements. A next-generation experiment can be constructed at a multi-kiloton site, such as JUNO. In order to produce the flux, Li-8 is generated primarily by neutron capture on Li-7. Neutrons are produced by a 10 mA, 60 MeV beam of protons striking a beryllium target. The proton beam is provided by a compact cyclotron that accelerates 5 mA of molecular H2+ ions. This talk addresses the physics opportunities and the recent results of our R&D program in addressing the technical challenges.

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Parallel Session #7 Thursday

Global constraints on Seesaw neutrino mixing

Josu Hernandez (IFT UAM, Madrid)

We derive constraints on the mixing of heavy Seesaw neutrinos with the SM fields. We explore and compare both a completely general scenario where the heavy neutrinos are integrated out and the more constrained case of only 3 extra heavy states. The latter assumption implies non-trivial correlations that do not allow to saturate all model-independent bounds. Among the electroweak and flavor observables included in the global fit, $\mu \Rightarrow e\gamma$ sets the present strongest bound on the additional neutrino mixing, while in the future it will be dominated by $\mu - e$ conversion in nuclei. Increasing its sensitivity in future experiments could probe non-unitarity in lepton-flavor-violating processes.

Electric dipole moments of charged leptons with sterile fermions

Takashi Toma (LPT Orsay)

We address the impact of sterile fermions on charged lepton electric dipole moments. First, we consider a minimal extension of the Standard Model via the addition of sterile fermions which mix with active neutrinos. Our study reveals that, in order to have a non-vanishing contribution in this framework, the minimal extension necessitates the addition of at least 2 sterile fermion states to the Standard Model field content. Our conclusion is that sterile neutrinos can give significant contributions to the charged lepton electric dipole moments, some of them lying within present and future experimental sensitivity if the masses of the non-degenerate sterile states are both above the electroweak scale. The Majorana nature of neutrinos is also important in order to allow for significative contributions to the charged lepton electric dipole moments. Second, we apply this computation for electric dipole moments for the Inverse Seesaw model as an specific model. In this case, the two pairs of (heavy) pseudo-Dirac mass eigenstates can give significant contributions to the electron electric dipole moment, lying close to future experimental sensitivity if their masses are above the electroweak scale. The major contribution comes from two-loop diagrams with pseudo-Dirac neutrino states running in the loops. In our analysis we further discuss the possibility of having a successful leptogenesis in this framework, compatible with a large electron electric dipole moment.

Conversions of Bound Muons: LFV from Doubly Charged Scalars

Tanja Geib (Max Planck Institute for Physics, Munich)

Apart from naturally explaining their smallness, models in which neutrino masses are generated only at the loop level are particularly interesting as they often contain electrically charged scalar fields. These additional particles contribute in particular to lepton flavour and/or number violating processes, like mu -> e gamma or neutrinoless double beta decay. On the other hand, at LHC new charged scalars could be identified from several decay and production channels, generating complementarity with low energy experiments. Using a radiative model based on an effective vertex as example, we discuss a setting involving a doubly charged scalar particle. However, our results even hold for much more general settings involving such a particle. We focus on a certain lepton flavour violating process, namely mu-e conversion in muonic atoms. This process is particularly interesting since future experiments will improve the bounds on the branching ratio by several orders of magnitude and thus will lead to strong constraints on the model space which could even challenge current LHC bounds. As this framework could stem from several known UV completions, our results are in fact rather general.