SNAC11

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Book of Abstracts

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A plan to measure reactor neutrino short-base line oscillation.

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A research reactor, HANARO, in South Korea can be used to measure the energy spectra of reactor neutrinos to check the recently claimed short-base line neutrino oscillation. A detector can be located as close as 5m from the core of the reactor which has 30 MW thermal power. The event rate of 500L liquid scintillator detector would be several hundred per day and two detector configuration would help to identify the oscillation effect. We will show the results of simulations on the outcome of the proposal and discuss on the strategy of the proposal.

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Astrophysics Theory Review

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Future Beam Experiments on Sterile Neutrinos

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Global Oscillation Fits

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IceCube Sterile Sensitivity

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Introduction to Daya bay reactor antineutrino experiment

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The Daya Bay reactor antineutrino experiment, currently under construction and commissioning in China, will be the most sensitive experiments in the world searching for the yet unknown neutrino mixing parameters, theta-13(θ13). With a thermal power of 17.4GW by 2011, the Daya Bay site provides an intense electron antineutrino flux, which together with 3 years of data taking from 4 pairs of identical detectors at far and near locations, optimized baseline with rock overburden and active water shielding, up to 80 tons total target mass comprising Gd-doped liquid scintillator and comprehensive, redundant calibration measures, will lower the upper bound on sin2 2θ13 to 0.01 or better.

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KARMEN Search for Disappearance of Electron-Neutrinos into Sterile Neutrinos

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Check on Reactor-Anomaly & LSND/MiniBooNE Results

Summary:

In the context of the reactor-anomaly, suggesting that electron-antineutrinos disappear into heavy sterile neutrinos with squared mass difference in the eV^2 range, a KARMEN result on disappearance of electron-neutrinos has recently obtained crucial importance, assuming CPT-conservation.
The total cross section sigma_CC of the exclusive CC-reaction 12^C(nu_e, e-)12^N_gs, as well as the flux-independent ratio R = sigma_NC / sigma_CC, which have been measured very precisely using the entire KARMEN data set, were both in good agreement with theoretical predictions. There was neither evidence for disappearance of electron-neutrinos nor evidence for the appearance of any other active neutrinos. The (860+/-29.3) nue-sequences from 12^C(nu_e, e-)12^N_gs, which have been measured in spectroscopic quality, met the theoretical expectation of (806.2+/-66.1) electron-neutrinos. An upper limit on nu_e -> nu_sterile disappearance was deduced, that excludes for most parts the reactor-anomaly favored regions (@ 90%CL).
KARMEN did not show evidence for such heavy sterile neutrinos being suggested by the reactor-anomaly or LSND/MiniBooNE.

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LENS Prototyping – Construction and Deployment of MicroLENS

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The LENS collaboration's goal is the construction of a low energy neutrino spectrometer (LENS) that will measure the entire solar neutrino spectrum above 114keV.
In an effort to reach this goal we have developed a two phase prototype program. The first of these is microLENS, a small prototype to study the light transmission in the as built LENS scintillation lattice—a novel detector method of high segmentation in a large liquid scintillator detector. The microLENS prototype is currently being finished and deployed at the Kimballton Underground Research Facility (KURF) near Virginia Tech. This prototype will be the main topic of this presentation. We will present the detector construction and the methods and schemes of the program during the first phases of running with minimal channels instrumented (~41 compared to full coverage 216). After construction of the microLENS detector we will finalize designs for the miniLENS prototype and have the miniLENS prototype running shortly thereafter.

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LENS Source Experiment

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LENS and Sterile Neutrino Oscillation Observation using the Novel LENS Scintillation Lattice

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LENS is a low energy solar neutrino detector that will measure the solar neutrino spectrum above 115 keV, >95% of the solar neutrino flux, in real time. The fundamental neutrino reaction in LENS is charged-current based capture on 115In detected in a liquid scintillator medium. The reaction yields the prompt emission of an electron and the delayed emission of 2 gamma rays that serve as a time & space coincidence tag. Sufficient spatial resolution is used to exploit this signature and suppress background, particularly due to 115In beta decay. A novel design of optical segmentation (Scintillation Lattice or SL) channels the signal light along the three primary axes. The channeling is achieved via total internal reflection by suitable low index gaps in the segmentation. The spatial resolution of a nuclear event is obtained digitally, much more precisely than possible by common time of flight methods. Advanced Geant4 analysis methods have been developed to suppress adequately the severe background due to 115In beta decay, achieving at the same time high detection efficiency.
Using the unique LENS Scintillation Lattice sterile neutrino conversion in meter scale baselines can be sensitively probed using mono-energetic, sub-MeV, flavor pure neutrinos from an artificial MCi source. Active-sterile oscillations can be directly observed in the granular LENS detector itself to critically test and extend results of short baseline accelerator and reactor experiments.[1]

[1] C. Grieb, J. M. Link, and R. S. Raghavan, Phys. Rev. D 75, 093006 (2007)

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LSND

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MINOS

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Measurement of the neutrino velocity with the OPERA detector in the CNGS neutrino beam

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MiniBooNE

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New Short Baseline Reactor Experiments

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Recent Re-evaluation of Reactor Neutrino Fluxes

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Reception

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Search for sterile neutrinos at reactors

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The sensitivity to the sterile neutrino mixing at very short baseline reactor neutrino experiments is investigated. In the case of conventional (thermal neutron) reactors it is found that the sensitivity is lost for Δm^2 $gtrsim$ 1 eV^2 due to smearing of the reactor core size. On the other hand, in the case of an experimental fast reactor Joyo, because of its small size, sensitivity to $\sin^2 2\theta_{14}$ can be as good as 0.03 for $\Delta m^2 \sim$ several eV^2 with the Bugey-like detector setup.

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Searching for Sterile Neutrinos at Daya Bay With a PBq Antineutrino Source

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The reactor antineutrino anomaly suggests the existence of at least one sterile neutrino separated from the three standard neutrinos by a few eV2 mass squared dierence. The far site of the Daya Bay Reactor Neutrino experiment, which contains four identical 20-ton antineutrino detectors immersed in a water muon veto pool, oers unique characteristics that allow for a more sentitive investigation of this suggested parameter space. Antineutrinos emanating from a PBq source will create energy-dependent oscillation signatures inside each individual detector. By placing the antineutrino source at asymmetric positions between pairs of detectors, One can perform relative measurements of these oscillations signatures between detector pairs, which minimizes systematic uncertainties and background eects. The variety of source placements in the far hall and water pool would also aid in sensitively probing a wide range of mass squared-splittings.

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Semianalytical approach to active-to-sterile neutrino oscillations

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Recent observations from several neutrino oscillation experiments have shown that the mixing between active and sterile neutrinos remains as an open possibility. To gain a better understanding of this phenomenon we make use of the Magnus expansion of the evolution operator to study neutrino oscillations within the Earth, in the context of a four-neutrino mixing scheme. We calculate the transition probabilities from active to sterile neutrinos with energies of the order of few GeV's, taking into account the effects of the terrestrial matter density and examine the signatures of the presence of the sterile neutrino at possible long-baseline experiments.

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Short Baseline Reactor Measurements

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Sterile Neutrinos and CMB/LSS

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Sterile Neutrinos and Supernova Nucleosynthesis

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Stopped Pion Beams

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True Neutrality as a New Type of Flavour

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