CosPA 2013

Report of Contributions

https://indico.phys.hawaii.edu/e/456

Contribution ID: **1** Type: **oral**

Dark Matter and baryogenesis as two sides of the same coin

Thursday, November 14, 2013 4:20 PM (25 minutes)

I review a testable dark matter model outside of the standard WIMP paradigm in which the observed ratio Omega_{DM}~ 5 Omega_{B} for visible and dark matter
densities finds its natural explanation as a result of their common QCD origin.
Special emphasis is placed on the observational consequences of this model and on the detection prospects for present or planned experiments. In particular, I argue that the relative intensities for a number of observed excesses of emission (covering more than 11 orders of magnitude) can be explained by this model without any new fundamental parameters as all relative intensities for these emissions are determined by standard and well established physics.

Primary author: Prof. ZHITNITSKY, Ariel (University of British Columbia)

Presenter: Prof. ZHITNITSKY, Ariel (University of British Columbia)

Session Classification: Dark Matter IV

Track Classification: Dark Matter

Contribution ID: **2** Type: **oral**

First results from the LUX dark matter experiment at the Sanford Underground Research Facility

Tuesday, November 12, 2013 5:15 PM (30 minutes)

The LUX (Large Underground Xenon) experiment is performing a direct-detection search for WIMP dark matter using a two-phase liquid xenon TPC. The target mass is 370 kg (100 kg fiducial), making it the largest such detector in operation and providing excellent self-shielding. Additional background rejection is provided by nuclear recoil discrimination via simultaneous detection of charge and light. LUX is deployed in a water shield at the 4850' level of the Sanford Underground Research Facility (SURF) in Lead, SD. The projected cross-section sensitivity of LUX is <3e-46 cm^2 for a 50 GeV WIMP and <4e-46 cm^2 for 100 GeV, after 300 live days. An update will be presented here on the status of the experiment.

Primary author: Dr SZYDAGIS, Matthew (UC Davis)

Presenter: Dr SZYDAGIS, Matthew (UC Davis)

Session Classification: Plenary Session 4

Contribution ID: **5** Type: **oral**

Resolving the power spectrum generated during inflation

Wednesday, November 13, 2013 2:20 PM (25 minutes)

Recently there have been differing viewpoints on how to evaluate the curvature power spectrum generated during inflation. In a series of papers by Parker and collaborators it has been argued that the renormalization scheme adopted for the inflaton field phi(x) to make <phi$^2(x) > finite should also be applied to |phi_k|\hat{}2. But this then modifies the curvature trivial way. On the other hand, others (Durrer, Marozzi and Rinaldi) have criticized this approach and suggested alternative trivial regularization, is still valid.

Published in Phys.Rev. D87 (2013) 087302 by Mar Bastero-Gil, Arjun Berera, Namit Mahajan and Raghavan Rangarajan.

Primary authors: Dr BERERA, Arjun (University of Edinburgh, UK); Dr BASTERO-GIL, Mar (Universidad de Granada, Spain); Dr MAHAJAN, Namit (Physical Research Laboratory, India); Dr RANGARAJAN, Raghavan (Physical Research Laboratory, India)

Presenter: Dr RANGARAJAN, Raghavan (Physical Research Laboratory, India)

Session Classification: Cosmology I

Track Classification: Cosmology

Contribution ID: **6** Type: **oral**

Reconstructing the Primordial Power Spectrum With Planck

Thursday, November 14, 2013 11:30 AM (25 minutes)

Four years ago the Planck satellite was launched with the objective of furthering our understanding of the history and structure of the universe by making detailed measurements of the Cosmic Microwave Background. In March, the data and preliminary cosmological results from Planck were finally made public. The data collected by Planck is the most precise and comprehensive yet obtained, the full ramifications of which are still being studied. The current paradigm in cosmology is that approximately 10^-36 seconds after the big bang, our universe underwent a very brief and very rapid period of expansion, where the universe expanded from the size of an atom to the size of a galaxy in 10^-32 seconds. An important consequence of inflation is that it creates tiny inhomogeneities in the curvature of the universe, which then grow with the expansion of the universe into the CMB anisotropies that we observe today. While inflation has been very successful in explaining the general features of the CMB, there are several competing theories about how inflation could have occurred. Most theories of inflation predict that the spectrum of the initial curvature inhomogeneities created during the inflationary epoch should be a nearly scale-invariant, power-law function. Frequently, studies of CMB data assume a power-law spectrum, which means that potential features, which could signal new physics at work, are missed. In this presentation I will talk about how the Planck data were used to reconstruct the primordial power spectrum of curvature inhomogeneities, in a non-parametric manner. This method makes no assumptions about the form of the primordial power spectrum or how it was created. Such an approach allows us to determine if there are any statistically significant deviations from the traditionally assumed power-law form. We find the Planck data is mostly consistent with a power-law spectrum, but there is a large deviation at small scales that remains unexplained at this time.

Primary author: Dr GAUTHIER, Christopher (LaCosPa, National Taiwan University)

Presenter: Dr GAUTHIER, Christopher (LaCosPa, National Taiwan University)

Session Classification: Cosmology III

Track Classification: Cosmology

Contribution ID: **7** Type: **oral**

Neutrino mass from neutrinophilic Higgs and leptogenesis

Wednesday, November 13, 2013 9:45 AM (25 minutes)

Under the assumption of hierarchical right-handed neutrino masses, masses of right-handed neutrinos must be larger than 10^8 GeV in the standard thermal leptogenesis scenario. On the other hand, we show the mass can be reduced to around 5 TeV in a neutrinophilic two Higgs doublet model. We also show the required mass degeneracy for resonant leptogenesis scenario becomes rather mild in neutrinophilic two Higgs doublet model.

Primary author: SETO, Osamu (Hokkai-Gakuen University)

Co-authors: Prof. HABA, Naoyuki (Shimane University); Mr YAMAGUCHI, Yuya (Hokkaido University)

Presenter: SETO, Osamu (Hokkai-Gakuen University)

Session Classification: Neutrinos I

Track Classification: Neutrinos

Contribution ID: **8** Type: **oral**

Observational signatures of anisotropic inflationary models

Wednesday, November 13, 2013 2:45 PM (25 minutes)

We study observational signatures of two classes of anisotropic inflationary models in which an inflaton field couples to (i) a vector kinetic term $F_{¥mu¥nu}F^{¥mu¥nu}$ and (ii) a two-form kinetic term $H_{¥mu¥nu¥lambda}H^{¥mu¥nu¥lambda}$. We compute the corrections from the anisotropic sources to the power spectrum of gravitational waves as well as the two-point cross correlation between scalar and tensor perturbations. The presence of statistical anisotropies generally leads to a suppressed tensor-to-scalar ratio r and a smaller scalar spectral index n_s. For the potentials of chaotic and natural inflation, we place observational constraints on the model parameters and the anisotropic parameter g_* by using the recent Planck bounds of n_s and r. Since the signs of g_* are different depending on the vector and two-form field models, the precise measurements of the anisotropic scalar power spectrum can allow us to discriminate between the two models further. The non-linear estimator f_{NL} of scalar non-Gaussianities in the two-form field model is generally smaller than that in the vector model for the same level of anisotropies, so that the former is easier to be compatible with the Planck bounds of non-Gaussianities than the latter.

Primary author: Ms OHASHI, Junko (Tokyo University of Science)

Co-authors: Prof. SODA, Jiro (Kyoto University); Prof. TSUJIKAWA, Shinji (Tokyo University of Science)

Presenter: Ms OHASHI, Junko (Tokyo University of Science)

Session Classification: Cosmology I

Track Classification: Cosmology

Contribution ID: **9** Type: **oral**

Investigating formation condition of primordial black holes for generalized initial perturbation profiles

Thursday, November 14, 2013 9:45 AM (25 minutes)

If the amplitude of the density perturbation is sufficiently large in some region in the early universe dominated by radiation, this region starts to contract against pressure gradients after the horizon reently and collapses to form a black hole (Primordial Black Hole, PBH). In order to analyze formation process of these PBHs, in our previous paper we developed an asymptotic expansion approach to calculate time evolution of a spherical perturbed region outside the horizon. Our formalism is valid even when the amplitude of the perturbation is sufficiently large to form a PBH in the end.
In this paper results of numerical computation of time evolution of the perturbed region after the horizon reentry are presented. The initial conditions for this numerical computation are given using
our asymptotic expansion technique. By calculating time evolution of various initial perturbations, the condition for PBH formation is investigated. We have investigated various shapes of initial curvature profiles at once, including those profiles which were not investigated in previous works as well as those investigated previously, and formed ”master variables”which decide if PBHs are formed or not. This condition will be useful in computing abundance of PBHs presicely.

Primary author: Mr NAKAMA, Tomohiro (Research Center for the Early Universe, the University of Tokyo)

Co-authors: Prof. POLNAREV, Alexander (Queen Mary University of London); Prof. YOKOYAMA, Jun'ichi (Research Center for the Early Universe, University of Tokyo); Prof. HARADA, Tomohiro (Rikkyo University)

Presenter: Mr NAKAMA, Tomohiro (Research Center for the Early Universe, the University of Tokyo)

Session Classification: Cosmology II

Track Classification: Cosmology

Contribution ID: **10** Type: **oral**

Dark matter production and baryogenesis from the Q-ball decay

Thursday, November 14, 2013 4:45 PM (25 minutes)

We consider the Q-ball decay and investigate the scenario that the amount of the baryons and the gravitino dark matter is at the same time naturally explained by the decay of the Q balls in the gauge-mediated SUSY breaking. We show the decay rates into baryons, NLSPs, and gravitinos, and estimate their branching ratios based on the consideration of Pauli blocking. Although the NLSPs are produced by the Q-ball decay, the efficient annihilations of NLSPs occur afterward so that their abundance does not spoil the successful BBN and they only produce negligible contribution to the gravitino dark matter density from their decay. In this way, we find that the scenario with the direct production of the gravitino dark matter from the Q-ball decay works naturally.

Primary author: Dr KASUYA, Shinta (Kanagawa University)

Presenter: Dr KASUYA, Shinta (Kanagawa University)

Session Classification: Dark Matter IV

Track Classification: Dark Matter

Contribution ID: **11** Type: **oral**

Detecting the first stars and black holes with 21-cm cosmology

Thursday, November 14, 2013 11:05 AM (25 minutes)

A major frontier area in cosmology is cosmic reionization, the key epoch in which the intergalactic hydrogen throughout the universe was reionized after having recombined in the early universe. Despite uncertainties about the sources of radiation at early times, it is widely assumed that prior to reionization the cosmic gas must have been pre-heated to well over the temperature of the cosmic microwave background. We show instead that the universe is likely to heat significantly only during reionization. This dramatically changes the expectations for currently operating as well as planned radio telescope arrays aimed at detecting the 21-cm spectral line of atomic hydrogen at high redshift. Observing the resulting signatures would provide a remarkable probe of some of the earliest stars (likely responsible for reionization) and black holes (responsible for the heating).

Primary author: Prof. BARKANA, Rennan (Tel Aviv University)

Presenter: Prof. BARKANA, Rennan (Tel Aviv University)

Session Classification: Cosmology III

Track Classification: Cosmology

Contribution ID: **12** Type: **oral**

Can kinetic Sunyaev-Zel'dovich power spectrum be used to constrain the interaction between DE and DM?

The interaction between Dark Matter and Dark Energy has been proposed as a mechanism to alleviate the coincidence problem. We analyze the effect of the interaction on the evolution of the gravitational field and propose two new observables based on its effect on the matter peculiar velocity field. We find that for different model parameters the matter peculiar velocity could be factor 2 times larger or 5 times smaller than the amplitude of velocity perturbations in the concordance LCDM cosmological model at the same scales. We show that the current upper limits on the amplitude of the kinetic Sunyaev-Zel'dovich power spectrum provide constraints on the coupling within the dark sectors that are consistent with those obtained previously from the CMB and galaxy clusters. In particular, we show that current upper limits from the Atacama Cosmology Telescope and the South Pole Telescope favor Dark Energy decaying into Dark Matter, as required to solve the coincidence problem.

Primary author: Prof. WANG, Bin (Shanghai Jiao Tong University)

Presenter: Prof. WANG, Bin (Shanghai Jiao Tong University)

Track Classification: Dark Matter

Contribution ID: **13** Type: **oral**

Cosmological perturbations in the models of dark energy and modified gravity

Thursday, November 14, 2013 3:25 PM (25 minutes)

The quasistatic solutions of the matter density perturbation in various dark energy models and modified gravity models have been investigated in numerous papers. However, the oscillating solutions in those models have not been investigated enough so far. In this talk, the oscillating solutions are also examined by using appropriate approximations. And the behaviors of the matter density perturbation in F(R) gravity models with singular evolutions of the physical parameters are shortly investigated as applications of the approximated calculations.

Primary author: Dr MATSUMOTO, Jiro (Tohoku University)

Presenter: Dr MATSUMOTO, Jiro (Tohoku University)

Session Classification: Cosmology IV

Track Classification: Cosmology

Contribution ID: **14** Type: **oral**

Probing the coupling of heavy dark matter to nucleons by detecting neutrino signature from the Earth core

Thursday, November 14, 2013 10:40 AM (25 minutes)

We argue that the detection of neutrino signature from the Earth core is an ideal approach for probing the coupling of heavy dark matter ($m_\chi > 10^5$ GeV) to nucleons. We first note that direct searches are not effective for dark matter (DM) in such a mass range. Furthermore the energies of neutrinos arising from DM annihilations inside the Sun cannot exceed a few TeV at the Sun surface due to attenuation. Therefore the information about the DM mass is lost. Finally, the detection of neutrino signature from galactic halo can only probe DM annihilation cross sections. After presenting the rationale of our study, we discuss the event rates in IceCube and KM3NeT arising from the neutrino flux produced by annihilations of Earth-captured DM heavier than 10^5 GeV. The IceCube and KM3NeT sensitivities to spin independent DM-proton scattering cross section $\sigma_{\chi p}$ in this mass range are presented. The implications of our results are discussed.

Primary authors: Prof. LIN, Guey-Lin (Institute of Physics, National Chiao Tung University, Taiwan); Mr LIN, Yen-Hsun (Institute of Physics, National Chiao Tung University, Taiwan)

Presenter: Mr LIN, Yen-Hsun (Institute of Physics, National Chiao Tung University, Taiwan)

Session Classification: Dark Matter/Cosmic Ray joint session

Track Classification: Cosmic Rays

Contribution ID: **15** Type: **oral**

New Results from the Daya Bay Reactor Neutrino Experiment

Thursday, November 14, 2013 4:45 PM (25 minutes)

The Daya Bay Reactor Neutrino Experiment aims at a precision measurement of the neutrino mixing angle theta_13 by observing the disappearance of electron antineutrinos from the Daya Bay nuclear reactor complex. The first Daya Bay result on theta_13 angle was announced in March 2012 and updated in June the same year. Recently, Daya Bay experiment announced a more precise result on theta_13. The improvement in precision results from higher statistics and the analysis of both event rates and energy spectra. The latter analysis also leads to the determination of the effective mass squared difference. This talk will present the new results in some detail.

Primary author: Ms HU, Bei-Zhen (On behalf of the Daya Bay collaboration (Institute of Physics, National Chiao Tung University))

Presenter: Ms HU, Bei-Zhen (On behalf of the Daya Bay collaboration (Institute of Physics, National Chiao Tung University))

Session Classification: Neutrinos II

Track Classification: Neutrinos

Contribution ID: **16** Type: **oral**

General AntiParticle Spectrometer (GAPS) - Hunt for dark matter using cosmic ray antideuterons

Thursday, November 14, 2013 11:05 AM (25 minutes)

The GAPS experiment is foreseen to carry out a dark matter search by hunting for low energy cosmic ray antideuterons with a novel detection approach. The theoretically predicted antideuteron flux resulting from secondary interactions of primary cosmic rays, e.g. protons, with the interstellar medium is very low. So far not a single cosmic antideuteron has been detected by any experiment, but well-motivated theories beyond the standard model of particle physics, e.g., supersymmetry or universal extra dimensions, contain viable dark matter candidates which could led to a significant enhancement of the antideuteron flux due to self-annihilation of dark matter particles. This flux contribution is believed to be especially large at small energies which leads to a high discovery potential for GAPS. GAPS is designed to achieve its goals via a series of ultra-long duration balloon flights at high altitude in Antarctica and had a successful prototype flight in June 2012.

The presentation will give an overview of the theoretical and experimental implications for a cosmic cosray antideuteron search and discuss the current status and perspectives of the GAPS experiment.

Primary author: Prof. VON DOETINCHEM, Philip (University of Hawaii)

Presenter: Prof. VON DOETINCHEM, Philip (University of Hawaii)

Session Classification: Dark Matter/Cosmic Ray joint session

Track Classification: Cosmic Rays

Contribution ID: **17** Type: **oral**

Strong link between the dark matter identity and the origin of the supermassive black holes

Wednesday, November 13, 2013 10:40 AM (25 minutes)

Supermassive black holes(SMBHs) more massive than billion solar mass are observed at redshifts around 6. Their origin is still unknown. Primordial black holes(PBHs) being their origin is one possibility. We propose a new method which can potentially falsify the PBH scenario as the explanation of the SMBHs. Based on the observation that large density perturbations required to create PBHs also result in the copious production of the ultracompact minihalos (UCMHs) of dark matter, we show that weakly interacting massive particles(WIMPs) as dark matter having sizable interaction strengths with the standard model particles, that are also typical in many extended standard models, annihilate efficiently inside the UCMHs to yield gamma-rays far exceeding the upper limit placed by the Fermi-LAT measurement. Therefore, if future terrestrial experiments identify dark matter as WIMPs having typical interaction strengths with the standard model particles, then our proposal indicates that the PBH scenario is strongly disfavored.

Primary author: Dr SUYAMA, Teruaki (Research Center for the Early Universe, University of Tokyo)

Co-authors: Dr KOHRI, Kazunori (KEK); Mr NAKAMA, Tomohiro (Research Center for the Early Universe, University of Tokyo)

Presenter: Dr SUYAMA, Teruaki (Research Center for the Early Universe, University of Tokyo)

Session Classification: Dark Matter/Cosmology joint session

Track Classification: Dark Matter

Contribution ID: **18** Type: **oral**

Cosmological constraint on light gravitino mass from cosmic shear

Wednesday, November 13, 2013 11:05 AM (25 minutes)

I will discuss the potential of cosmic shear to constraint the light gravitino mass.
The gravitino mass, that is directly related to the supersymmetry breaking scale, is one of most fundamental parameters in the supersymmetric theory.
In the gauge mediation supersymmetric breaking (GMSB) models, the gravitino is generically the lightest supersymmetric particle (LSP) with mass in the order of eV to keV.
While the collider experiment such as Large Hadron Collider (LHC) gives the lower bound of the light gravitino mass, the cosmic shear measurement can put the upper bound.
Combining the future LHC runs at 14 TeV and the forthcoming Subaru Hyper Suprime-Cam (HSC)- and Large Synoptic Survey Telescope (LSST)-like survey, we can reach almost all light gravitino mass in GMSB.

Primary author: Mr SHIRASAKI, Masato (University of Tokyo)

Co-authors: Mr KAMADA, Ayuki (Kavli IPMU); Prof. YOSHIDA, Naoki (University of Tokyo / Kavli IPMU)

Presenter: Mr KAMADA, Ayuki (Kavli IPMU)

Session Classification: Dark Matter/Cosmology joint session

Track Classification: Dark Matter

Contribution ID: **20** Type: **oral**

The DarkSide Experiment

Thursday, November 14, 2013 3:00 PM (25 minutes)

There is a wide range of astronomical evidence that the visible stars and gas in all galaxies, including our own, are immersed in a much larger cloud of non-luminous matter, typically an order of magnitude greater in total mass. The existence of this "dark matter"is consistent with evidence from large-scale galaxy surveys and microwave background measurements, indicating that the majority of matter in the universe is non baryonic. The nature of this non-baryonic component is still totally unknown, and the resolution of the "dark matter puzzle"is of fundamental importance to cosmology, astrophysics, and elementary particle physics.
A review and description of the DarkSide underground argon program at LNGS will be presented, focusing in particular on the technological aspects of the DarkSide-50 experiment and presenting the first preliminary results. The talk is mostly devoted to the description of the detectors (Dark Matter TPC, Neutron Veto, Muon Veto) from the design to the construction to operations; performances and results will also be shown, and plans for future detectors.

Primary author: Mr IANNI, Andrea (Princeton University)

Co-author: Mr GORETTI, Augusto Mario (Princeton University)

Presenter: Mr GORETTI, Augusto Mario (Princeton University)

Session Classification: Dark Matter III

Track Classification: Dark Matter

Contribution ID: **21** Type: **oral**

Constraints on Large-Scale Dark Acoustic Oscillations from Cosmology

Wednesday, November 13, 2013 11:30 AM (25 minutes)

If all or a fraction of the dark matter (DM) were coupled to a bath of dark radiation (DR) in the early Universe we expect the combined DM-DR system to give rise to acoustic oscillations of the dark matter until it decouples from the dark radiation. Much like the standard baryon acoustic oscillations, these dark acoustic oscillations (DAO) imprint a characteristic scale, the sound horizon of dark matter, on the matter power spectrum. We compute in detail how the microphysics of the DM-DR interaction affects the clustering of matter in the Universe and show that the DAO physics also gives rise to unique signatures in the temperature and polarization spectra of the cosmic microwave background (CMB). We use cosmological data from the CMB, baryon acoustic oscillations (BAO), and large-scale structure to constrain the possible fraction of interacting DM as well as the strength of its interaction with DR. Although our results can be straightforwardly applied to a broad class of models that couple dark matter particles to various light relativistic species, in order to make quantitative predictions, we model the interacting component as dark atoms coupled to a bath of dark photons. We find that linear cosmological data and CMB lensing put strong constraints on existence of DAO features in the CMB and the large-scale structure of the Universe. Interestingly, we find that at most ~3.5% of all DM can be very strongly interacting with DR. We show that our results are surprisingly constraining for the recently proposed Double-disk DM model, a novel example of how large-scale precision cosmological data can be used to constrain galactic physics and sub-galactic structure.

Primary author: Dr CYR-RACINE, Francis-Yan (Jet Propulsion Laboratory/Caltech)

Co-authors: Dr RACCANELLI, Alvise (Jet Propulsion Laboratory/Caltech); Prof. SIGURDSON, Kris (University of British Columbia); Dr DE PUTTER, Roland (Jet Propulsion Laboratory/Caltech)

Presenter: Dr CYR-RACINE, Francis-Yan (Jet Propulsion Laboratory/Caltech)

Session Classification: Dark Matter/Cosmology joint session

Track Classification: Dark Matter

Contribution ID: **22** Type: **oral**

Astrophysical Origin of Positrons

Wednesday, November 13, 2013 10:40 AM (25 minutes)

The recent observations of excess of high energy positrons by PAMELA and AMS-2 have raised an intriguing question of the origin of antimatter. Particle-antiparticle annihilation mechanism and astrophysical mechanism are most popular scenarios suggested so far. In this talk the astrophysical scenario, in particular QED aspect of compact stars, is critically studied and discussed. The super-critical magnetic fields and the dynamo of neutron stars and magnetars can create electron-positron pairs and then accelerate them to high energy via pulsar electrodynamics. Furthermore, the Dirac vacuum can become unstable due to the rotating supercritical magnetic fields and spontaneously emit electron-positron pairs. Finally, the astrophysical scenario is compared with particle-antiparticle annihilation mechanism and the isotropy of observed positrons is discussed.

Primary author: Prof. KIM, Sang Pyo (Kunsan National University)

Presenter: Prof. KIM, Sang Pyo (Kunsan National University)

Session Classification: Cosmic Ray I

Track Classification: Cosmic Rays

Contribution ID: **23** Type: **oral**

Gravitational waves from curvaton

Thursday, November 14, 2013 3:00 PM (25 minutes)

We investigate the gravitational wave background induced by the first order scalar perturbations in the curvaton models. We consider the quadratic and axion-like curvaton potential which can generate the blue-tilted power spectrum of curvature perturbations on small scales and derive the maximal amount of gravitational wave background today. We find the power spectrum of the induced gravitational wave background has a characteristic peak at the frequency corresponding to the scale reentering the horizon at the curvaton decay, in the case where the curvaton does not dominate the energy density of the Universe. We also find the enhancement of the amount of the gravitational waves in the case where the curvaton dominates the energy density of the Universe. Such induced gravitational waves would be detectable
by the future space-based gravitational wave detectors or pulsar timing observations.

Primary author: Mr KITAJIMA, Naoya (University of Tokyo)

Co-authors: Prof. KAWASAKI, Masahiro (Institute for Cosmic Ray Research, University of Tokyo); Dr YOKOYAMA, Shuichiro (Institute for Cosmic Ray Research, University of Tokyo)

Presenter: Mr KITAJIMA, Naoya (University of Tokyo)

Session Classification: Cosmology IV

Track Classification: Cosmology

Contribution ID: **24** Type: **oral**

WIMPy Leptogenesis With Absorptive Final State Interactions

Thursday, November 14, 2013 5:10 PM (25 minutes)

We consider a class of leptogenesis models in which the lepton asymmetry arises from dark matter annihilation processes which violate CP and lepton number. Importantly, a necessary one-loop contribution to the annihilation matrix element arises from absorptive final state interactions. We elucidate the relationship between this one-loop contribution and the CP-violating phase. As we show, the branching fraction for dark matter annihilation to leptons may be small in these models, while still generating the necessary asymmetry.

Primary author: STENGEL, Patrick (University of Hawaii)

Co-author: KUMAR, Jason (University of Hawaii)

Presenter: STENGEL, Patrick (University of Hawaii)

Session Classification: Dark Matter IV

Track Classification: Dark Matter

Contribution ID: **25** Type: **oral**

Hubble-induced mass from MSSM plasma

Thursday, November 14, 2013 9:20 AM (25 minutes)

We evaluate the effective mass of a scalar field ¥phi coupled to thermal plasma through Planck-suppressed interactions.
We find it useful to rescale the coupled fields so that all the ¥phi-dependences are absorbed into the yukawa and gauge couplings,
which allows us to read off the leading order contributions to the effective mass ¥$tildem_{¥phi}$ from the 2-loop free energy calculated
with the rescaled couplings.
We give an analytical expression for ¥$tildem_{¥phi}$ at a sufficiently high temperature
in the case where ¥phi is coupled to the MSSM chiral superfields through non-minimal K¥$ddot$¥$texta$hler potential.
We find that $|¥tildem^2_{¥phi}|$ is about $10^{-3}H^2$¥$sim$$10^{-2}H^2$ at the leading order in terms of the couplings for typical parameter sets, where H is the Hubble expansion rate in the radiation-dominated era.

Primary author: Mr TAKESAKO, Tomohiro (ICRR, University of Tokyo)

Co-authors: Prof. TAKAHASHI, Fuminobu (Tohoku University); Prof. KAWASAKI, Masahiro (ICRR, University of Tokyo)

Presenter: Mr TAKESAKO, Tomohiro (ICRR, University of Tokyo)

Session Classification: Cosmology II

Track Classification: Cosmology

Contribution ID: **26** Type: **oral**

Domain wall and isocurvature perturbation problems in axion models

Thursday, November 14, 2013 8:55 AM (25 minutes)

Axion models have two serious cosmological problems, domain wall and isocurvature perturbation problems.These problems may be solved if the field value of the Peccei-Quinn (PQ) scalar is large during inflation. However, the fluctuations of the PQ field grow after inflation through the parametric resonance and stable axionic strings may be produced, which results in the domain wall problem. We study formation of axionic strings using lattice simulations and obtain the constraints on the PQ breaking scale and the Hubble parameter during inflation.

Primary author: Prof. KAWASAKI, Masahiro (Institute for Cosmic Ray Research, University of Tokyo)

Presenter: Prof. KAWASAKI, Masahiro (Institute for Cosmic Ray Research, University of Tokyo)

Session Classification: Cosmology II

Track Classification: Cosmology

Contribution ID: **27** Type: **oral**

Physics of Atmospheric Neutrino Oscillations with a Huge Underground Detector

Thursday, November 14, 2013 5:10 PM (25 minutes)

A general theoretical framework, in which the contributions of the neutrino mass hierarchy, octant of the atmospheric angle and the lepton number conserving CP phase are disentangled analytically, is established to study the potential of using atmospheric neutrino oscillations, detectable by huge underground detectors, to determine the three unknowns. To benchmark the detectability we take the implementation of PINGU as an example and compute muon-like and electron-like event rates with event cuts on neutrino energy and zenith angle. We find that the experiment has the potential of resolving the mass hierarchy and the octant degeneracies, while the measurement of the CP phase is significantly more challenging. Our observation merits a serious study of the detector capability of estimating the neutrino momentum for both muon-like and electron-like events and the background.

Primary author: Dr GE, Shao-Feng (KEK, Japan)

Co-authors: Dr ROTT, Carsten (Department of Physics, Sungkyunkwan University, Suwon 440-746, Korea); Prof. HAGIWARA, Kaoru (KEK, Japan)

Presenter: Dr GE, Shao-Feng (KEK, Japan)

Session Classification: Neutrinos II

Track Classification: Neutrinos

Contribution ID: **28** Type: **oral**

Void magnetic field and its primordial origin in inflation

Wednesday, November 13, 2013 3:10 PM (25 minutes)

In 2010, it was first reported that weak and large scale magnetic fields (MFs) were observed in void regions. These void MFs may share their origin with galactic/galaxy cluster MFs in primordial MFs. Thus a theoretical research on the generation of primordial MFs is now strongly motivated.
I seek the possibility that primordial MFs is produced during inflation and find
not only several interesting implications for inflationary magnetogenesis model building but also further observational connections.

Primary author: Mr FUJITA, Tomohiro (Kavli IPMU/Tokyo Univ.)

Presenter: Mr FUJITA, Tomohiro (Kavli IPMU/Tokyo Univ.)

Session Classification: Cosmology I

Track Classification: Cosmology

Contribution ID: **30** Type: **oral**

On Model-Dependence in String Inflation

Wednesday, November 13, 2013 3:35 PM (25 minutes)

This year the Planck Collaboration has ruled out many models of inflation that would have informed us of new physics. The models which survived the data release are fairly close to vanilla: single-field inflation with a nearly Gaussian, slightly redshifted spectrum. Well-studied scenarios in the string inflation context include inflection point inflation and the Starobinsky-like models.

We report on searches for model independent predictions for inflation in the context of these string models. In particular, we examine how these scenarios can provide an explanation of the low power at large scales anomaly which persists in the CMB data. We present a general mechanism for this phenomena in term the "slow-roll" paradigm, and explain to what extent this can provide information about the UV physics. We point out a striking similarity between the these and comment about its implications for string inflation models and the study of inflation in general.

Primary author: Dr DOWNES, Sean (Leung Center for Cosmology and Particle Astrophysics)

Co-author: Dr DUTTA, Bhaskar (Texas A&M university)

Presenter: Dr DOWNES, Sean (Leung Center for Cosmology and Particle Astrophysics)

Session Classification: Cosmology I

Track Classification: Cosmology

Contribution ID: **31** Type: **oral**

Gravitational wave oscillation in bi-metric gravity

Thursday, November 14, 2013 2:35 PM (25 minutes)

We discuss graviton oscillations based on the ghost free bi-gravity theory. We point out that this theory possesses a natural cosmological background solution which is very close to the case of general relativity. Furthermore, interesting parameter range of the graviton mass, which can be explored by the observations of gravitational waves, is not at all excluded by the constraint from the solar system tests. Therefore the graviton oscillation with possible inverse chirp signal would be an interesting scientific target of KAGRA, adv LIGO, adv Virgo and GEO.

Primary author: Prof. TANAKA, Takahiro (Yukawa Insititute for Theoretical Physics)

Co-authors: Prof. DE FELICE, Antonio (The Institute for Fundamental Study, Naresuan University); Prof. NAKAMURA, Takashi (Kyoto University)

Presenter: Prof. TANAKA, Takahiro (Yukawa Insititute for Theoretical Physics)

Session Classification: Cosmology IV

Track Classification: Cosmology

Contribution ID: **32** Type: **oral**

Self-interacting Dark Matter

Wednesday, November 13, 2013 8:55 AM (25 minutes)

Dark matter self-interactions have important implications for the distributions of dark matter in the Universe, from dwarf galaxies to galaxy clusters. In this talk, we present benchmark models that illustrate characteristic features of dark matter that is self-interacting through a new light mediator. These models have self-interactions large enough to change dark matter densities in the centers of galaxies in accord with observations, while remaining compatible with large-scale structure data and all astrophysical observations such as halo shapes and the Bullet Cluster. These observations favor a mediator mass in the 1–100 MeV range and large regions of this parameter space are accessible to direct detection experiments like LUX, SuperCDMS, and XENON1T.

Primary author: Dr YU, HAI-BO (UNIVERSITY OF CALIFORNIA, RIVERSIDE)

Presenter: Dr YU, HAI-BO (UNIVERSITY OF CALIFORNIA, RIVERSIDE)

Session Classification: Dark Matter I

Track Classification: Dark Matter

Contribution ID: **33** Type: **oral**

Limits on Neutrino-Neutrino Scattering in the Early Universe

Thursday, November 14, 2013 5:35 PM (25 minutes)

In the standard model neutrinos are assumed to have streamed across the Universe since they last scattered at the weak decoupling epoch when the temperature of the standard-model plasma was ~MeV. The shear stress of free-streaming neutrinos imprints itself gravitationally on the Cosmic Microwave Background (CMB) and makes the CMB a sensitive probe of neutrino scattering. Yet, the presence of nonstandard physics in the neutrino sector may alter this standard chronology and delay neutrino free-streaming until a much later epoch. We use observations of the CMB to constrain the strength of neutrino self-interactions G_eff and put limits on new physics in the neutrino sector from the early Universe. Recent measurements of the CMB at large multipoles made by the Planck satellite and high-l experiments are critical for probing this physics. Within the context of conventional LambdaCDM parameters cosmological data are compatible with G_eff < 1/(56 MeV)^2 and neutrino free-streaming might be delayed until their temperature has cooled to as low as ~25 eV. Intriguingly, we also find an alternative cosmology compatible with cosmological data in which neutrinos scatter off each other until z~10^4 with a preferred interaction strength in a narrow region around G_eff = 1/(10 MeV)^2. This distinct self-interacting neutrino cosmology is characterized by somewhat lower values of both the scalar spectral index and the amplitude of primordial fluctuations. While we phrase our discussion here in terms of a specific scenario in which a late onset of neutrino free-streaming could occur, our constraints on the neutrino visibility function are very general.

Primary author: Dr CYR-RACINE, Francis-Yan (Jet Propulsion Laboratory/Caltech)

Co-author: Prof. SIGURDSON, Kris (University of British Columbia)

Presenter: Dr CYR-RACINE, Francis-Yan (Jet Propulsion Laboratory/Caltech)

Session Classification: Neutrinos II

Track Classification: Neutrinos

Contribution ID: **34** Type: **oral**

Dipole Moment Bounds on Dark Matter Annihilation

Thursday, November 14, 2013 5:35 PM (25 minutes)

g-2 correction has been accurately measured in the E821 experiment at Brookhaven National Lab (BNL). Yet, there remains a 3 sigma difference between experiment and theory.

One way that this discrepancy can be interpreted is by new particles running in the loop. The smallness of this discrepancy provides a tight constraint on its coupling. This bound is then applied to constrain the annihilation cross section.

We find that the bound on annihilation to the electrons is 4.0x10^-7pb + 8.8x10^-15pb and the muons is 5.6x10^-4pb + 180pb, in the limit where the mediator is much heavier than dark matter. The parentheses indicate the dipole moment used to obtain the values. It is interesting to note that only the annihilation to muons through a CP violating (EDM) coupling is not excluded.

Primary authors: KUMAR, Jason (University of Hawaii); Mr FUKUSHIMA, Keita (University of Hawaii at Manoa)

Presenter: Mr FUKUSHIMA, Keita (University of Hawaii at Manoa)

Session Classification: Dark Matter IV

Track Classification: Dark Matter

Contribution ID: **35** Type: **oral**

Spontaneous Parity Breaking and Metastable Supersymmetry Breaking Vacua : cosmological constraint

Thursday, November 14, 2013 8:30 AM (25 minutes)

We study cosmology in a model with spontaneous parity breaking in the context of metastable supersymmetry breaking vacuum. We point out that such a mechanism leads to parity violation only locally, leading to the formation of a network of domain walls. We show that conflict with observed cosmology can be avoided through Planck scale suppressed terms, provided the parity breaking scale is constrained to remain smaller than about 10^10 – 10^11 GeV. We also study the compatibility of this requirement with the possibility of B-L gauge symmetry at the scale of a few TeV.

Primary author: Prof. YAJNIK, Urjit (IIT Bombay)

Co-author: Prof. BORAH, Debasish (Tezpur University)

Presenter: Prof. YAJNIK, Urjit (IIT Bombay)

Session Classification: Cosmology II

Track Classification: Cosmology

Contribution ID: **36** Type: **oral**

The Mystery and Promise of Fast Radio Bursts

The past few months has brought the announcement of the discovery of 4 more Fast Radio Bursts (FRBs) bringing the total number of these enigmatic events to 6. These bursts of GHz radio waves last only a few milliseconds, are non-repeating, and several pieces evidence point to them originating at cosmological distances. If so ~10^40 ergs of GHz radio waves are emitted in a few msec from a region of size less than 1000 km leading to a brightness temperature at emission significantly exceeding the Planck temperature. I argue that these are most likely coalescing neutron star binaries. If so coincident bursts of neutrinos and gravitational radiation should be emitted, containing even greater energy. Since the radio waves are much easier to detect FRBs can serve as triggers for detection of neutrinos and gravitational radiation. With a network of radio receivers the trigger rate could exceed one million per year. Relative timing information could be used to determine the absolute mass scale of neutrinos.

Primary author: Dr STEBBINS, Albert (Fermilab)

Presenter: Dr STEBBINS, Albert (Fermilab)

Track Classification: Cosmic Rays

Contribution ID: **37** Type: **oral**

Light bending by a black body radiation

Wednesday, November 13, 2013 11:05 AM (25 minutes)

We consider the shift of light velocity when the vacuum is non-trivial by electromagnetic radiation emitted from a black body. Within geometric optics formalism we calculate the bending angle of a light ray when there is a gradient in the energy density. Simplifying a neutron star as an isothermal black body, we estimate the order of magnitude for the bending angle and compared it with the bending angles by gravitation and magnetic field.

Primary author: Prof. KIM, Jin Young (Kunsan National University)

Co-author: Prof. LEE, Taekoon (Kunsan National University)

Presenter: Prof. KIM, Jin Young (Kunsan National University)

Session Classification: Cosmic Ray I

Track Classification: Cosmic Rays

Contribution ID: **38** Type: **oral**

CDMSlite: A Search for Light WIMPs

Wednesday, November 13, 2013 2:20 PM (25 minutes)

The CDMS-low-ionization-threshold-experiment was designed to measure low-energy recoils from Weakly Interacting Massive Particles of mass < 10 GeV. This experiment uses voltage-assisted Luke-Neganov amplification of the ionization-energy deposited by particle interactions, which allows us to probe for light WIMP scatters. In this talk I will describe the physics behind CDMSlite and present science results from the first run. The data were collected with a single 0.6 kg germanium detector running for 10 live days at the Soudan Underground Laboratory. A low ionization-energy threshold of 170 eVee (electron equivalent) was obtained, which allows us to constrain new WIMP-nucleon spin-independent parameter space for WIMP masses below 6 GeV.

Primary author: BASU THAKUR, Ritoban (Fermilab/ UIUC)

Presenter: BASU THAKUR, Ritoban (Fermilab/ UIUC)

Session Classification: Dark Matter II

Track Classification: Dark Matter

Contribution ID: **39** Type: **oral**

The electron and positron spectra measured by AMS-02

Thursday, November 14, 2013 11:30 AM (25 minutes)

The electron and positron spectra in the primary cosmic rays have been measured during the years with increasing precision by many experiments (Fermi, PAMELA, AMS-01, ATIC, HEAT among the others), up to the latest result of AMS-02.
AMS-02 is a large-acceptance spectrometer installed on the International Space Station on May 2011. After two years of data taking, more than 30 billion of events have been collected, allowing for a very precise measurement of the separate and combined electron and positron fluxes in the energy range from 0.5 to 700 GeV.
These results will be used to derive the local interstellar spectrum (LIS) of electrons and positrons with the Parker model, tuned on the proton flux measured by AMS-02, disentangling a possible signal of new physics from the effects due to the solar modulation.
The most important steps of this analysis will be discussed in this presentation.

Primary author: Mr CORTI, Claudio (University of Hawaii at Manoa)

Co-authors: Dr CONSOLANDI, Cristina (University of Hawaii at Manoa); Ms WHITMAN, Kathryn (University of Hawaii at Manoa); Dr BINDI, Veronica (UH)

Presenter: Mr CORTI, Claudio (University of Hawaii at Manoa)

Session Classification: Dark Matter/Cosmic Ray joint session

Track Classification: Cosmic Rays

Contribution ID: **40** Type: **oral**

The spectral index may be blue: superhorizon coupling to subhorizon modes.

Thursday, November 14, 2013 11:55 AM (25 minutes)

In a universe much larger than our current Hubble volume, locally unobservable long wavelength modes can induce a scale-dependence in the power spectrum of typical subvolumes, so that the observed spectral index varies at a cosmologically significant level. This talk will explain how super-Hubble dynamics can impact sub-Hubble measurements and survey the features of inflation models that would yield Hubble volumes with significantly varying spectral indices.

Primary author: BRAMANTE, Joseph (University of Notre Dame)

Co-authors: KUMAR, Jason (University of Hawaii); Prof. SHANDERA, Sarah (Pennsylvania State University)

Presenter: BRAMANTE, Joseph (University of Notre Dame)

Session Classification: Cosmology III

Track Classification: Cosmology

Contribution ID: **41** Type: **oral**

Analysis of 3.4 years of CoGeNT Data

Tuesday, November 12, 2013 4:45 PM (30 minutes)

The CoGeNT dark matter detector has been taking data at the Soudan mine since December 2009. The data have been analyzed for a possible WIMP signal using multi-dimensional PDFs in energy, time, and pulse rise-time. The bulk event (fast rise-time pulses) and surface (slow rise-time) event fractions are determined through this analysis. We have also done extensive simulations of backgrounds for the CoGeNT detector, and these backgrounds are compared to the CoGeNT data. The current plans for the next generation detector, C4, are also outlined. We will detail specific improvements in background reduction and energy resolution. Finally, our results are compared to other experiments in the context of low-mass dark matter.

Primary author: Dr KOS, Mark (Pacific Northwest National Laboratory)

Presenter: Dr KOS, Mark (Pacific Northwest National Laboratory)

Session Classification: Plenary Session 4

Contribution ID: **42** Type: **oral**

Primary Proton Flux measured by AMS-02

Wednesday, November 13, 2013 11:30 AM (25 minutes)

The Alpha Magnetic Spectrometer (AMS-02) is a high energy particle detector designed to study origin and nature of cosmic rays up to a few TV from space. It was installed on the International Space Station (ISS) on May 19, 2011.
During the first two years of operation AMS-02
performed precise measurements of the proton flux. In the low rigidity range, from 1 GV to 20 GV, the proton flux was daily measured with a statistical error less than 1%. In the same rigidity range a gradual decrease due to Solar modulation effects and transit variations due to Solar Flares and Coronal Mass Ejection were also observed.
In the rigidity range from 20 GV up to 100 GV instead, AMS data show no drastic variation and the results are consistent with other experiments. Above 100 GV, AMS proton flux exhibits a single power low behavior with no fine structures nor brakes.

Primary author: Dr CONSOLANDI, Cristina (University of Hawaii Physics and Astronomy department)

Presenter: Dr CONSOLANDI, Cristina (University of Hawaii Physics and Astronomy department)

Session Classification: Cosmic Ray I

Track Classification: Cosmic Rays

Contribution ID: **43** Type: **oral**

PICO: dark matter direct detection with bubble chambers.

Wednesday, November 13, 2013 3:10 PM (25 minutes)

Bubble chambers offer a number of compelling properties relevant for the direct detection of WIMP dark matter. Of particular note, it is possible, by the appropriate selection of operating conditions, to make a bubble chamber sensitive to the nuclear recoils produced by dark matter interactions, but insensitive to the typically-dominant background of electron recoils. I will discuss a suite of bubble chambers for dark matter detection in various stages of development by the former COUPP collaboration and the new PICO collaboration, formed by the merger of COUPP and PICASSO. The COUPP-60 detector, a 60-kg scale chamber with target fluid CF3I, began operating in summer 2013 and I will present preliminary data. The PICO-2L detector, with two-liters of C3F8 as the target fluid, is being commissioned in fall 2013 and is projected to have world-leading sensitivity in the low-mass region of recent dark matter hints from CDMS-II, CoGent and other experiments. PICO-250L, a ton-scale experiment, is currently in the engineering and design phase.

Primary author: Dr NEILSON, Russell (University of Chicago)

Presenter: Dr NEILSON, Russell (University of Chicago)

Session Classification: Dark Matter II

Track Classification: Dark Matter

Contribution ID: **44** Type: **oral**

Gravitational Modulated Reheating

Thursday, November 14, 2013 2:10 PM (25 minutes)

In inflation models whose reheating occurs through gravitational particle production, only conformally noninvariant fields are created. In particular, fermions are created if and only if they have nonvanishing mass terms. Since mass terms are geerically proportional to the expectation value of the relevant Higgs field, its spatialy fluctuation gives rise to spatially fluctuating particle creation rate, which results in modulated reheating. We discuss implications of such gravitational modulated reheating and cauclate its predictions on nongaussianity.

Primary author: Prof. YOKOYAMA, Jun'ichi (RESCEU, The University of Tokyo)

Co-author: Dr WATANABE, Yuki (RESCEU, The Unversity of Tokyo)

Presenter: Prof. YOKOYAMA, Jun'ichi (RESCEU, The University of Tokyo)

Session Classification: Cosmology IV

Track Classification: Cosmology

Contribution ID: **45** Type: **oral**

Multi High Charged Scalars and Majorana Neutrino Mass Generations

Wednesday, November 13, 2013 9:20 AM (25 minutes)

One natural way to understand the excess of the measured $H \to \gamma\gamma$ rate over the standard model (SM) expectation at the Large Hadron Collider (LHC) is to have charged scalar bosons, existing in most of the SM extensions. Motivated by this LHC result, we explore if it also sheds light on solving the small neutrino mass generation problem. We concentrate on a class of models with high dimensional representations of scalars to realize Majorana neutrino masses at two-loop level without imposing any new symmetry. In these models, multi scalars with the electric charges higher than two are naturally expected, which not only enhance the $H \to \gamma\gamma$ rate, but provide more searching grounds at the LHC. In particular, the rate of $H \to Z\gamma$ also changes similar to that of the diphoton channel.

Primary author: Prof. GENG, CQ (NTHU)

Presenter: Prof. GENG, CQ (NTHU)

Session Classification: Neutrinos I

Track Classification: Neutrinos

Contribution ID: **46** Type: **oral**

Ultra High Energy Cosmic Ray Detection via Radar at the Telescope Array

Thursday, November 14, 2013 8:30 AM (25 minutes)

Ultra high energy cosmic ray (UHECR) detection has been dominated mainly by two methods: air fluorescence detection and charged particle detectors on the Earth's surface. Due to the steeply falling flux of UHECRs, these detectors must be able to observe very large apertures (thousands to tens of thousands of square kilometers) in order to collect enough statistics over several years to make meaningful measurements about the spectrum, arrival direction, and composition of cosmic rays. An alternate technique using radar was first proposed about 50 years ago, but has yet to be proven as a viable means of UHECR air shower measurement. I will discuss the Telescope Array Radar (TARA) project which is the largest and most ambitious attempt yet at detecting UHECR by their radar signature. TARA has an effective radiated power of 8 MW continuous power and is collocated with the Telescope Array detector in Millard County, Utah. I will discuss the technique of bistatic radar detection, the equipment deployed to use this technique, and the methods we will use to confirm detection of cosmic rays. This method of cosmic ray detection can have great impact on the field if proven successful due to the relatively low cost to deploy and monitor large apertures.

Primary author: HANLON, William (University of Utah, Department of Physics and Astronomy, High Energy Astrophysics Institute)

Presenter: HANLON, William (University of Utah, Department of Physics and Astronomy, High Energy Astrophysics Institute)

Session Classification: Cosmic Ray II

Track Classification: Cosmic Rays

Contribution ID: **47** Type: **oral**

Recent Progress on D3 - The Directional Dark Matter Detector

Thursday, November 14, 2013 3:25 PM (25 minutes)

Direction-sensitive WIMP dark matter detection promises to help overcome the challenges faced by direct dark matter detection experiments. In particular, directional detectors should be able to clearly differentiate a dark matter signal from background sources. We are developing a Directional Dark Matter Detector (D3) based on a gas Time Projection Chamber (TPC) using Gas Electron Multipliers (GEMs) for charge amplification and pixel electronics for readout. This approach allows the three-dimensional reconstruction of nuclear recoils in a room-temperature detector with low energy threshold and low noise. We present an overview of our past and ongoing work developing this technology, including the performance measurement of small prototypes, as well as our planned future work constructing a m^3-scale detector to clearly determine whether the signals seen by DAMA, CoGeNT, and CRESST-II are due to low-mass WIMPs or background.

Primary author: ROSS, Steven (University of Hawaii)

Presenter: ROSS, Steven (University of Hawaii)

Session Classification: Dark Matter III

Track Classification: Dark Matter

Contribution ID: **48** Type: **oral**

Studies of the North American central high plains for the next large cosmic ray experiment

Thursday, November 14, 2013 8:55 AM (25 minutes)

A series of ongoing studies of the suitability of the Colorado-Kansas-Oklahoma high plains has been going on since 2010 as a possible location of the next large cosmic ray experiment. These studies have included the necessary features of a flat high altitude plateau, but the next large cosmic ray experiment will also need a vastly greater area than current ongoing experiments, with a final aim towards a 100 by 100 mile area. This brings new problems such as communications over a rougher terrain, interference from local cities and their inhabitants, and air quality. We will report on an ongoing study of 10 Single PMT modified Auger style water tanks, and a 20 nodal point communication system and air quality studies. Concluding with a summary of the usefulness of the North American central high plains of Eastern Colorado, Western Kansas and the Oklahoma panhandle for the location of the next very large area cosmic ray experiment.

Primary author: Prof. NICKOLAS, Solomey (Wichita State University)

Presenter: Prof. NICKOLAS, Solomey (Wichita State University)

Session Classification: Cosmic Ray II

Track Classification: Cosmic Rays

Contribution ID: **49** Type: **oral**

Recent results from Telescope Array

Thursday, November 14, 2013 9:20 AM (25 minutes)

The Telescope Array (TA) observatory, located in midwest Utah, USA, is designed to detect ultra high energy cosmic rays whose energy is more than one EeV. TA mainly consists of two types of detector. The first type is the atmospheric Fluorescence Detector (FD). TA's three FDs have been in operation since Fall 2007. The other type of detector is a ground-covering Surface Detector (SD), which has been operating at TA since Spring 2008. In addition, the TA-RADAR (TARA) and TA-EUSO associated experiments are colocated with TA, and the TA Low Energy (TALE) extension recently started partial operation. I will report some recent general results from TA, and describe our future plans.

Primary author: OKUDA, Takeshi (Ritsumeikan University)

Presenter: OKUDA, Takeshi (Ritsumeikan University)

Session Classification: Cosmic Ray II

Track Classification: Cosmic Rays

Contribution ID: **50** Type: **oral**

Search for the 4th neutrino with CeLAND

Thursday, November 14, 2013 4:20 PM (25 minutes)

Neutrino oscillation with baseline shorter than 10 m is a 'terra incognita', although there have been various hints that a 4th, sterile neutrino may be lurking in this baseline range.

We plan to search for the signature of the sterile neutrino at the very short baseline by deploying a massive 76 kCi electron antineutrino source (cerium-144 and praseodymium-144) in the veto region of Kamioka Liquid Scintillator Antineutrino Detector (KamLAND). The project name is CeLAND. CeLAND will search for the sterile neutrino oscillation in 3-16 m range and probe the majority of the oscillation phase space suggested by the Reactor Antineutrino Anomaly with 95% confidence level. The status and prospects of the experiment will be presented.

Primary author: Dr MARICIC, Jelena (University of Hawaii, High Energy Physics Group)

Presenter: Dr MARICIC, Jelena (University of Hawaii, High Energy Physics Group)

Session Classification: Neutrinos II

Track Classification: Neutrinos

Contribution ID: **51** Type: **oral**

Overcoming Velocity Suppression in Dark Matter Direct Detection

Wednesday, November 13, 2013 9:20 AM (25 minutes)

Dark matter direct detection analyses have typically relied on two types of contact operators that mediate the interaction between dark matter and the target nuclei. Other contact operators, such as {\it pseudoscalar}-type operators, are almost universally neglected in the literature; the reason being that in the non-relativistic approximation, these operators are suppressed by powers of galactic dark matter velocity, $calO(10^{-3})$. I will show that these types of operators receive an enhancement from nuclear effects of the order $calO(m_N/m_q)$ that can cancel the velocity-suppression. I provide results of a spin-dependent direct detection analysis which show that pseudoscalar-coupled dark matter could actually be detectable at current and soon-to-come experiments.

Primary authors: Dr THOMAS, Brooks (Carleton); Mr YAYLALI, David (University of Hawaii); KUMAR, Jason (University of Hawaii); Prof. DIENES, Keith (University of Arizona)

Presenter: Mr YAYLALI, David (University of Hawaii)

Session Classification: Dark Matter I

Track Classification: Dark Matter

Contribution ID: **52** Type: **oral**

A Light Sterile Neutrino from Soft broken Friedberg-Lee Symmetry

Wednesday, November 13, 2013 8:30 AM (25 minutes)

Light sterile neutrinos of mass about an eV with mixing U_{ls} of a few percent to active neutrinos may solve some anomalies shown in experimental data related to neutrino oscillation. How to have light sterile neutrinos is one of the theoretical problems which have attracted a lot of attentions. In this article we show that such an eV scale light sterile neutrino candidate can be obtained in a seesaw model in which the right-handed neutrinos satisfy a softly-broken Friedberg-Lee symmetry. In this model a right-handed neutrino is guaranteed by the FL symmetry to belight comparing with other two heavy right-handed neutrinos. It can be of eV scale when the FL symmetry is softly broken and can play the role of eV scale sterile neutrino needed for explaining the anomalies of experimental
data. This model predicts that one of the active neutrino is massless. We find that this model prefers inverted hierarchy mass pattern of active neutrinos than normal hierarchy. An interesting consequence of this model is that realizing relatively large U_{es} and relatively small U_{\mu s} in this model naturally leads to a relatively small U}_{tau s}|A Light Sterile Neutrino from Freidberg-Lee Symmetry. We also comment on some cosmological implications of this type of model, such as the possibility of having the sterile neutrino of a few KeV as dark matter and also constraining sterile neutrino mass from Planck data.

Primary author: Prof. HE, Xiao-Gang (NCTS)

Presenter: Prof. HE, Xiao-Gang (NCTS)

Session Classification: Neutrinos I

Track Classification: Neutrinos

Contribution ID: **53** Type: **oral**

Calibrations for the DarkSide Experiment

Thursday, November 14, 2013 2:35 PM (25 minutes)

DarkSide is a three phase direct dark matter detection experiment. The first phase (DS-10) was a 10kg prototype located first at Princeton University and then moved to Gran Sasso National Laboratory (LNGS). The second phase (DS-50) is a 50kg detector to have a three year run at LNGS. The results of DS-50 will help prepare us for the eventual multi-ton G2 experiment. DarkSide aims to use novel techniques for background suppression allowing us to make a convincing claim of dark matter detection based upon a few events.
In this talk, I will present a brief overview of the DarkSide experiment and the new techniques that have been implemented. I will also present the efforts at UH Manoa towards the building of calibration devices that have been used in DarkSide-50 and also future calibration devices to be used in the DarkSide experiment.

Primary author: Ms HACKETT, Brianne (University of Hawaii at Manoa)

Presenter: Ms HACKETT, Brianne (University of Hawaii at Manoa)

Session Classification: Dark Matter III

Track Classification: Dark Matter

Contribution ID: **54** Type: **oral**

Dark Matter Detectors as Dark Photon Helioscopes

Wednesday, November 13, 2013 9:45 AM (25 minutes)

Light new particles with masses below 10 keV, often considered as a plausible extension of the Standard Model, will be emitted from the solar interior, and can be detected on the Earth with a variety of experimental tools. Here we analyze the new "dark" vector state V, a massive vector boson mixed with the photon via an angle kappa, that in the limit of the small mass m_V has its emission spectrum strongly peaked at low energies. Thus, we utilize the constraints on the atomic ionization rate imposed by the results of the XENON10 experiment to set the limit on the parameters of this model: kappa times m_V< 3 times10^{-12} eV. This makes low-threshold Dark Matter experiments the most sensitive dark vector helioscopes, as our result not only improves current experimental bounds from other searches by several orders of magnitude, but also surpasses even the most stringent astrophysical and cosmological limits in a seven-decade-wide interval of m_V.

Primary authors: Dr AN, Haipeng (Perimeter Institute); Dr PRADLER, Josef (Johns Hopkins University); Prof. POSPELOV, Maxim (Perimeter Institute and University of Victoria)

Presenter: Dr AN, Haipeng (Perimeter Institute)

Session Classification: Dark Matter I

Track Classification: Dark Matter

Contribution ID: **55** Type: **oral**

Photons signaling a phase transition in nuclear matter during neutron star mergers

Wednesday, November 13, 2013 11:55 AM (25 minutes)

Binary neutron star mergers are thought to be the engines of some short gamma ray bursts. We show that a merger creates conditions of sufficiently high density and temperature that a phase transition from nuclear to quark degrees of freedom may occur. For a signal of the transition, we study photons produced by the decay of collective modes of the quark plasma. These photons have a characteristic quasi-thermal spectrum and a high energy associated with their origin in quantum chromodynamical effects. Placed in the context of the hot plasma and competing sources of electromagnetic radiation in the merger, these photons may provide a signature of the phase transition and thus also support the binary neutron star-short gamma ray burst connection.

Primary author: Dr LABUN, Lance (National Taiwan University)

Co-author: Prof. CHEN, Pisin (SLAC)

Presenter: Dr LABUN, Lance (National Taiwan University)

Session Classification: Cosmic Ray I

Track Classification: Cosmic Rays

Contribution ID: **56** Type: **oral**

Gravitational Redshifts in Clusters of Galaxies

Thursday, November 14, 2013 10:40 AM (25 minutes)

Wojtak, Hansen and Hjorth (Nature, 2011) have measured the long-predicted gravitational redshifts in galaxy clusters using Sloan Digital Sky Survey data. The effect is very small, corresponding to a velocity shift of only ~10 km/s in clusters with internal random motions ~600 km/s) but is in good agreement with general relativity predictions and possibly in conflict with some alternative gravity theories. Zhao, Peacock and Li (2012) showed there should also be a competing special relativistic effect - the transverse Doppler (TD) effect - of similar magnitude. In this talk I will describe how there are two more kinematic effects that need to be considered in interpreting these observations; a 'light cone' effect that augments the TD shift and a competing effect caused by modulation of the surface brightness of galaxies by relativistic beaming. I will discuss how these observations constrain gravitation theory.

Primary author: Dr KAISER, Nicholas (Institute for Astronomy, U. Hawaii)

Presenter: Dr KAISER, Nicholas (Institute for Astronomy, U. Hawaii)

Session Classification: Cosmology III

Track Classification: Cosmology

Contribution ID: **57** Type: **oral**

Implications of the abnormal neutrino mass ordering on the lepton flavor mixing structure

Wednesday, November 13, 2013 8:55 AM (25 minutes)

Abstract: Both up- and down-type quarks have the normal mass hierarchies, and this fact coincides with the observed structure of quark flavor mixing. While the charged lepton mass spectrum have a similar feature, it remains unclear whether the neutrino mass ordering is normal or not. In this talk we discuss various phenomenological implications of the abnormal neutrino mass ordering, and comment on its naturalness or unnaturalness from a point of view of model building. We argue that the observed pattern of lepton flavor mixing appears to favor the normal neutrino mass ordering in the large tau mass limit. A comparison between the lepton and quark flavor mixing structures is also made.

Primary author: XING, Zhi-Zhong (IHEP)

Presenter: XING, Zhi-Zhong (IHEP)

Session Classification: Neutrinos I

Track Classification: Neutrinos

Contribution ID: **58** Type: **oral**

The DarkSide Experiment - Physics of Direct Dark Matter Detection

Thursday, November 14, 2013 2:10 PM (25 minutes)

There is now strong astrophysical evidence that the majority of the mass in the universe is comprised of an as yet unidentified form of non-baryonic matter. This matter does not interact via the electromagnetic force nor the strong force and is non-relativistic. Predicted by supersymmetric models and possessing all of the required properties, WIMPS (Weakly Interacting Massive Particles) form a promising candidate for this 'dark matter.' Despite the lack of electromagnetic or strong interactions, WIMPS should occasionally elastically recoil off atomic nuclei, and it is these recoils which liquid noble gas detectors are ideally suited to detect.
In this talk, I will discuss the physics of liquid noble gas detectors, as well as sources of background in WIMP searches and methods of their suppression, with a particular emphasis on the techniques employed by the DarkSide program at LNGS.

Primary author: Ms EDKINS, Erin (University of Hawaii at Manoa)

Presenter: Ms EDKINS, Erin (University of Hawaii at Manoa)

Session Classification: Dark Matter III

Track Classification: Dark Matter

Contribution ID: **59** Type: **oral**

Ultra light dark matter search using the spherical gaseous detector

Wednesday, November 13, 2013 2:45 PM (25 minutes)

The new detector based on a spherical geometry will be presented. The detector consists of a large spherical gas volume with a central electrode forming a radial electric field. A small spherical sensor located at the center is acting as a proportional amplification structure. Sub-keV energy threshold with good energy resolution is achieved and calibration source developed. The very low energy threshold of such detector and versatility of the target (Ar, Ne, He, H) has led to investigations of its potential performance for dark matter searches, in particular low mass WIMP's and Axion like particles. WIMP sensitivity could be pushed down to 100 MeV. Preliminary results obtained with a low radioactivity prototype operated in Underground lab of Modane and typical expected sensitivities will be discussed.

Primary author: GIOMATARIS, Ioannis (CEA-Saclay)

Presenter: GIOMATARIS, Ioannis (CEA-Saclay)

Session Classification: Dark Matter II

Track Classification: Dark Matter

Contribution ID: **60** Type: **oral**

Results from Ultra High Energy Cosmic Rays detection with the Pierre Auger Observatory

Thursday, November 14, 2013 9:45 AM (25 minutes)

The Pierre Auger Observatory in Malargüe Argentina, is the largest cosmic ray observatory in the world and is dedicated to the observation of Ultra High Energy Cosmic Rays. The current exposure reaches nearly 40,000 km^2 sr. The analysis of this unprecedented data set have led to number of major breakthroughs. In this contribution I will discuss the performance of the observatory, new enhancements, and highlight some of the major results. Among these results are the energy spectrum, the search for large-scale anisotropies, and the developments made in mass composition studies.

Primary author: Dr SCHOORLEMMER, Harm (University of Hawaii at Manoa)

Presenter: Dr SCHOORLEMMER, Harm (University of Hawaii at Manoa)

Session Classification: Cosmic Ray II

Track Classification: Cosmic Rays

Contribution ID: **121** Type: **not specified**

Overview of Dark Matter Indirect Detection

Presenter: ROTT, Carsten

Contribution ID: **123** Type: **not specified**

High-Energy Gamma Rays

Friday, November 15, 2013 1:50 PM (45 minutes)

Presenter: SINNIS, Gus

Session Classification: Plenary Session 7

Contribution ID: **124** Type: **not specified**

A Quest for Sources of Ultra High Energy Cosmic Rays

Friday, November 15, 2013 2:35 PM (45 minutes)

Presenter: KOTERA, Kumiko

Session Classification: Plenary Session 7

Contribution ID: **125** Type: **not specified**

Latest results from the AMS-02 experiment

Tuesday, November 12, 2013 8:55 AM (30 minutes)

Presenter: Dr BINDI, Veronica (UH)

Session Classification: Plenary Session 1

Contribution ID: **126** Type: **not specified**

The Dark Energy Survey

Friday, November 15, 2013 4:20 PM (30 minutes)

Presenter: CUNHA, Carlos

Session Classification: Plenary Session 8

Contribution ID: **127** Type: **not specified**

The Birth of Neutrino Astrophysics

Friday, November 15, 2013 3:20 PM (30 minutes)

Presenter: KURAHASHI NEILSON, Naoko (UW WIPAC)

Session Classification: Plenary Session 7

Contribution ID: **128** Type: **not specified**

Outlook

Friday, November 15, 2013 4:50 PM (40 minutes)

Presenter: HALZEN, Francis (University of Wisconsin)

Session Classification: Plenary Session 8

Contribution ID: **129** Type: **not specified**

Neutrino Physics Now and in the Near Future

Friday, November 15, 2013 8:30 AM (45 minutes)

Presenter: Dr MINAKATA, Hisakazu (TMU)

Session Classification: Plenary Session 5

Contribution ID: **130** Type: **not specified**

Overview of Low-Energy Neutrino Experiments

Friday, November 15, 2013 9:15 AM (45 minutes)

Presenter: LUK, Kam-Biu (UC-Berkeley)

Session Classification: Plenary Session 5

Contribution ID: **131** Type: **not specified**

Overview of Dark Matter Indirect Detection

Friday, November 15, 2013 10:30 AM (45 minutes)

Presenter: ROTT, Carsten (Sungkyunkwan University)

Session Classification: Plenary Session 6

Contribution ID: **132** Type: **not specified**

Observation of Ultra High-Energy Cosmic Rays: Status and Prospects

Friday, November 15, 2013 11:15 AM (45 minutes)

Presenter: FUKUSHIMA, MASAKI (ICRR, Univ. Tokyo)

Session Classification: Plenary Session 6

Contribution ID: **133** Type: **not specified**

Overview of Dark Matter Direct Detection

Tuesday, November 12, 2013 10:40 AM (45 minutes)

Presenter: LANG, Rafael (Purdue University)

Session Classification: Plenary Session 2

Contribution ID: **134** Type: **not specified**

Dark Matter Searches at Accelerator Facilities

Tuesday, November 12, 2013 11:25 AM (45 minutes)

Presenter: Dr DUTTA, Bhaskar (Texas A&M university)

Session Classification: Plenary Session 2

Contribution ID: **135** Type: **not specified**

Lambda CDM and Its Variants: Theory and Observation

Tuesday, November 12, 2013 2:00 PM (45 minutes)

Presenter: KAPLINGHAT, Manoj (UC-Irvine)

Session Classification: Plenary Session 3

Contribution ID: **136** Type: **not specified**

Overview of Dark Matter Theory

Tuesday, November 12, 2013 2:45 PM (45 minutes)

Presenter: Dr BELL, Nicole (Caltech)

Session Classification: Plenary Session 3

Contribution ID: **137** Type: **not specified**

Planck

Tuesday, November 12, 2013 4:00 PM (45 minutes)

Presenter: LAWRENCE, Charles (JPL/Caltech)

Session Classification: Plenary Session 4

Contribution ID: **140** Type: **not specified**

Opening Remarks

Tuesday, November 12, 2013 8:30 AM (25 minutes)

Session Classification: Plenary Session 1

Contribution ID: **141** Type: **not specified**

DAMPE

Presenter: CHANG, Jin (Purple Mountain Observatory)

Contribution ID: **142** Type: **not specified**

Overview of Inflation after Planck

Tuesday, November 12, 2013 9:25 AM (45 minutes)

Presenter: SENATORE, Leonardo (Stanford U)

Session Classification: Plenary Session 1