43rd SLAC Summer Institute

Report of Abstracts

Abstract ID : **110**

The Direct Detection of Boosted Dark Matter at High Energies and PeV events at IceCube

Content

We study the possibility of detecting dark matter directly via a small but energetic component that is allowed within present-day constraints. Drawing closely upon the fact that neutral current neutrino nucleon interactions are indistinguishable from DMnucleon interactions at low energies, we extend this feature to high energies for a small, non-thermal but highly energetic population of DM particle χ, created via the decay of a significantly more massive and long-lived non-thermal relic φ, which forms the bulk of DM. If χ interacts with nucleons, its cross-section, like the neutrino-nucleus coherent cross-section, can rise sharply with energy leading to deep inelastic scattering, similar to neutral current neutrino-nucleon interactions at high energies. Thus, its direct detection may be possible via cascades in very large neutrino detectors. As a specific example, we apply this notion to the recently reported three ultra-high energy PeV cascade events clustered around $1 - 2$ PeV at IceCube (IC). We discuss the features which may help discriminate this scenario from one in which only astrophysical neutrinos constitute the event sample in detectors like IC.

Summary

Primary author(s) : Dr. GANDHI, Raj (Harish Chandra Research Institute); GUPTA, Aritra (HARISH-CHANDRA RESEARCH INSTITUTE); Dr. BHATTACHARYA, Atri (Dept. of Physics, University of Arizona)

Presenter(s) : GUPTA, Aritra (HARISH-CHANDRA RESEARCH INSTITUTE)

Comments:

I would like to give a short talk on the above mentioned topic.

Status: ACCEPTED

Track Judgements:

Submitted by **GUPTA, Aritra** on **Thursday 07 May 2015**

Abstract ID : **111**

Texture or Minor zeros in Lepton Mass Matrices

Content

The phenomenology of lepton mass matrices with texture zeros or minor zeros are discussed. The flavor symmetry realization of the models are shown.

Summary

Primary author(s) : WANG, Weijian

Presenter(s) : WANG, Weijian

Status: ACCEPTED

Track Judgements:

Submitted by **WANG, Weijian** on **Monday 11 May 2015**

Abstract ID : **112**

Neutrino Masses and Sterile Neutrino Dark Matter from the PeV Scale

Content

The Higgs boson mass of 125 GeV is suggestive of superpartners at the PeV scale. We show that new physics at this scale can also explain the observed active neutrino masses via a modified, low energy seesaw mechanism and provide a sterile neutrino dark matter candidate with keV-GeV scale mass. These emerge in a straightforward manner if the right-handed neutrinos are charged under a new symmetry broken by a scalar field vacuum expectation value at the PeV scale. The dark matter relic abundance can be obtained through active-sterile oscillation, freeze-in through the decay of the heavy scalar, or freeze-in via non-renormalizable interactions at high temperatures. The low energy effective theory maps onto the widely studied νMSM framework. We also demonstrate how the recent observations of PeV energy neutrinos at IceCube and the 3.5 keV X-Ray line arise in our framework.

Summary

Primary author(s) : ROLAND, Samuel (University of Michigan)

Co-author(s) : SHAKYA, Bibhushan; WELLS, James Daniel (University of Michigan (US))

Presenter(s) : ROLAND, Samuel (University of Michigan)

Track Classification : Aug/12

Status: ACCEPTED

Track Judgements:

Submitted by **ROLAND, Samuel** on **Tuesday 26 May 2015**

Abstract ID : **119**

Identification of multi-site events in coplanar grid CZT detectors for the COBRA experiment

Content

COBRA is a next-generation experiment searching for the existence of neutrinoless double beta decay ($0\nu\beta\beta$-decay). The aim is to clarify the nature of neutrinos as either Dirac or Majorana particles. Furthermore, the study of $0\nu\beta\beta$-decay could allow for the identification of the neutrino mass hierarchy realized in nature and the determination of the effective Majorana neutrino mass in case of a signal.
Currently a demonstrator setup at the underground facility LNGS (Italy) built of 4×4×4 coplanar grid (CPG) detectors collects high quality low background physics data with FADC pulse shape sampling. The detectors are made of natural abundant CdZnTe, which is a commercially available room temperature semiconductor. It contains several double beta isotopes, the most promising of which is Cd-116 with a Q-value of 2813.5 keV – which is well above the highest naturally occurring prominent gamma lines. One of the key instruments to further reduce background is the discrimination of so called single-site events (SSE) and multi-site events (MSE). The signal of a double beta decay is expected to be a single detector event with a single-site energy deposition in the crystal. Hence, all MSEs for the same energy can be vetoed as background.
This poster summarizes a newly developed approach to identify MSEs via pulse shape analysis and first efficiency calculations.

Summary

Primary author(s) : ZATSCHLER, Stefan

Presenter(s) : ZATSCHLER, Stefan

Status: ACCEPTED

Track Judgements:

Submitted by **ZATSCHLER, Stefan** on **Friday 10 July 2015**

Abstract ID : **120**

In-situ measurement of the light attenuation in liquid argon in GERDA

Content

The acronym GERDA emerges from Germanium Detector Array and is an experiment searching for neutrinoless double beta decay in ^{76}Ge. It uses germanium detectors which are enriched in ^{76}Ge and operates them naked in liquid argon (LAr), which serves both as a coolant and a shield for external radiation. For Phase II of GERDA it is planned to reach an exposure of 100 $kg \cdot yr$ with a background index (BI) of 10^{-3} cts/$(keV \cdot kg \cdot yr)$. One of the major improvements to further reduce the BI is to instrument the LAr to act as an additional background veto. The attenuation of the scintillation light in LAr creates a constraint on the effective active volume of the LAr veto and is therefore a key parameter to characterize the instrumentation.

In order to measure the light attenuation in LAr, a dedicated setup was designed that could be deployed directly into the GERDA cryostat. This setup consists of a movable beta source and a PMT to measure scintillation light at different distances.

The poster will present the setup, the measurement inside the GERDA cryostat and the analysis of the acquired data.

Summary

Primary author(s) : SCHNEIDER, Birgit

Presenter(s) : SCHNEIDER, Birgit

Status: ACCEPTED

Track Judgements:

Submitted by **SCHNEIDER, Birgit** on **Friday 10 July 2015**

Abstract ID : **140**

Flavor ratios of extragalactical neutrinos and neutrino shortcuts in extra dimensions

Content

The recent measurement of high energy extragalactic neutrinos by the IceCube Collaboration has opened a new window to probe non-standard neutrino properties. Among other effects, sterile neutrino altered dispersion relations (ADRs) due to shortcuts in an extra dimension can significantly affect astrophysical flavor ratios. We discuss an MSW-like resonant conversion arising from geodesics oscillating around the brane in an asymmetrically warped extra dimension. We demonstrate that the second case has the potential to suppress significantly the flux of specific flavors such as ν_μ or ν_τ at high energies.

Summary

Primary author(s) : SICKING, Philipp (TU Dortmund)

Presenter(s) : SICKING, Philipp (TU Dortmund)

Status: ACCEPTED

Track Judgements:

Submitted by **SICKING, Philipp** on **Tuesday 14 July 2015**

Abstract ID : **142**

An introduction to a CC1π^0 exclusive analysis using the ND280 Tracker + ECal

Content

Poster Abstract
Author : Dave Shaw - Lancaster University
The Tokai to Kamioka (T2K) experiment in Japan is designed to investigate properties of neutrinos. A beam of muon neutrinos is produced at the J-PARC facility in Tokai. The beam's flux, composition, energy spectrum and interaction cross section is measured 280 m downstream of the production point at the near detector (ND280). This is measured again after 295 km at the Super-Kamiokande detector. By comparing these two measurements, oscillation parameters can be obtained.

As it is possible for decay photons from neutral pions to be mis-identified as electron neutrino events in Super-Kamiokande, it is of great importance that we clearly understand the mechanisms by which these are produced. This analysis will focus on the muon neutrino charged current single π^0 interactions which occur in the ND280. These interactions will be investigated by selecting events where a muon is produced in one of the fine grained detectors (FGD) and the decay photons from the π^0 are identified using the electromagnetic Calorimeter (ECal) and the time projection chambers (TPCs). This poster will present ideas and preliminary work on such a selection.

Summary

An introduction to a CC1π^0 exclusive analysis using the ND280 Tracker + ECal

Primary author(s) : SHAW, Dave (Lancaster University)

Presenter(s) : SHAW, Dave (Lancaster University)

Status: ACCEPTED

Track Judgements:

Submitted by **SHAW, Dave** on **Wednesday 15 July 2015**

Abstract ID : **143**

Impact of Gravitational Slingshot of Dark Matter on Galactic Halo Profiles

Content

We study the impact of gravitational slingshot on the distribution of cold dark matter in early and modern era galaxies. Multiple gravitational encounters of a lower mass dark matter particle with massive baryonic astrophysical bodies would lead to an average energy gain for the dark matter, similar to second order Fermi acceleration. We calculate the average energy gain and model the integrated effect on the dark matter profile. We find that such slingshot effect was most effective in the early history of galaxies where first generation stars were massive, which smeared the dark matter distribution at the galactic center and flattened it from an initial cusp profile. On the other hand, slingshot is less effective after the high mass first generation stars and stellar remnants are no longer present. Our finding may help to alleviate the cusp-core problem, and we discuss implications for the existing observation-simulation discrepancies and phenomena related to galaxy mergers.

Summary

Primary author(s) : Mr. LIN, Yao-yu (National Taiwan University)

Co-author(s) : Prof. CHEN, Pisin (National Taiwan University); Mr. DUH, Yi-shiou (National Taiwan University); Dr. LABUN, Lance (The University of Texas at Austin)

Presenter(s) : Mr. LIN, Yao-yu (National Taiwan University)

Status: ACCEPTED

Track Judgements:

Submitted by **LIN,** [U+6797] [U+66DC] [U+5B87] on **Wednesday 15 July 2015**

Abstract ID : **145**

Sensitivity analysis of JUNO to large extra dimensions

Content

The upcoming JUNO (Jiangmen Underground Neutrino Observatory) project is a multipurpose neutrino experiment that has as main purpose to determine the hierarchy of massive neutrino states with a confidence level between 3σ and 4σ by collecting data for a period of six years. Also JUNO will determine with a precision better than 1% the oscillation parameters $\sin^2\theta_{12}$, Δm^2_{21} and $|\Delta m^2_{31}|$ and will measure the neutrinos produced by supernova explosions, geo-neutrinos, solar and atmospheric neutrinos. JUNO will have an energy resolution $3\%\sqrt{E_{vis}/1MeV}$ which can be used to put bounds on new physics. We shall do a sensitivity analysis of JUNO to large extra dimensions, consedering that the space-time has four flat space dimensions, and we shall compare our results with the ones obtained by other researchers in the experiment Daya Bay.

Summary

Primary author(s) : BASTO-GONZALEZ, Victor (PUC-RIO)

Co-author(s) : NUNOKAWA, Hiroshi (Pontificia Universidade Catolica do Rio de Janeiro)

Presenter(s) : BASTO-GONZALEZ, Victor (PUC-RIO)

Status: ACCEPTED

Track Judgements:

Submitted by **BASTO-GONZALEZ, Victor** on **Thursday 16 July 2015**

Abstract ID : **146**

KM3NeT: the next-generation neutrino telescope in the Mediterranean Sea

Content

This poster presents KM3NeT: the next-generation neutrino detector in the Mediterranean Sea, which is currently under construction.

Summary

Primary author(s) : VAN EIJK, Daan (Nikhef)

Presenter(s) : VAN EIJK, Daan (Nikhef)

Comments:

The attached file is a first version and thus subject to change.

Status: ACCEPTED

Track Judgements:

Submitted by **VAN EIJK, Daan** on **Thursday 16 July 2015**

Abstract ID : **148**

The MAJORANA DEMONSTRATOR Neutrinoless Double-Beta Decay Experiment

Content

Neutrinoless double-beta decay is the only experimentally viable process which can distinguish whether the neutrino is Majorana or Dirac in nature. Observation of this rare decay would prove that the neutrino mass is generated, at least in part, by Majorana mass terms. This implies that the neutrino is its own antiparticle, and that lepton number is not a conserved quantity. The MAJORANA collaboration is constructing the DEMONSTRATOR to search for neutrinoless double-beta decay in germanium-76 at the 4850-foot level of the Sanford Underground Research Facility in Lead, South Dakota. The DEMONSTRATOR is an array of both natural and ^{76}Ge-enriched HPGe detectors assembled using low-background components, situated within layers of active and passive shielding. The modular cryostat design has allowed physics runs with the first module of enriched detectors to begin while construction proceeds on the second module. Presented here is an overview of the experiment, focusing on the current status and potential physics reach of the DEMONSTRATOR.

Summary

Primary author(s) : SHANKS, Benjamin (UNC - Chapel Hill)

Presenter(s) : SHANKS, Benjamin (UNC - Chapel Hill)

Track Classification : Aug/12

Status: ACCEPTED

Track Judgements:

Submitted by **SHANKS, Benjamin** on **Friday 17 July 2015**

Abstract ID : **149**

Dedicated Trigger for Highly Ionising Particles at ATLAS

Content

In 2012, a new algorithm novel trigger was designed at ATLAS to detect signatures of Highly Ionising Particles (HIPs) such as magnetic monopoles with the ATLAS trigger system. With proton-proton collisions at a centre-of-mass energy of 8 TeV, those the algorithm trigger was designed to detect ionising signatures of HIPs were recorded using the Transition Radiation Tracker (TRT). With this new approach it is possible to probe The new trigger is capable of probing higher monopole masses and charges than before, as well as other HIP signatures such as QBalls and dyons.

We will give a description of the algorithm and its performance during the 2012 data-taking, as well as a comparison to the triggers used so far to detect HIPs in ATLAS. Furthermore an improved algorithm is presented which is expected to efficiency record the events of interest in the challenging environment of Run 2 due to the increased center-of-mass energy and pile-up condidtions.

Summary

Primary author(s) : KATRE, Akshay (Universite de Geneve (CH))

Presenter(s) : KATRE, Akshay (Universite de Geneve (CH))

Status: ACCEPTED

Track Judgements:

Submitted by **KATRE, Akshay** on **Friday 17 July 2015**

Abstract ID : **150**

Data Acquisition for the MAJORANA Demonstrator

Content

The MAJORANA DEMONSTRATOR is a low-background array of germanium detectors constructed to demonstrate the feasibility of future neutrinoless double-beta decay measurements in ^{76}Ge. Low-background non-accelerator experiments have unique requirements for their data acquisition and environmental monitoring, which we must consider. Background signals can easily overwhelm the signals of interest, so events which could contribute to the background must be identified or prevented. Data acquisition is a detailed process that runs from the detector itself through a variety of electronics into a digitized signal, and eventually into the readout software and analysis toolchain. This system is designed to be scalable into a large-scale detector array. This poster will summarize this full path of data acquisition for the MAJORANA DEMONSTRATOR.

Summary

Primary author(s) : MEIJER, Sam (University of North Carolina)

Presenter(s) : MEIJER, Sam (University of North Carolina)

Track Classification : Aug/18

Status: ACCEPTED

Track Judgements:

Submitted by **MEIJER, Sam** on **Friday 17 July 2015**

Abstract ID : **151**

Searching for the neutrinoless double beta decay with the SuperNEMO experiment

Content

The SuperNEMO experiment is looking for the neutrinoless double beta decay which, if observed, would prove the Majorana nature of the neutrino. Under the assumption neutrinos are indeed identical to their antiparticles, the detector could not only constrain the effective neutrino mass but also identify precisely the mechanism responsible for the neutrinoless double beta decay among the several hypothesized today (light Majorana neutrino exchange, Right-Handed Currents,etc...). The unique detector design combines tracking and calorimetry techniques allowing a full event topology reconstruction and thus, a powerful background identification and rejection. It also gives access to other rare processes such as the double beta decay to the excited states of the daughter nucleus.

Summary

Primary author(s) : CALVEZ, Steven (Laboratoire de l'Accélérateur Linéaire)

Presenter(s) : CALVEZ, Steven (Laboratoire de l'Accélérateur Linéaire)

Status: ACCEPTED

Track Judgements:

Submitted by **CALVEZ, Steven** on **Friday 17 July 2015**

Abstract ID : **152**

Pulse shape analysis of CUORE-0 bolometers

Content

Neutrinoless double beta decay is a decay mode in which two neutrons are converted in two protons and two electrons are emitted. This process can take place only if neutrino is its own antiparticle. Thus it is a unique tool to probe the Majorana nature of the neutrino. CUORE (Cryogenic Underground Observatory for Rare Events) aims to detect neutrinoless double beta decay of the ^{130}Te. The CUORE experiment, currently in its construction phase, will consist of an array of 998 TeO_2 bolometers and will be operated at 10 mK temperature in Laboratori Nazionali del Gran Sasso.
CUORE-0, the first tower of CUORE, an array of 52 TeO_2 crystals, has been operated in the last two years as a full CUORE prototype. The large amount of data collected by CUORE-0 makes it ideal to study in detail the performances of bolometric detectors.
The goal of my analysis is to study of CUORE-0 detectors response and behaviour. The bolometric technique is based on the measurement of the energy released by an interacting particle converted in to phonons. Despite the simple model of an ideal bolometer the actual response is much more complex. Finding the different components of the CUORE-0 pulses and correlating them to physics parameters will allow a better understanding of the detectors and possible improvements of the response. In my analysis I first defined a set of variables to describe the pulse shape. Then I started the study of correlation between pulse shape parameters and detector response.

Summary

Primary author(s) : SANTONE, Daria (Università dell'Aquila/ LNGS-INFN)

Presenter(s) : SANTONE, Daria (Università dell'Aquila/ LNGS-INFN)

Status: ACCEPTED

Track Judgements:

Submitted by **SANTONE, Daria** on **Friday 17 July 2015**

Abstract ID : **153**

Background Reduction Strategies for the MAJORANA DEMONSTRATOR

Content

The MAJORANA Collaboration is seeking neutrinoless double-beta decay ($0\nu\beta\beta$) using an array of P-type point contact (PPC) high-purity germanium (HPGe) detectors isotopically enriched in ^{76}Ge. For inverted hierarchy neutrinos, a tonne-scale array with backgrounds of < 1 ct/ROI-t-y in the 4 keV region of interest (ROI) around the 2039 keV Q-value for double-beta decay in ^{76}Ge will be sensitive to $0\nu\beta\beta$ decay. In order to demonstrate the feasibility of such an experiment, the MAJORANA DEMONSTRATOR is being constructed at the 4850' level of the Sanford Underground Research Facility (SURF). The DEMONSTRATOR will consist of an array of 40 kg of PPC HPGe detectors, 30 kg of which will be enriched to 87% in ^{76}Ge.The background goal for the DEMONSTRATOR is < 3 cts/ROI-t-y, which is expected to scale down to < 1 ct/ROI-t-y for a tonne-scale experiment. A variety of strategies are employed in order to acheive such a low background, including the development of low background materials and components, clean handling of components, a compact shield, and an extensive background estimation and verification campaign. This poster will describe several examples of the use of these strategies for the MAJORANA DEMONSTRATOR.

Summary

Primary author(s) : GUINN, Ian (University of Washington)

Presenter(s) : GUINN, Ian (University of Washington)

Track Classification : Aug/12

Status: ACCEPTED

Track Judgements:

Submitted by **GUINN, Ian** on **Saturday 18 July 2015**

Abstract ID : **154**

Analysis Techniques for the MAJORANA DEMONSTRATOR

Content

The MAJORANA DEMONSTRATOR is a low-background array of approximately 40 kg of germanium detectors searching for neutrinoless double-beta (0nbb) decay in germanium-76, deployed 4,850 feet underground at the Sanford Underground Laboratory in Lead, South Dakota, USA. Our primary objective is to demonstrate background levels low enough to justify constructing a ton-scale experiment with the same design principles which will be able to fully probe the inverted-hierarchy region of the 0nbb decay phase-space. In addition to reducing background through materials-selection and experimental design, we are developing a range of analysis-based background-suppression cuts. Examples of these cuts include timing cuts, pulse-shape cuts, and coincidence cuts. This poster will present an overview of those analysis cuts.

Summary

Primary author(s) : BUUCK, Micah (University of Washington)

Presenter(s) : BUUCK, Micah (University of Washington)

Track Classification : Aug/12

Status: ACCEPTED

Track Judgements:

Submitted by **BUUCK, Micah** on **Saturday 18 July 2015**

Abstract ID : **164**

TITUS- An intermediate near detector for Tokai to HyperKamiokande neutrino oscillations

Content

The Tokai Intermediate Tank for the Unoscillated Spectrum (TITUS) is a water cerenkov near detector proposed in addition to the Hyper-Kamiokande experiment to measure the unoscillated neutrino beam from the J-PARC accelerator. The 2kton detector will be placed off-axis and optimised for the delta cp measurement. Studies to determine the improvement in sensitivity from a 0.1% Gadolinium doping and a magnetised muon range detector are currently underway.

Summary

Primary author(s) : Mr. RAJ, Shah (Oxford, STFC)

Presenter(s) : Mr. RAJ, Shah (Oxford, STFC)

Track Classification : Aug/12

Status: ACCEPTED

Track Judgements:

Submitted by **SHAH, Raj** on **Friday 24 July 2015**

Abstract ID : **165**

The Daya Bay Reactor Neutrino Experiment

Content

The Daya Bay reactor neutrino experiment has observed the disappearance of $\bar{\nu}_e$ from nuclear reactors at ∼kilometer baselines. Utilizing powerful nuclear reactors as antineutrino sources and tall mountains that provide ample shielding against cosmic-rays, we have performed a relative comparison of the $\bar{\nu}_e$ rate and spectrum with an array of eight identically-designed detectors positioned in near and far locations. As a result, we have achieved unprecedented precision in measuring the neutrino mixing angle θ_{13} and the neutrino mass square difference $|\Delta m^2_{ee}|$ in the $\bar{\nu}_e$ disappearance channel. This poster describes our experimental setup and our detector design. It also presents our latest results on neutrino oscillations, the search for a light sterile neutrino, and the high-statistics measurement of the absolute reactor antineutrino flux and spectrum.

Summary

Primary author(s) : WONG, Henoch (UC Berkeley)

Presenter(s) : WONG, Henoch (UC Berkeley)

Track Classification : Aug/12

Status: ACCEPTED

Track Judgements:

Submitted by **WONG, Henoch** on **Friday 24 July 2015**

Abstract ID : **168**

Cosmogenic Background Discrimination at SNO+

Content

High energy muons produced in cosmic ray showers create radioactive elements in otherwise radiopure materials via spallation and neutron capture. Such cosmogenics are an important backgrounds in low energy searches. The SNO+ experiment is searching for Neutrinoless Double Beta Decay (0nu) in 130Te, which can be cosmogenically activated. Purification 2km underground at SNOLAB will eliminate near 100% of cosmogenics formed at the surface.
As additional contingency a new statistical technique is presented here, based on timing and calibrated on internal backgrounds, that distinguishes between a 0nu signal and cosmogenic decays.

Summary

Primary author(s) : Mr. DUNGER, Jack (University of Oxford)

Co-author(s) : Prof. BILLER, Steven (University of Oxford)

Presenter(s) : Mr. DUNGER, Jack (University of Oxford)

Track Classification : Aug/12

Status: ACCEPTED

Track Judgements:

Submitted by **DUNGER, Jack** on **Tuesday 04 August 2015**

Abstract ID : **113**

Detection of supernova ν_e in water Cherenkov and liquid scintillator detectors

Content

We develop a new way to isolate supernova ν_e, using gadolinium-loaded water Cherenkov detectors. The forward-peaked nature of $\nu_e + e^- \to \nu_e + e^-$ allows an angular cut that contains the majority of events. Even in a narrow cone, near-isotropic inverse beta events, $\bar{\nu}_e + p \to e^+ + n$, are a large background. With neutron detection by radiative capture on gadolinium, the background events can be individually identified with high efficiency. The remaining backgrounds are smaller and can be measured separately, so they can be statistically subtracted. Super-Kamiokande with gadolinium could measure the total and average energy of supernova νe with $\sim$ 20% precision or better each (90% C.L.).
The main detection channels for supernova ν_e in a liquid scintillator are its elastic scattering with electrons and its charged-current interaction with the ^{12}C nucleus. In existing scintillator detectors, the numbers of events from these interactions are too small to be very useful. However, at the 20-kton scale planned for the new detectors, these channels become powerful tools for probing the νe emission. We find that the νe spectrum can be well measured, to better than ∼40% precision for the total energy and better than ∼25% precision for the average energy. This is adequate to distinguish even close average energies, e.g., 11 MeV and 14 MeV, which will test the predictions of supernova models.
Based on arXiv:1311.6407 and arXiv:1311.6407

Summary

Primary author(s) : Dr. LAHA, Ranjan (Stanford University)

Co-author(s) : BEACOM, John (Ohio State University); Prof. AGARWALLA, Sanjib K (Institute of Physics, India)

Presenter(s) : Dr. LAHA, Ranjan (Stanford University)

Track Classification : Aug/18

Status: ACCEPTED

Track Judgements:

Submitted by **LAHA, Ranjan** on **Tuesday 26 May 2015**

Abstract ID : **114**

HOLMES, an experiment for a direct neutrino mass measurement

Content

Measuring the neutrino mass is one of the most compelling challenges of modern physics. HOLMES is a new experiment recently founded by the European Research Council to directly measure the neutrino mass. HOLMES will perform a calorimetric measurement of the energy released in the electron capture decay of 163Ho in order to reach a sensitivity as low as 0.4 eV on the neutrino mass. HOLMES will deploy a large array of low temperature microcalorimeters with implanted 163Ho nuclei in a Bismuth-Gold absorber coupled to a Transition Edge Sensor. The R&D activities necessary to optimize the 163 Ho isotope production, the source embedding, the detector optimization and the multiplexed readout, are already in progress. We outline here the project with its technical challenges and perspectives.

Summary

HOLMES is a new experiment aiming to measure the electron neutrino mass from the electron capture decay spectrum of 163Ho with sub-eV sensitivity. In order to reach a sensitivity of 0.4 eV a large array of 1000 low temperature microcalorimeteres will be operated starting from 2016 for three years time. Tags: HOLMES, neutrino mass direct measurement, 163 Ho electron capture.

Primary author(s) : PUIU, Andrei (INFN)

Presenter(s) : PUIU, Andrei (INFN)

Status: ACCEPTED

Track Judgements:

Submitted by **PUIU, Andrei** on **Saturday 06 June 2015**

Abstract ID : **115**

Adulterated Dirac neutrinos in a type-I seesaw

Content

Recently we proposed a type-I seesaw with two right-handed (RH) neutrinos per generation naturally leading to light Dirac neutrinos. These have an adulterated nature in the sense that their ordinary RH components are integrated out and replaced by the extra ones of much weaker couplings. The great disparity between their couplings is guaranteed by an underlying symmetry defined with one RH neutrino by transformations exchanging lepton and quark bare states with equal charges. Here we briefly review our findings.

Summary

Primary author(s) : Dr. MATUTE, Ernesto (USACH (Chile))

Presenter(s) : Dr. MATUTE, Ernesto (USACH (Chile))

Status: ACCEPTED

Track Judgements:

Submitted by **MATUTE, Ernesto** on **Tuesday 09 June 2015**

Abstract ID : **116**

Electroweak precision of Higgs sneutrino models

Content

In supersymmetric models the (down-type) higgs has the same quantum numbers as the sneutrinos. This suggests that if supersymmetry is realized at the TeV scale it can take an exciting form where the recently discovered higgs is also the first supersymmetric partner to the Standard Model. This has foundational implications in terms of electroweak precision tests as well as neutrino masses and their interactions. In this poster I present novel bounds on such models and classify their different types. I show that not only can neutrino masses be naturally small, but can also predict a small θ_{13} mixing angle.

Summary

Primary author(s) : DROR, Jeff (Cornell University)

Co-author(s) : NG, Wee Hao (Cornell University); BIGGIO, Carla (IFAE); GROSSMAN, Yuval (Cornell)

Presenter(s) : DROR, Jeff (Cornell University)

Status: ACCEPTED

Track Judgements:

Submitted by **DROR, Jeff** on **Thursday 18 June 2015**

Abstract ID : **118**

Tracker Commissioning for the SuperNEMO experiment

Content

The SuperNEMO experiment will search for neutrinoless double beta decay in the Modane Underground Laboratory. The existence of this process implies the existence of Majorana fermions and new lepton number violating interactions in the weak sector. The SuperNEMO demonstrator module is the first stage of the experiment, containing 7 kg of 82Se, with an expected sensitivity of T1/20ν>6.6x1024y after 2.5 y. Full topological event reconstruction is achieved through the use of a wire tracker operating in geiger mode combined with scintillator calorimeter modules. To achieve the low backgrounds required, all materials must achieve stringent radiopurity limits, and the modules constructed in a clean room environment. Construction of the tracker for the demonstrator module is underway in the UK, and the detector design, construction status and results from commissioning the first section of the tracker are presented.

Summary

Primary author(s) : CHOPRA, Ashwin (UCL)

Presenter(s) : CHOPRA, Ashwin (UCL)

Status: ACCEPTED

Track Judgements:

Submitted by **CHOPRA, Ashwin** on **Thursday 09 July 2015**

Abstract ID : **121**

Neutrino mass hierarchy from atmospheric neutrinos

Content

The current global analysis of neutrino oscillation experiments shows no significant information regarding the neutrino mass hierarchy, either normal or inverted. In the near future, there will be a strong experimental effort to discriminate these hierarchy options. One of the most promising methods is based on atmospheric neutrino oscillations in matter, e.g. in PINGU (Precision IceCube Next Generation Upgrade). This method requires, apart from a very large statistics, accurate theoretical calculations and a refined analysis of systematic uncertainties. In such a context, we revisit some aspects of the theoretical calculations of the event spectra, and we analyze in detail the impact of spectral shape systematics, focusing on possible error sources which may play a significant role in spectral measurements. We show that the inclusion of such systematic uncertainties may alter the prospective hierarchy sensitivity in a non negligible way, and thus deserve further, dedicated studies. We also discuss the interplay between the mixing angle θ_{23} and the PINGU sensitivity to the hierarchy.

Summary

Primary author(s) : CAPOZZI, Francesco (Università degli studi di Bari - INFN Bari)

Presenter(s) : CAPOZZI, Francesco (Università degli studi di Bari - INFN Bari)

Status: ACCEPTED

Track Judgements:

Submitted by **CAPOZZI, Francesco** on **Monday 13 July 2015**

Abstract ID : **141**

Searching for Dark Matter Annihilation into Neutrinos with Super-Kamiokande

Content

Summary

This poster presents indirect searches for dark matter (DM) as WIMPs (Weakly Interacting Massive Particles) using neutrino data recorded by Super-Kamiokande from 1996 to 2014. The results of the search for WIMP-induced neutrinos from the Sun and the Milky Way are discussed. We looked for an excess of neutrinos from the Sun/Milky Way compared to the expected atmospheric neutrino background. Event samples including both electron and muon neutrinos covering a wide range of neutrino energies (GeV to TeV) were used, with sensitivity to WIMP masses down to tens of GeV. Various WIMP annihilation modes were taken into account in the analyses.

Primary author(s) : FRANKIEWICZ, Katarzyna (National Centre for Nuclear Research)

Presenter(s) : FRANKIEWICZ, Katarzyna (National Centre for Nuclear Research)

Track Classification : Aug/18

Status: ACCEPTED

Track Judgements:

Submitted by **FRANKIEWICZ, Katarzyna** on **Tuesday 14 July 2015**

Abstract ID : **144**

A Direct Construction of the Nuclear Effective Interaction from Scattering Observables

Content

The calculation of nuclear matrix elements (dark matter & neutrinos) and other observables rely on the construction of a nuclear effective interaction, usually in a harmonic oscillator basis. The standard strategy for constructing the interaction is to first fit a potential formed by the product of a large number of pairs of coefficients and symmetry allowed operators to scattering observables (phase shifts and mixing angles). A momentum cutoff is then applied, commonly followed by a unitary transform to decouple high and low momentum states and finished by integrating out high quanta states. These steps introduce errors, break translation invariance and induce 3+ body forces, which are often untracked. We demonstrate an alternative wherein we directly construct the effective interaction in a small harmonic oscillator basis by fitting to scattering observables at a range of continuum energies. The result is validated by computation of bound state energies and comparison of wave functions to the projection of numerical results.

Summary

Primary author(s) : MCELVAIN, Kenneth (UC Berkeley)

Co-author(s) : HAXTON, Wick (University of California, Berkeley)

Presenter(s) : MCELVAIN, Kenneth (UC Berkeley)

Track Classification : Aug/18

Status: ACCEPTED

Track Judgements:

Submitted by **MCELVAIN, Kenneth** on **Wednesday 15 July 2015**

Abstract ID : **147**

A Cyclic Universe Approach to Fine Tuning

Content

We present a closed bouncing universe model where the value of coupling constants is set by the dynamics of a ghost-like dilatonic scalar field. We show that adding a periodic potential for the scalar field leads to a cyclic Friedmann universe where the values of the couplings vary randomly from one cycle to the next. While the shuffling of values for the couplings happens during the bounce, within each cycle their time-dependence remains safely within present observational bounds for physically-motivated values of the model parameters. Our model presents an alternative to solutions of the fine tuning problem based on string landscape scenarios.

Summary

Primary author(s) : CORMACK, Sam (Dartmouth College); ALEXANDER, Stephon (Dartmouth College); GLEISER, Marcelo (Dartmouth College)

Presenter(s) : CORMACK, Sam (Dartmouth College)

Status: ACCEPTED

Track Judgements:

Submitted by **CORMACK, Sam** on **Thursday 16 July 2015**

Abstract ID : **156**

Cosmological Axion and neutrino mass constraints from Planck 2015 temperature and polarization data

Content

In the primordial Universe the axion particles, which solve in an elegant way the CP problem in QCD, can be produced both thermally, contributing to the hot dark matter of the Universe, or not thermally, contributing to the cold dark matter. I will show the recent constraints from cosmology for the thermal axion mass and the total neutrino mass, using the Planck 2015 temperature and polarization data.

Summary

Primary author(s) : DI VALENTINO, Eleonora (Institut d'Astrophysique de Paris)

Co-author(s) : GIUSARMA, Elena (Università 'La Sapienza' di Roma); Dr. LATTANZI, Massimiliano (Università di Ferrara); MENA, Olga (IFIC); Prof. MELCHIORRI, Alessandro (Università 'La Sapienza' di Roma); SILK, Joseph (IAP)

Presenter(s) : DI VALENTINO, Eleonora (Institut d'Astrophysique de Paris)

Track Classification : Aug/18

Status: ACCEPTED

Track Judgements:

Submitted by **DI VALENTINO, Eleonora** on **Monday 20 July 2015**

Abstract ID : **157**

Nucleon final state interaction in NEUT

Content

This work describes the nucleon final state interaction (FSI) model in NEUT. Nucleon rescattering inside a nucleus can alter the kinematics of outgoing nucleon from a neutrino interaction, therefore understanding nucleon interaction inside nucleus is crucial to be able to acquire precise incident neutrino energy for accurately measuring oscillation parameters. The nucleon scattering Monte Carlo generated by NEUT is compared to external data and these can be used to tune and estimate uncertainty of parameters of the FSI model.

Summary

This work describes the nucleon final state interaction (FSI) model in NEUT.

Primary author(s) : MA, Wing Yan (Imperial College London)

Presenter(s) : MA, Wing Yan (Imperial College London)

Track Classification : Aug/18

Status: ACCEPTED

Track Judgements:

Submitted by **MA, Wing Yan** on **Wednesday 22 July 2015**

Abstract ID : **158**

Supernova keV Sterile Neutrinos

Content

We consider the production of keV sterile neutrinos in the cooling phase of the Supernova. A matter enhanced conversion from active to sterile neutrino is analyzed, leading to a strong bound on the sterile neutrino $\sin^2 2\theta - m_{sterile}$ parameter space from Supernova energy loss. In addition, we analyzed the impact of the standard production mechanism via interactions which is small compered to the aforementioned MSW. We also consider $\nu_s \to \nu_a \gamma$ loop process, with respect to a possible observable photon signal, and obtain a limit using data from satellites which are sensitive in the MeV photon energy range.

Summary

Primary author(s) : BRDAR, Vedran (JGU Mainz)

Co-author(s) : KOPP, Joachim (Johannes-Gutenberg-Universitaet Mainz (DE)); Mr. ARGUELLES DELGADO, Carlos (Madison,WIPAC)

Presenter(s) : BRDAR, Vedran (JGU Mainz)

Track Classification : Aug/18

Status: ACCEPTED

Track Judgements:

Submitted by **BRDAR, Vedran** on **Wednesday 22 July 2015**

Abstract ID : **159**

The AmC calibration source induced background at Daya Bay Experiment

Content

The Daya Bay experiment has made the most precise measurement of the neutrino mixing angle theta13 and the first independent measurement of the effective mass splitting in the electron antineutrino disappearance channel utilizing measured reactor anti-neutrino rate and spectral shape. A thorough understanding of backgrounds is crucial for the measurement. Among all the backgrounds at Daya Bay, one comes from the AmC calibration source parked on top of the anti-neutrino detectors, which is an especially major background contributor at the far site. Many efforts have been made to better evaluate this background and constrain related systematics, including an in-situ measurement using a much stronger AmC source to directly measure the background spectra and benchmark our simulations. Details of the measurement and evaluation of the AmC background will be presented in this poster.

Summary

Primary author(s) : Mr. GU, Wenqiang (SJTU)

Presenter(s) : Mr. GU, Wenqiang (SJTU)

Track Classification : Aug/18

Status: ACCEPTED

Track Judgements:

Submitted by **GU, Wenqiang** on **Friday 24 July 2015**

Abstract ID : **160**

Probing Nuclear Effects at the T2K Near Detector Using Transverse Kinematic Variables

Content

With the latest generation of neutrino-nucleus scattering experiments we are now well within a precision era of neutrino interaction physics. Consequently we now find it increasingly important to develop a more detailed understanding of our nuclear targets. We propose to address this through a set of neutrino scattering measurements on a carbon target at the Tokai to Kamioka (T2K) off-axis near detector (ND280), using variables projected into the plane transverse to the beam of incoming muon neutrinos. These measurements will allow us to characterise the nuclear effects on the observables in neutrino scattering, thus providing valuable constraints on the systematic uncertainties associated with neutrino oscillation measurements.

Summary

Primary author(s) : Mr. DOLAN, Stephen (University of Oxford)

Co-author(s) : WEBER, Alfons (STFC/RAL & Uni Oxford); Dr. LU, Xianguo (University of Oxford)

Presenter(s) : Mr. DOLAN, Stephen (University of Oxford)

Track Classification : Aug/18

Status: ACCEPTED

Track Judgements:

Submitted by **DOLAN, Stephen** on **Friday 24 July 2015**

Abstract ID : **161**

A Truth Study Using Transverse Variables to Characterise Nuclear Effects in neutrino–nucleus scattering.

Content

In the past few years it has become clear that nuclear effects impose significant uncertainties on precision measurements in neutrino physics of the few GeV energy region. A number of convoluted effects in the nuclear model, affecting both the initial nucleon momentum spectrum and intranuclear hadronic transport, result in different interaction types giving the same hadronic final state and also affects the hadronic kinematics. This is a problem for both exclusive cross-section measurements and event-by-event energy reconstruction.

We propose the use of variables defined in a plane transverse to the incoming neutrino momenta to directly study such nuclear effects. We focus on the predictions from four of the most commonly used neutrino event generators (GENIE, GiBUU, NEUT, and NuWro) including their predictions for the initial neutrino interaction model, the initial states of all particles in the interaction, and the final states.

Summary

Primary author(s) : PICKERING, Luke (Imperial College London); LU, Xianguo (Ruprecht-Karl-s-Universitaet Heidelberg (DE)); UCHIDA, Yoshi (Imperial College London)

Presenter(s) : PICKERING, Luke (Imperial College London)

Track Classification : Aug/18

Status: ACCEPTED

Track Judgements:

Submitted by **PICKERING, Luke** on **Friday 24 July 2015**

Abstract ID : **162**

Inflation and the Measurement Problem

Content

Inflation is a very successful paradigm in cosmology, solving the Horizon, Flatness and Monopole problems with the Hot Big Bang theory. But perhaps the biggest selling point of inflation is that, it provides an elegant, quantum mechanical origin of large scale structure in the universe, described originally in [Starobinsky 1980, Guth and Pi 1982] and others. However, while this description of the emergence of primordial structure from quantum zero-point fluctuations of the inflaton field has been studied in detail for decades [Prokopec et al 1992, Polarski and Starobinsky 1995, Kiefer et al 2007], a number of prominent authors acknowledge important gaps in our understanding of the mechanism [Weinberg OUP 2008, Lyth and Liddle CUP 2009, Padmanabhan CUP 1996]. (For a review see [Sudarsky et al 2005]). Even some of the leading proponents of the theory concede that the current description, the so-called quantum-to-classical transition, is only "pragmatic" and needs eventually to be fully justified. [Kiefer and Polarski 2009] In our upcoming paper [Alexander, Jyoti and Magueijo (to appear)], we discuss and define this cosmological quantum measurement problem, and propose a solution. Our work is similar in spirit to that of [Martin et al 2012, Cañate et al 2012], except that we propose an effective collapse mechanism arising from interaction of Fourier modes, rather than a fundamental modification to the Schrodinger equation. This Measurement problem in Inflation is a rich and compelling arena for both foundational issues of quantum mechanics as well as a deep understanding of early universe cosmology, and our research may potentially teach us about aspects of quantum gravity.

Summary

Primary author(s) : Dr. ALEXANDER, Stephon (Dartmouth College); JYOTI, Dhrubo (Dartmouth College); MAGUEIJO, João (Imperial College)

Presenter(s) : JYOTI, Dhrubo (Dartmouth College)

Track Classification : Aug/18

Status: ACCEPTED

Track Judgements:

Submitted by **JYOTI, Dhrubo** on **Friday 24 July 2015**

Abstract ID : **167**

Development of a Timing Detector for the Mu3e Experiment

Content

The *Mu3e* experiment is designed to search for lepton flavour violation through the $\mu^+ \to e^+e^-e^+$ decay channel with a sensitivity of 1 in 10^{16}, thus improving by four orders of magnitude the present experimental limit. To achieve such precision we need highly granulated tracking detector complemented by an accurate timing system. The current work offers an introduction to the requirements of the experiment, followed by a discussion on the development of a timing sub-detector which is based on scintillating fibres readout by silicon photo-multipliers. We conclude by presenting the most recent prototype testing results.

Summary

Primary author(s) : DAMYANOVA, Antoaneta (Universite de Geneve (CH))

Presenter(s) : DAMYANOVA, Antoaneta (Universite de Geneve (CH))

Track Classification : Aug/18

Status: ACCEPTED

Track Judgements:

Submitted by **DAMYANOVA, Antoaneta** on **Tuesday 04 August 2015**

Abstract ID : **169**

First Steps Towards ν_μ Charged Current Inclusive Cross Section Measurements With the NOνA Near Detector

Content

NOνA is a long-baseline experiment that uses the NuMI beam, at Fermilab, to study muon neutrino to electron neutrino oscillations. The experiment is located 14.6 *mrad* off the beam axis which allows access a narrow band of neutrino energies centered at 2 *GeV*. NOνA is a two-detector experiment with one located underground at Fermilab (Near Detector), and the other one located on the surface in northern Minnesota (Far Detector), 810 *km* away from Fermilab. The design of the two detectors is identical, varying only in their mass: 14 *kton* for the Far Detector, and 300 *ton* for the Near Detector. The similarities between the detectors allow the initial event rate of muon and electron neutrinos, measured by the Near Detector, to yield a nearly bias-free normalization of the event rate at the Far Detector. The NuMI beam is currently delivering power in the order of 450 *kW*, and it will go up to a maximum of 700 *kW* in the near future. With the current power, the beam delivers protons on target on the order of 10^{13} per spill, which accounts for an average of 5 neutrino interactions in the Near Detector. This high rate of neutrino interactions favors measurements such as neutrino cross sections, and in particular, muon neutrino cross sections due to the high purity of the muon neutrino beam. This poster presents the first steps towards measurements of the muon neutrino charged current inclusive cross section, using the NOνA Near Detector, at a neutrino energy region centered at 2 *GeV*.

Summary

Primary author(s) : ARRIETA DIAZ, Enrique (Southern Methodist University)

Presenter(s) : ARRIETA DIAZ, Enrique (Southern Methodist University)

Track Classification : Aug/18

Comments:

Replacing previously accepted abstract to incorporate comments from NOvA collaborators

Status: ACCEPTED

Track Judgements:

Submitted by **ARRIETA DIAZ, Enrique** on **Friday 07 August 2015**