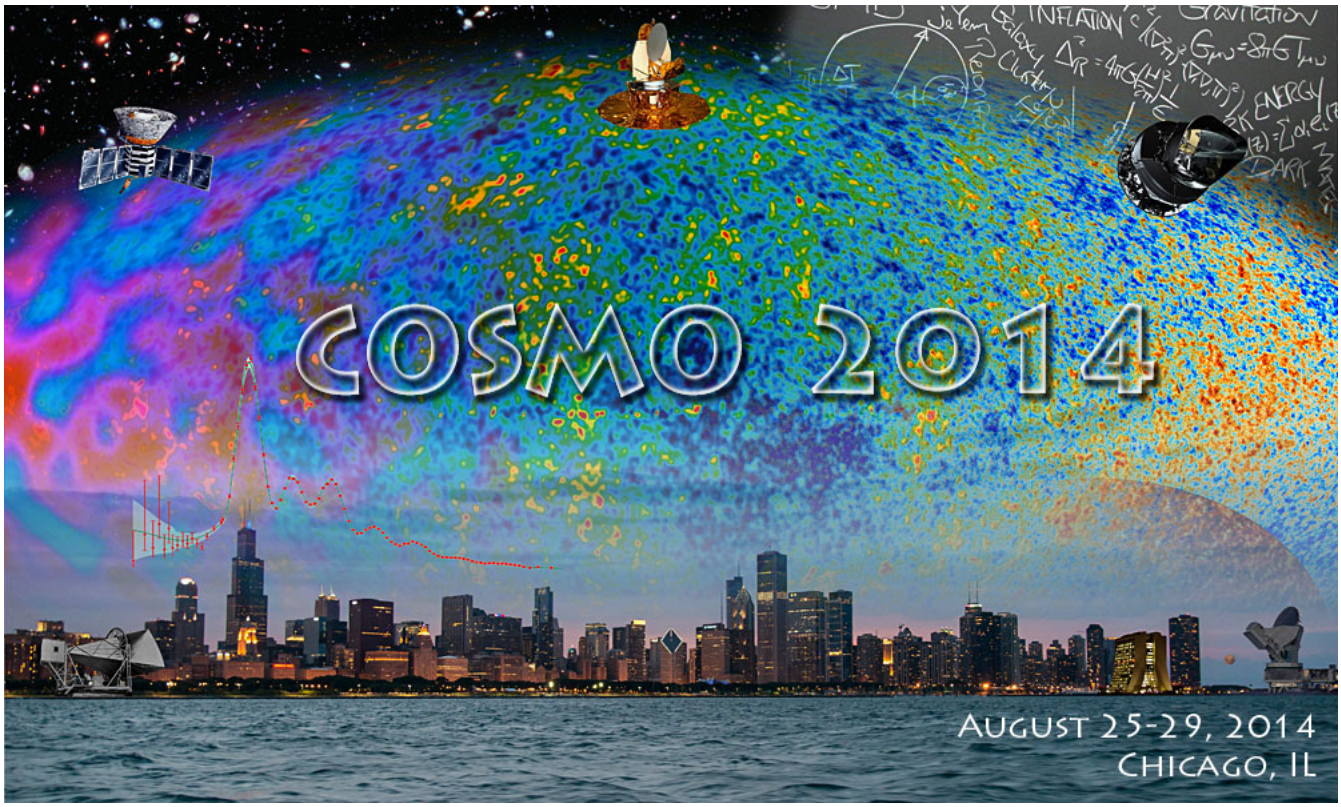

http://cosmo2014.uchicago.edu/

CONFERENCE PRESENTATIONS

The 18th annual International Conference on Particle Physics and Cosmology (COSMO 2014) will be held in Chicago on August 25 29, 2014. The meeting is being hosted by the Kavli Institute for Cosmological Physics (KICP) at the University of Chicago, and will be held at the University of Chicago's Gleacher Center in downtown Chicago.

Plenary Speakers

Nima Arkani-Hamed
Institute for Advanced Study

Kiwoon Choi
Institute for Basic Science (IBS)

Daniel Green
CITA

Will Kinney
University at Buffalo, SUNY

Andrei Linde
Stanford University

Sarah Shandera
Pennsylvania State University

Mark Trodden
University of Pennsylvania

Laura Baudis
University of Zurich

Ryan Foley
University of Illinois, Urbana-Champaign

Catherine Heymans
University of Edinburgh

Lloyd Knox
UC Davis

Nikhil Padmanabhan
Yale University

Eva Silverstein
Stanford University

Neal Weiner
New York University

Stefano Borgani
Astronomical Observatory of Trieste

Wendy Freedman
Carnegie Observatories

Justin Khoury
University of Pennsylvania

John Kovac
Harvard University

Hiranya Peiris
University College London

Tracy Slatyer
Massachusetts Institute of Technology

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University of Geneva

Goran Senjanovic
International Centre for Theoretical Physics

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Luca Grandi
University of Chicago

Dragan Huterer
University of Michigan

Michael Turner
Kavli Institute for Cosmological Physics

1. **L. Raul Abramo**, University of Sao Paulo
   Talk: Future massive multi-tracer surveys: the case of J-PAS

   August 26, 2014 (2:40 PM - 3:00 PM)
   Parallel session: CMB/Large Scale Structure

   Co-authors: The J-PAS Collaboration
   New galaxy surveys are becoming capable of mapping many different types of galaxies and other tracers of large-scale structures. If these tracers are sufficiently dense, then we can expect dramatic enhancements in the constraints on some cosmological parameters compare with single-tracer surveys. These enhancements derive from comparing the relative clustering between different tracers of large-scale structure, and can be easily understood in terms of the Fisher matrix for multi-tracer galaxy surveys. I will present forecasts for J-PAS, a deep (z<1.3), large-area multi-tracer survey tthat will start collecting data in 2015. [Based on Abramo & Leonard, 2013, MNRAS 432: 318 ; and on Benitez et al., 1403.5237]

2. **Michel Aguena**, University of Sao Paulo
   Poster: Constraining Cosmological Parameters with Galaxy Clusters

   August 25, 2014

   Co-authors: Marcos Lima
   Over the past years, the clustering of galaxies have been recognized as powerful cosmological probe. This study aims to understand this process and how it is related to the underlying cosmology. The results presented are based on mock catalogs from the upcoming data from the Dark Energy Survey. Through Monte Carlo statistical analysis, using MCMC codes such as emcee, cosmological parameters are estimated from the number of galaxy clusters at different redshifts. Both clusters and halos from mock catalogs are used in the several evaluations.

3. **Carlos Alberto S Almeida**, Physics Department - Universidade Federal do Ceará
   Poster: Modified Newton's gravity and spontaneous Lorentz violation

   August 25, 2014

   Co-authors: WILAMI T. CRUZ, ROBERTO V. MALUF, VICTOR SANTOS
   Considering quantum gravity within the framework of effective field theory, we investigated the consequences of spontaneous Lorentz violation for the gravitational potential. In particular, we focus our attention on the bumblebee models, in which the graviton couples to a vector B? that assumes a nonzero vacuum expectation value. The leading order corrections for the nonrelativistic potential are obtained from calculation of the scattering matrix of two scalar particles interacting gravitationally. These corrections imply anisotropic properties associated with the bumblebee background and also add a Darwin-like term for Newton's potential.

4. **Mustafa A Amin**, University of Cambridge/ Kavli Institute for Cosmology
   Talk: Inflaton Fragmentation and Matter-Antimatter Asymmetry

   August 26, 2014 (4:20 PM - 4:40 PM)
   Parallel session: Formal/Inflation

   Co-authors: Kaloian Lozanov
   Is the matter-antimatter asymmetry linked to inflation? I will show how the nonlinear dynamics at the end of inflation, including fragmentation, soliton formation and reheating can generate the baryon asymmetry in our universe. I will present results from a detailed linear analysis as well as 3+1 dimensional lattice simulations.

5. **Adam J Anderson**, MIT
   Talk: Low-Energy Analysis of Data from SuperCDMS Soudan

   August 27, 2014 (2:40 PM - 3:00 PM)
   Parallel session: Dark Matter

   Co-authors: on behalf of the SuperCDMS collaboration
   The SuperCDMS experiment has operated a 9kg array of cryogenic germanium detectors to search for weakly interacting massive particles (WIMPs) in the Soudan Underground Lab since early 2012. We recently published a blind analysis of 577 kg-d of low-energy data on a subset of detectors with 1.6 keVnr energy threshold. This analysis uses boosted decision trees and a detector simulation to optimize the background discrimination and sensitivity to light WIMPs. The resulting limit disagrees with WIMP-interpretations of the CDMSII-Si and CoGeNT excesses. I will describe the results of this analysis and ongoing followup studies of the newly-unblinded data, which focus on refining the background modeling and discrimination algorithms.

6. **Nima Arkani-Hamed**, Institute for Advanced Study
Invited Talk: Cosmological collider physics

August 28, 2014 (9:00 AM - 9:45 AM)
Plenary session

7. **Amjad Ashoorioon**, Lancaster University
Talk: M-flation after BICEP2

August 25, 2014 (2:40 PM - 3:00 PM)
Parallel session: Formal/Inflation

Co-authors: M. M. Sheikh-Jabbari

8. **Metin Ata**, AIP, Germany
Poster: Reconstruction of the non-linear cosmic density field from biased tracers with Bayesian methods

August 25, 2014

Co-authors: Francisco-Shu Kitaura, Volker Müller
The distribution of galaxies encodes a wealth of information on the origin and evolution of the Universe, which can be used to constrain the cosmological parameters and ultimately understand the nature of dark matter clustering and the expansion caused by dark energy. However, its nonlinear stochastic biased nature with respect to the underlying continuous dark matter field makes a straightforward analysis difficult. The new era of galaxy surveys (such as eBOSS, JPAS, 4MOST, WEAVE, DESI, EUCLID) will trace the LSS with unprecedented accuracy relying on emission line galaxies (eLGs), which are highly nonlinear biased tracers hosted in a wide dark matter density range. Specific data analysis methods need to be developed to extract the maximum information from such data. We propose to sample the posterior distribution function relating the dark matter field to the biased tracers in a Bayesian approach, including the nonlinear stochastic biased nature of the data in the likelihood.

9. **Anna Paula R Bacalhau**, Brazilian Center for Physics Research
Poster: Cosmological dynamics with non-linear interactions

August 25, 2014

Co-authors: Fabiola Arevalo, Winfried Zimdahl
We consider a set of non-linear interactions between dark matter and dark energy which comprises couplings proportional to products of (powers of) the energy densities of both dark components and of the total energy. We demonstrate that under such conditions the final state of the Universe may differ substantially from that of the standard $Lambda$CDM model. In particular, the ratio of the energy densities of dark matter and dark energy may approach a stable finite value or oscillate about such a value. Stationary solutions of this type require a phantom-type ``bare" equation of state of the dark energy which, however, does not lead to a big-rip singularity. A corresponding analytic solution for a particular case is shown to be consistent with the supernova type Ia (SNIa) data from the Union2 set. For a broader class of interactions, a dynamical system analysis classifies stationary points with emphasis on their potential relevance for the coincidence problem.

10. **Irène Balmès**, IFUSP, São Paulo
Poster: CDM halo profile in modified gravity simulations

August 25, 2014

Co-authors: Marcos Lima, David Mota, Claudio Llinares
Viable models of modified gravity typically display an expansion history similar to LCDM, but may leave imprints on structures at intermediate and large scales. Fully consistent models must also have mechanisms which suppress the modifications on e.g. the solar system, where the theory reduces to General Relativity in order to satisfy local gravity tests. A number of screening mechanisms arise in different models, such as f(R), Gallileons and Symmetron. As a result of screening, the transition from linear to non-linear scales offers the possibility to test this unique signature of these models. Here we study halo profiles in simulations of f(R) and Symmetron models and contrast them to LCDM, with hopes to highlight such differences on cluster scales.

11. **Laura Baudis**, University of Zurich
Invited Talk: Direct detection of dark matter

August 28, 2014 (11:00 AM - 11:45 AM)
Plenary session

12. **Lasha Berezhiani**, University of Pennsylvania
Talk: On Consistency Conditions for Primordial Perturbations

August 29, 2014 (3:00 PM - 3:20 PM)
Parallel session: Formal/Inflation

Co-authors: Justin Khoury
I will show that all cosmological consistency relations derive from the Slavnov-Taylor identity for spatial diffeomorphisms. Our approach underscores the role of diffeomorphism invariance at the root of these relations and offers new insights on the necessary conditions for their validity.

13. **Asher Berlin**, University of Chicago
Talk: Hidden Sector Dark Matter Models for the Galactic Center Gamma-Ray Excess

August 29, 2014 (3:00 PM - 3:20 PM)
Parallel session: Dark Matter

Co-authors: Pierre Gratia, Dan Hooper, Samuel D. McDermott
The gamma-ray excess observed from the Galactic Center can be interpreted as dark matter particles annihilating into Standard Model fermions with a cross section near that expected for a thermal relic. Although many particle physics models have been shown to be able to account for this signal, the fact that this particle has not yet been observed in direct detection experiments somewhat restricts the nature of its interactions. One way to suppress the dark matter's elastic scattering cross section with nuclei is to consider models in which the dark matter is part of a hidden sector. In such models, the dark matter can annihilate into other hidden sector particles, which then decay into Standard Model fermions through a small degree of mixing with the photon, Z, or Higgs bosons. After discussing the gamma-ray signal from hidden sector dark matter in general terms, we consider two concrete realizations: a hidden photon model in which the dark matter annihilates into a pair of vector gauge bosons that decay through kinetic mixing with the photon, and a scenario within the generalized NMSSM in which the dark matter is a singlino-like neutralino that annihilates into a pair of singlet Higgs bosons, which decay through their mixing with the Higgs bosons of the MSSM.

14. **Nikita Blinov**, TRIUMF/University of British Columbia
Talk: Rescuing Light Moduli Cosmology from Indirect Detection

August 26, 2014 (3:00 PM - 3:20 PM)
Parallel session: Dark Matter

Co-authors: Jonathan Kozaczuk, Arjun Menon, David E. Morrissey
Moduli fields with Planck suppressed couplings to light species are ubiquitous in string theory and supersymmetry. In the early universe coherent oscillations of these scalar fields are expected to dominate the energy budget. Eventually their out of-equilibrium decays reheat the universe. This mechanism provides a viable avenue for non-thermal production of dark matter. In supergravity theories the modulus mass is typically tied to the scale of supersymmetry breaking, which determines superpartner masses. Collider constraints on Standard Model superpartners point to a split spectrum with gauginos much lighter than the scalars. Such spectra are typical of Anomaly Mediated Supersymmetry Breaking (AMSB), which also predicts the lightest supersymmetric particle to be the wino. If stable, the wino can be an attractive dark matter candidate. Unfortunately, its self annihilation rate in the present universe is in severe conflict with observations from the Fermi-LAT and HESS experiments, which rule out wino dark matter and therefore AMSB-type spectra for a wide range of parameters. The resulting bounds on superpartner masses offer dim prospects for collider discovery of supersymmetry. We investigate extensions of the Minimal Supersymmetric Standard Model that allow low scale supersymmetry accessible by direct searches, while being consistent with astrophysical and cosmological probes. The tension with indirect searches is most easily relieved by allowing the wino to decay into new stable states that play the role of dark matter. We examine the viability of this scenario in models with light Abelian and non-Abelian hidden sectors, and asymmetric dark matter.

15. **Linda Blot**, LUTH Observatoire de Paris, Meudon
Talk: Matter Power Spectrum Covariance Matrix from the DEUS-PUR LCDM simulations: Mass Resolution and non Gaussian Errors

August 26, 2014 (3:40 PM - 4:00 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: Pier Stefano Corasaniti, Jean-Michel Alimi, Vincent Reverdy, Yann Rasera
We compute the covariance matrix of the matter power spectrum for the concordance LCDM cosmology from an ensemble of N-body simulations of the Dark Energy Universe Simulation - Parallel Universe Runs (DEUS-PUR). This consists of 12288 realizations of a (656 h/Mpc)^3 simulation box with 256^3 particles. We combine this set with an auxiliary sample of 96 simulations of the same volume with 1024^3 particles which we use to assess the impact of non-Gaussian uncertainties due to mass resolution effects. We find this to be an important source of systematic error in the covariance matrix estimation at high redshift and small scales. We introduce an empirical statistical method to correct for this effect and provide an accurate determination of the covariance matrix over a large interval of scales including the Baryon Acoustic Oscillations. The large statistical sample of DEUS-PUR simulations enables us to finely sample the probability distribution of the matter power spectrum. Contrary to previous studies which have used smaller N-body simulation ensembles, we find the skewness of the distribution to significantly deviate from expectations of a Gaussian random density field at k >~ 0.25 h/Mpc and z<0.5. This suggests that in the case of finite volume surveys an unbiased estimate of the ensemble averaged band power at these scales and redshifts may require a carefull assessment of non-Gaussian errors more than previously considered.

16. **Stefano Borgani**, Astronomical Observatory of Trieste
Invited Talk: Cosmology with Galaxy Clusters: the Role of Simulations

August 28, 2014 (9:45 AM - 10:30 AM)
Plenary session

17. **Daniel Boriero**, Bielefeld University
Poster: Cosmological neutrinos out of equilibrium

August 25, 2014

In this work will be described how the process of flavour oscillation produces distortions in the Fermi-Dirac distribution of cosmological neutrinos. The effects on cosmological observables and model parameters will be discussed with attention to the minimal standard model.

18. **Latham Boyle**, Perimeter Institute
Talk: On testing and reformulating the inflationary consistency relation $n_{t}=-r/8$

August 25, 2014 (4:00 PM - 4:20 PM)
Parallel session: Formal/Inflation

Co-authors: Kendrick M. Smith, Cora Dvorkin, Mark Halpern, Gary Hinshaw, Neil Turok
If we measure a non-zero value of r on CMB scales, then the inflationary consistency relation $n_{t}=-r/8$ predicts a small negative value for the tensor spectral index n_{t}; we show that, if r is as large as BICEP2 suggests, future CMB polarization experiments should be able to confirm this prediction at several sigma. By combining a measurement of r on large (CMB) scales with a direct detection of the gravitational wave amplitude $Omega_{gw}$ on much smaller (solar system) scales, it should be possible to test the consistency relation with much higher significance and, in addition, access qualitatively new information about the very early universe. This relies on a certain reformulation of the consistency relation which we propose.

19. **Juan Bueno Sanchez**, Universidad del Valle (Cali, Colombia)
Poster: CMB anomalies from local, out-of-equilibrium inflationary relics: A window to observe primary inflation

August 25, 2014

We discuss the inflationary origin of large-angle CMB anomalies by means of a recently developed physical mechanism to imprint a spatially localized contribution to the curvature perturbation from an isocurvature field. In particular, we discuss the role that the localization mechanism may have played in the origin of a recently discovered supervoid claimed to explain the Cold Spot anomaly, thus shedding light on the rarity of such supervoid. We also discuss how the localization mechanism, when applied to vector fields, manages to imprint a spatially localized, direction-dependent contribution to the curvature perturbation, thus realizing the localized version of the vector curvaton mechanism. We briefly comment on the implications of this scenario to a number of large-angle anomalies.

20. **Clare Burrage**, University of Nottingham
Talk: Detecting dark energy in the laboratory

August 25, 2014 (2:00 PM - 2:20 PM)
Parallel session: Dark Energy

Co-authors: Ed Copeland (Nottingham), Ed Hinds (Imperial)
The growing expansion rate of the universe leads to the conclusion that most of the energy in the universe is dark energy, but the nature and origin of this substance are not understood. Natural explanations typically require a new scalar field, but such a field should produce a new force. Laboratory and solar-system experiments show that any such fifth force is far weaker than gravity, suggesting in a simple Yukawa model that the underlying physics is at energies far above the Planck scale and impossible to incorporate into normal quantum field theory. This difficulty can only be avoided if the properties of the scalar field vary with environment. The archetype of this is the chameleon field, which is screened - i.e. suppressed - in regions of high density and so goes undetected in fifth forces experiments on earth and in the solar system. This leaves the pressing question of how to test whether the chameleon fields actually exist. I will show that individual atoms, though dense in the nucleus, are too small to screen the chameleon field inside a large enough high-vacuum chamber, and therefore can detect the field with high sensitivity. This will allows us to derive new limits on the chameleon parameters from existing experiments to measure forces on atoms. I will go on to show that most of the remaining parameter space is readily accessible using atom interferometry to measure the chameleon force. Our results show that there are already more constraints on scalar fields than previously thought and open a powerful route to search for dark energy in the laboratory.

21. **Joyce Byun**, Cornell University
Talk: Non-Gaussian Shape Reconstruction from Future Galaxy Surveys

August 27, 2014 (4:20 PM - 4:40 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: Rachel Bean
Detecting a non-zero 3-point correlation function, or bispectrum, of primordial fluctuations would have enormous implications for our understanding of inflation, because competing inflationary models make distinct predictions for how the bispectrum's amplitude should vary across combinations of 3 wavenumbers that form 'triangles' in Fourier-space. Most searches for bispectra focus on a handful of bispectrum templates that approximate large classes of models employing different physics to drive inflation, such as models with multiple fields, higher derivative terms in the inflaton's Lagrangian, or non-trivial initial quantum states, to name only a few. However, many models don't fit neatly into these template categories and might exist in the data overlooked, unless we expand our search to more general bispectra that extend beyond the usual templates. Furthermore, in many cases the tightest constraints on a particular model comes from assuming the underlying bispectrum's wavenumber dependence to take the model's particular form, while using the data to constrain the value of one parameter 'fnl' that dials the overall amplitude of the observed bispectrum. In contrast, a constraint that accounts for our uncertainty in the true bispectrum will be weaker, and an interesting question is how well the data will be able to discriminate between a larger set of bispectra. With upcoming galaxy surveys like DESI and Euclid looming, these questions have become more pressing. How well will future data be able to constrain not just templates, but also more general shapes? How well will we be able to discriminate between competing models? Recent theoretical advances have been able to quantify how a primordial bispectrum leaves its traces on dark matter halos at late times by changing the halo bias and halo mass function relative to a universe with purely Gaussian primordial fluctuations. Since galaxies reside in halos, bispectra can in turn change the galaxy power spectrum. In this talk, I will present recent work employing the Fisher method to forecast how well upcoming measurements of the galaxy power spectrum can constrain, and distinguish between, general bispectra.

22. **Hugo O. Camacho**, DFMA/IF. University of São Paulo.
Poster: A Comparison between different methods to Compute Cosmological Correlations and Covariances

August 25, 2014

Co-authors: Marcos Lima, Fernando de Simoni and Flavia Sobreira.
We compare the computation speed and accuracy of different methods to calculate theoretical two-point correlation functions and power spectra, as well as their covariance matrices, in the context of galaxy surveys. The usual method involves the computation of correlation multipoles, which as integrals over spherical Bessel functions require a large computation time for sufficient accuracy. The computation of covariance matrices typically involve integrals over a product of Bessel functions, and may be even slower. We find that the FFTlog method from [A. Hamilton, MNRAS 312 (2000)] increases the computation speed by up to 3 orders of magnitude in the 3D correlation multipoles. We also present different approaches to the theoretical two-point correlation covariance computation with and without the FFTLog method along with a comparison between them. Special emphasis is given on angular correlations between tomographic shells which prove to be of fundamental importance in the context of modern photometric galaxy surveys. In this context the FFTLog method proves to be very useful for model parameter inference involving cosmological correlation functions observables based on MCMC techniques.

23. **Matteo Cataneo**, Dark Cosmology Centre
Talk: New constraints on f(R) gravity from clusters of galaxies and the cosmic microwave background

August 29, 2014 (4:20 PM - 4:40 PM)
Parallel session: Dark Energy

Co-authors: David A. Rapetti, Steve W. Allen, Adam B. Mantz, Anja von der Linden, Douglas E. Applegate
Viable modifications of gravity able to explain the observed late time cosmic acceleration without dark energy typically predict deviations from the growth of structure of GR. The number of massive galaxy clusters is a sensitive probe of such modifications on scales of tens of Mpc/h. In addition, imprints of structure formation emerge on the cosmic microwave background (CMB) through the integrated Sachs-Wolf effect ($r > 300$ Mpc/h) and CMB lensing ($150 < r < 500$ Mpc/h). We employ X-ray cluster survey data, together with extensive X-ray follow-up observations calibrated with robust weak gravitational lensing measurements, in combination with CMB data, to constrain the model parameters of two popular classes of f(R) gravity, namely the Hu-Sawicki model and the designer model. Our results show that current large scale structure data have the potential to enter the chameleon regime, where modifications of gravity are suppressed and GR is recovered.

24. **Chi-Ting Chiang**, Max-Planck-Institute for Astrophysics
Talk: Position-dependent power spectrum of the large-scale structure: a novel method to measure the squeezed-limit bispectrum

August 27, 2014 (3:40 PM - 4:00 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: Christian Wagner, Fabian Schmidt, and Eiichiro Komatsu
The influence of large-scale density fluctuations on structure formation on small scales is described by the three-point correlation function (bispectrum) in the so-called "squeezed configurations." This bispectrum is generated by non-linear gravitational evolution and possibly also by inflationary physics. We use this fact to show that the bispectrum in the squeezed configurations can be measured without employing three-point function estimators. Specifically, we use the "position-dependent power spectrum," i.e., the power spectrum measured in smaller subvolumes of the survey (or simulation box), and correlate it with the mean overdensity of the corresponding subvolume. This correlation directly measures an integral of the bispectrum dominated by the squeezed configurations. Measuring this correlation is only slightly more complex than measuring the power spectrum itself, and sidesteps the considerable complexity of the full bispectrum estimation. We use cosmological N-body simulations of collisionless particles with Gaussian initial conditions to show that the measured correlation between the position-dependent power spectrum and the long-wavelength overdensity agrees with the theoretical expectation predicted by the "separate universe approach," in which we consider an overdense subvolume as a positively curved universe evolving differently with respect to the background. The position-dependent power spectrum thus provides a new, efficient, and promising way to measure the squeezed- limit bispectrum from large scale structure observations such as galaxy redshift surveys.

25. **Kiwoon Choi**, Institute for Basic Science (IBS)
Invited Talk: QCD axions with high scale inflation

August 29, 2014 (9:00 AM - 9:45 AM)
Plenary session

26. **Ilias Cholis**, Fermilab
Talk: Searching for signals of dark matter in the extragalactic gamma-ray background

August 29, 2014 (4:00 PM - 4:20 PM)
Parallel session: Dark Matter

Co-authors: Dan Hooper, Sam McDermott, Andrew Hearin
The approximately isotropic gamma-ray background measured by Fermi-LAT probes the contribution from several classes of astrophysical sources. Using the catalog of known gamma-ray sources along with similar catalogues at radio wavelengths, we can model and constrain the contributions to the extragalactic gamma-ray background from astrophysical sources, as are radio galaxies, star-forming galaxies, and blazars. Then combine that information with the measurement of the gamma-ray background one can derive constraints on the dark matter annihilation cross section, including contributions from both extragalactic and galactic halos and subhalos. The resulting current constraints are competitive with the strongest current constraints from the galactic center and dwarf spheroidal galaxies. With a greater number of astrophysical sources observed in gamma-rays and other wavelengths, the gamma-ray contribution from various classes of extragalactic objects will become more tightly constrained, leading to subsequent improvement of the potential constraints on the dark matter annihilation. At the end of the Fermi-LAT mission, the sensitivity to dark matter annihilations will exceed the strongest current gamma-ray constraints by a factor of ~ 5-10. In addition, the contribution from dark matter annihilations to the anisotropy of the gamma-ray sky at high multipoles is maximal from low redshift galaxies. Thus, cross-correlating the observed gamma-ray map with known galaxies, increases the sensitivity of dark matter annihilation searches in such objects and provides limits competitive to other gamma-ray searches.

27. **Siri Chongchitnan**, University of Hull
Poster: Disentangling Non-Gaussianities with the Lyman-alpha Forest

August 25, 2014

Co-authors: Avery Meiksin
Detection of primordial non-Gaussianity will give us an unprecedented insight into the physics of inflation. As observational probes are now exploring new expanses of the inflationary landscape, it is crucial to distinguish and disentangle effects of various non-Gaussianities beyond f_NL. In this talk, I will demonstrate the effects of non Gaussianities parametrized by f_NL and g_NL on the Lyman-alpha-forest flux measurements. I will present the forms of the "flux bias" due to these non-Gaussianities, which can be deduced from accurate measurements of the transmitted flux. I show how these two effects can be cleanly disentangled via a flux transformation, which also keeps the errors in check.

28. **Adam Christopherson**, University of Nottingham
Poster: Non-linear effects on magnetic field generation

August 25, 2014

Magnetic fields are present on all scales in the Universe, in structures and even in voids. There is no single "natural" mechanism to generate the initial seed fields needed to produce these large scale magnetic fields. In this talk, I will use relativistic perturbation theory to study the generation of magnetic fields analytically, presenting results in terms of amplitude and scale dependence. I will discuss the potential for these magnetic fields to act as the initial seed field. Then, time allowing, I will consider the effects of including the non-linear perturbations on predictions of magnetic fields from inflationary magnetogenesis mechanisms.

29. **Roland de Putter**, JPL/Caltech
Talk: Constraining Fundamental Physics with Weak Lensing and Galaxy Clustering

August 27, 2014 (2:20 PM - 2:40 PM)
Parallel session: CMB/Large Scale Structure

I will discuss examples of the importance of complementarity between cosmological data sets. I will first discuss bounds from current data on neutrino mass and the primordial power spectrum, and will show that combining cosmological probes is crucial for obtaining robust constraints. I will then discuss the complementarity between near-future weak lensing and galaxy clustering surveys such as SuMIRe (Subaru Measurements of Images and Redshifts), showing that the combination of these probes promises much tighter dark energy and modified gravity constraints than those from either probe alone.

30. **Constantinos Demetroullas**, University of Manchester
Talk: A Galaxy-Galaxy lensing measurement by cross correlating optical and radio data

August 29, 2014 (3:40 PM - 4:00 PM)
Parallel session: Dark Energy

Co-authors: Michael Brown
Weak Gravitational Lensing (WGL) is a powerful tool used by astronomers to probe the matter distribution in the Universe. Most of the WGL studies up to date have been performed in the optical/Near Infra Red (NIR) with only a handful conducted in the radio. This is because optical/NIR experiments deliver a much higher source count than current radio surveys. This is expected to change in the near future, with new radio surveys delivering number densities that are comparable to the optical/NIR. But where the source number density is similar, performing WGL studies in the radio has advantages, like a well known and deterministic beam pattern (PSF), the detected sources potentially laying at higher redshifts and polarisation information. Our aim is to deliver a WGL measurement using shape information from existing radio data. For that we cross correlate shapes/positions from the VLA FIRST with positions from SDSS. During systematics identification and quantification we detect a contamination in the FIRST shapes that can leak into our measurements. We apply a correction to remove it with the cost of diluting the real signal. We quantify the level of dilution using simulations and correct our galaxy-galaxy and cluster-galaxy lensing measurements. We finally compare our results against measurements made by optical surveys.

31. **Emanuela Dimastrogiovanni**, University of Minnesota
Talk: Anisotropic signatures in cosmic structures from primordial tensor perturbations

August 26, 2014 (2:40 PM - 3:00 PM)
Parallel session: Formal/Inflation

Long wavelength primordial tensor perturbations correlated with scalar fluctuations can leave an anisotropic imprint on cosmic structures in the form of a quadrupolar power asymmetry. We compute the primordial tensor-scalar-scalar correlation in the squeezed limit for inflationary models whose predictions are compatible with such an anisotropic signal in the observed local power spectrum for matter and galaxies.

32. **Scott Dodelson**, Fermilab/Chicago
Talk: Combining Probes in the Dark Energy Survey

August 27, 2014 (2:20 PM - 2:40 PM)
Parallel session: Dark Energy

33. **Alex Drlica-Wagner**, Fermilab
Talk: Searching for Dark Matter Annihilation in the Smith High-Velocity Cloud

August 29, 2014 (4:40 PM - 5:00 PM)
Parallel session: Dark Matter

Co-authors: German Gomez-Vargas, Jack Hewitt, Tim Linden, and Luigi Tibaldo
Recent observations suggest that some high-velocity clouds may be confined by massive dark matter halos. In particular, the proximity and proposed dark matter content of the Smith Cloud make it a tempting target for the indirect detection of dark matter annihilation. We argue that the Smith Cloud may be a better target than some Milky Way dwarf spheroidal satellite galaxies and use gamma-ray observations from the Fermi Large Area Telescope to search for a dark matter annihilation signal. No significant gamma-ray excess is found coincident with the Smith Cloud, and we set strong limits on the dark matter annihilation cross section assuming a spatially extended dark matter profile consistent with dynamical modeling of the Smith Cloud. Notably, these limits exclude the canonical thermal relic cross section (~3x10^-26 cm^3 s^-1) for dark matter masses >30 GeV annihilating via the b-bbar or tau+tau- channels for certain assumptions of the dark matter density profile; however, uncertainties in the dark matter content of the Smith Cloud may significantly weaken these constraints.

34. **Cora Dvorkin**, Institute for Advanced Study
Talk: Probing Dark Matter with the Cosmic Microwave Background and Large-Scale Structure

August 27, 2014 (3:00 PM - 3:20 PM)
Parallel session: CMB/Large Scale Structure

Cosmological observations and galaxy dynamics seem to imply that five out of six parts in mass of all matter in the Universe is composed of dark matter, that is not accounted for by the Standard Model of particles. The particle nature of dark matter is one of the most intriguing puzzles of our time. It is therefore important to identify astrophysical and cosmological processes where the particle interactions of dark matter may be of relevance. In this talk, I will show that dark matter annihilation around the time of recombination can lead to growing ionization perturbations that track the linear collapse of matter overdensities. This amplifies small scale cosmological perturbations to the free electron density by a significant amount compared to the usual acoustic oscillations. Electron density perturbations distort the Cosmic Microwave Background (CMB), inducing secondary non-gaussianity. I will present a novel analytic calculation of CMB non-gaussianity from recombination, providing a clear identification of the relevant physical processes. In the last part of the talk, I will consider the possibility of dark matter-baryon interactions. I will present results from a Markov Chain Monte Carlo likelihood analysis of CMB data from the Planck satellite and measurements of the Lyman-alpha forest from the Sloan Digital Sky Survey that probe the imprints of these interactions both at large and small scales.

35. **Maksym Eingorn**, North Carolina Central University, CREST and NASA Research Centers, Durham, NC, U.S.A.
Poster: Discrete cosmology: scalar perturbations and dynamics of galaxies

August 25, 2014

Co-authors: Alexander Zhuk (Odessa National University, Astronomical Observatory, Odessa, Ukraine)
The mechanical approach to cosmological problems inside the cell of uniformity represents a very promising scientific research direction in modern cosmology. It may be also associated with discrete cosmology in the nonrelativistic limit. In its framework the observable inhomogeneous Universe is described in the first order approximation with respect to its deviation from the averaged homogeneous FLRW one, the gravitational potentials of separate inhomogeneities (galaxies) are found and their relative motion (particularly, the motion of the Milky Way and Andromeda as well as the dwarf galaxies around our Local Group) is investigated in detail. It turns out that the characteristic features of scalar perturbations (including, for example, singularities in the places of gravitating masses locations and beyond them) are sensitive to spatial topology and composition of the Universe. Thus, the discrete cosmology screens powerfully different cosmological models and sheds light on the spacetime structure and its filling.

36. **Adrienne Erickcek**, UNC Chapel Hill
Talk: Challenges for Chameleon Gravity in the Early Universe

August 27, 2014 (2:40 PM - 3:00 PM)
Parallel session: Dark Energy

Co-authors: Neil Barnaby, Clare Burrage, Zhiqi Huang
In chameleon theories, a scalar degree of freedom is hidden in high-density environments because its effective mass depends on the trace of the stress-energy tensor. In the early Universe, when the trace of the stress-energy tensor is nearly zero, the chameleon scalar field is very light, and Hubble friction prevents it from reaching its potential's minimum. Whenever a particle species becomes non-relativistic, however, the trace of the stress-energy tensor is temporarily nonzero, and the chameleon begins to roll. These "kicks" to the chameleon field have catastrophic consequences for a broad range chameleon potentials and initial conditions. The velocity imparted to the chameleon field is sufficiently large that the chameleon's mass changes rapidly as it slides past the minimum of its effective potential. This nonadiabatic process shatters the chameleon field by generating extremely high-energy perturbations just prior to the onset of Big Bang nucleosynthesis, which casts doubt on chameleon gravity's viability as an alternative to general relativity.

37. **Matteo Fasiello**, Case Western
Poster: FRW Cosmology in Massive Gravity

August 25, 2014

Co-authors: Claudia de Rham, Andrew J. Tolley
We show the existence of stable, exactly FRW, self-accelerating solutions in massive gravity. We investigate how Vainshtein screening works in this setup.

38. **Francesc Ferrer**, Washington University in St Louis
Talk: Dark-matter distributions around massive black holes: A general relativistic Analysis

August 26, 2014 (4:00 PM - 4:20 PM)
Parallel session: Dark Matter

Co-authors: The talk is based on my paper with Laleh Sadeghian and Clifford Will: Physical Review D88, 063522 (2013)
The cold dark matter at the center of a galaxy will be redistributed by the presence of a massive black hole. We apply the adiabatic growth framework in a fully relativistic setting to obtain the final dark-matter density for both cored and cusped initial distributions. Besides the implications for indirect detection estimates, we show that the gravitational effects of such a dark-matter spike are smaller than the relativistic effects of the black hole for stars orbiting close to the black hole that might be candidates for testing the black-hole no-hair theorems.

39. **Ryan Foley**, University of Illinois, Urbana-Champaign
Invited Talk: Supernova Cosmology: Successes, Challenges, and Prospects

August 26, 2014 (11:45 AM - 12:30 PM)
Plenary session

40. **Anthony Fradette**, University of Victoria
Talk: Cosmological Constraints on Very Dark Photons

August 26, 2014 (2:00 PM - 2:20 PM)
Parallel session: Dark Matter

Co-authors: Maxim Pospelov, Josef Pradler, Adam Ritz
We explore the cosmological consequences of kinetically mixed dark photons with a mass between 1 MeV and 10 GeV, and an effective electromagnetic fine structure constant as small as 10^{?38}. We calculate the freeze-in abundance of these dark photons in the early Universe and explore the impact of late decays on BBN and the CMB. This leads to new constraints on the parameter space of mass mV vs kinetic mixing parameter ?. Preprint: A. Fradette et al., Cosmological Constraints on Very Dark Photons (http://arxiv.org/abs/1407.0993)

41. **Jeroen Franse**, Leiden University
Talk: An unidentified line in X-ray spectra of the Andromeda galaxy and Perseus galaxy cluster

August 26, 2014 (4:20 PM - 4:40 PM)
Parallel session: Dark Matter

We identify a weak line at 3.5 keV in X-ray spectra of the Andromeda galaxy and Perseus galaxy cluster using deep exposures from the XMM-Newton Telescope Science Archive. The detection of this signal is presented, along with evidence that it can not concern a previously unknown systematic. The possibility is discussed that the signal originates from the decay of dark matter particles rather than from an astrophysical source. Finally, outlines of ongoing and future work to test this scenario are given.

42. **Jonathan Frazer**, UVP/EHU
Talk: Multifield Inflation and the Many Field Limit

August 25, 2014 (3:40 PM - 4:00 PM)
Parallel session: Formal/Inflation

String theory strongly motivates scenarios in which inflation is driven by multiple, or even hundreds of scalar degrees of freedom. This poses a number of both conceptual and practical challenges for which current approaches to studying inflation are ill-equipped to tackle. Drawing on concepts from information theory, we describe a methodology enabling one to make sharp statements about the predictive capability of a model and identify changes in behaviour as one traverses the space of hyperparameters. We present an example where dynamics in the manyfield limit results in robust predictions.

43. **Wendy Freedman**, Carnegie Observatories
Invited Talk: Overview of dark energy measurements

August 27, 2014 (11:00 AM - 11:45 AM)
Plenary session

44. **Katherine Freese**, University of MIchigan
Talk: Novel ideas for Dark Matter Detection

August 27, 2014 (4:00 PM - 4:20 PM)
Parallel session: Dark Matter

Co-authors: Alejandro Lopez, Andrzej Drukier, David Spergel, Charles Cantor, George Church, Takeshi Sano, Greg Tarle, Cagliyan Kurdak
Two novel approaches to dark matter detection will be presented. First, DNA-based detectors can provide directional sensitivity with nanometer tracking. Second, dark matter particles striking thermites can initiate a reaction that leads to a "nano-boom" i.e. a detectable explosion.

45. **Antonella Garzilli**, Lorentz Instituut, Leiden University
Talk: IGM: The broadening in the Lyman-alpha forest

August 27, 2014 (4:00 PM - 4:20 PM)
Parallel session: Dark Energy

Co-authors: T Theuns, J Schaye
The Lyman-alpha forest is one of the observables of the IGM at high redshift. We give an analytic description of the broadening occurring in the Lyman-alpha forest at high redshift. Our analytical description makes explicit the role of the Hubble expansion and thermal history in setting the broadening. We give a recipe to reconstruct the dark matter over density associated to each absorbing cloud from the neutral hydrogen column density. We compare our formula to our fiducial simulation and find a remarkable agreement. Our understanding of the broadening opens the way to a new method to measure the IGM thermal state and the size of the absorbing structures (and indirectly the thermal history) and to characterise the filaments properties at small scales, like the dark matter over-densities associated to each absorbing filament.

46. **Jerome Gleyzes**, IPhT CEA Saclay
Poster: Healthy theories beyond Horndeski

August 26, 2014

Co-authors: David Langlois, Federico Piazza, Filippo Vernizzi
In search for a candidate that could explain the current acceleration of the Universe, a lot of attention has been given recently to Galileon theories, or in their generalized form, Horndeski theories. They are interesting as they represent the most general scalar tensor theories that do not lead to equations of motion containing more than two derivatives. This restriction is generally thought to be of great importance, as generically, higher order derivatives lead to ghost instabilities. I will present a new class of scalar tensor theories that are broader than Horndeski and, as such, do bring higher order derivatives. However, when studying carefully the theories, it was shown that they do not propagate any additional ghostly degree of freedom. I will give details on how and why this is possible, and I'll further talk about the uncommon phenomenology associated. Indeed, these theories exhibit a new type of coupling to matter, even when the latter is minimally coupled

47. **Vera Gluscevic**, Institute for Advanced Study
Talk: Prospects for understanding WIMP-baryon interactions with direct detection

August 27, 2014 (4:20 PM - 4:40 PM)
Parallel session: Dark Matter

Co-authors: Annika H. G. Peter
We study the prospects for dark-matter direct-detection searches in probing non-relativistic effective theory for WIMP baryon scatterings. In this work, we simulate a large set of noisy recoil-energy spectra for different scattering scenarios (beyond the standard momentum-independent contact interaction), for Generation 2 and futuristic experiments, and analyze them using Bayesian model selection. Assuming a WIMP signal is observed in the next decade or so, we quantify the probability of successfully identifying the operator governing the scattering. For example, we show that a single Generation 2 experiment is unlikely to accomplish this task on its own, but the situation improves drastically when signals from different targets and energy windows are analyzed jointly. We also find that the WIMP-mass estimates can be significantly biased if data are analyzed assuming the standard (momentum-independent) operator while the scattering is momentum dependent, raising a cautionary note relevant to future data analysis. In addition, we evaluate the ultimate reach of direct detection, finding that the prospects for successful operator selection prior to reaching the irreducible neutrino backgrounds are excellent, if the signal is just below the current limits, but slim if Generation 2 does not report WIMP detection.

48. **Vera Gluscevic**, Institute for Advanced Study
Poster: Probing primordial magnetic fields with high-redshift 21cm emission

August 26, 2014

Co-authors: Tejaswi Venumadhav, Antonija Oklopcic, Abhilash Mishra, and Christopher M. Hirata
I will describe a new method to search for primordial seeds of present-day cosmic magnetic fields, using future measurements from low-frequency radio-arrays designed to study tomography of the redshifted 21-cm brightness temperature fluctuations. When hydrogen atoms in the triplet state of the hyperfine transition are immersed into a weak external magnetic field B, they slowly precesses around the direction of B. The signature of a coherent precession of an ensemble of atoms at high redshift is introduction of a preferred direction in the power spectrum of the brightness temperature fluctuations observed in the sky. The order-of-magnitude of the magnetic fields that could in principle be captured by precise measurements of the power spectrum is less than 10^{-19} Gauss at redshift of about 20. Such sensitivity makes this method an extremely promising avenue for probing physics of gas at high redshifts and potentially providing insight into the physics of inflation. I will summarize the theoretical basis for this effect and discuss detectability of primordial magnetic fields using data from SKA and similar surveys.

49. **Daniel Green**, CITA
Invited Talk: B-modes and the Nature of Inflation

August 29, 2014 (9:45 AM - 10:30 AM)
Plenary session

Co-authors: Daniel Baumann, Rafael Porto

50. **Ruth Gregory**, Durham University
Talk: Catalysing vacuum decay

August 29, 2014 (4:20 PM - 4:40 PM)
Parallel session: Formal/Inflation

Co-authors: Ian Moss, Ben Withers
Under certain conditions the universe can undergo a phase transition by tunneling from a false vacuum. This Coleman-de Luccia process of vacuum decay assumes the universe is very symmetric, and is the "gold standard" for describing any sort of gravitational decay process. However, just as impurities can act as nucleation sites of a phase transition, gravitational impurities, in the guise of black holes, can act as bubble nucleation sites for false vacuum decay. We show how the presence of a black hole can significantly enhance the probability of vacuum decay.

51. **Daniel Grin**, University of Chicago
Talk: Some new sources of CMB spectral distortions

August 25, 2014 (4:00 PM - 4:20 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: Jens Chluba, Mustafa Amin
With the PIXIE and PRISM CMB satellite proposals, measuring distortions of the CMB frequency spectrum away from a perfect blackbody becomes a realistic experimental possibility. We discuss two new ways in which these distortions could open windows on aspects of primordial cosmology. In particular, we will show the power of CMB spectral distortions to test for the presence of primordial isocurvature modes on extremely small scales, and for the presence of active sources of CMB fluctuations on extremely small scales. In the second scenario, we will consider perturbations sourced by global symmetry breaking phase transitions after inflation, and consider the acoustic waves excited as well as the ultimate spectral distortion signature generated. In light of this work, we see that CMB spectral distortions can test physics of the perturbations beyond the simplest inflationary hypothesis for perturbations on these scales.

52. **Yann Guardincerri**, FermiLab
Talk: DarkSide-50: performance and results from the first atmospheric argon run

August 27, 2014 (2:00 PM - 2:20 PM)
Parallel session: Dark Matter

Co-authors: On behalf of the DarkSide collaboration
DarkSide-50 (DS-50) at Gran Sasso underground laboratory, Italy, is a direct dark matter search experiment based on a TPC with liquid argon from underground sources. The DS-50 TPC, with 50 kg of active argon and a projected fiducial mass of >33 kg, is installed inside an active neutron veto based on a boron-loaded organic scintillator. The neutron veto is built inside a water cherenkov muon veto. DS-50 has been taking data since Nov 2013, collecting more than 2e7 events with atmospheric argon. This data represents an exposure to the largest background, beta decays of Ar-39, comparable to the full three-year run planned for DS-50 with underground argon. When analyzed with a threshold that would give a sensitivity in the full run of about 1e-45 cm^2 at a WIMP mass of 100 GeV/c^2, there is no Ar-39 background observed. The detector design and performance will be presented as well as results from the atmospheric argon run still in progress. Plans for the underground argon run and for a ton-scale detector within the same neutron veto vessel will be presented.

53. **Daniel C Guariento**, Universidade de São Paulo
Poster: Cosmological black holes: exact solutions and interaction with scalar-tensor field theories

August 26, 2014

Co-authors: Elcio Abdalla, Niayesh Afshordi, Alan M. da Silva, Michele Fontanini, Eleftherios Papantonopoulos
Systems which contemplate gravitational interaction between compact objects and the matter content in a cosmological environment constitute an important problem which has been studied since the early days of General Relativity. The generalized McVittie black hole is a simple exact solution to this problem, which provides us with insight on some of its physical aspects, as well as hints to new mechanisms which arise from a more formal treatment. We review some properties of this solution and its matter source, which can be interpreted as a classical fluid, but is also an exact solution to a nontrivial Horndeski theory.

54. **Nico Hamaus**, Institut d'Astrophysique de Paris
Talk: A unique composition of emptiness - Cosmic voids as cosmological probes

August 27, 2014 (2:00 PM - 2:20 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: Benjamin Wandelt, Paul Sutter, Guilhem Lavaux, Michael Warren
Understanding the internal structure and spatial distribution of cosmic voids is crucial when considering them as tracers of large-scale structure. I will present some recent advances in modelling average void density- and velocity profiles, as well as their two-point statistics in redshift space on the basis of state-of-the-art N-body simulations and mock galaxy catalogs. The excellent agreement of these models with the data is demonstrated, suggesting voids to be among the most pristine objects to consider for future studies on the nature of dark energy, dark matter and modified gravity.

55. **Orin Harris**, IUSB
Talk: Update from PICO

August 27, 2014 (3:40 PM - 4:00 PM)
Parallel session: Dark Matter

Co-authors: The PICO Collaboration
The PICO Collaboration (formed from the merger of the Chicago-based COUPP and the Canadian-based PICASSO experiments) uses bubble chambers to search for dark matter. Operated at only moderate superheat, PICO bubble chambers are sensitive to the nuclear recoils produced by dark matter interactions, but are insensitive to the typically-dominant background of electron recoils. PICO bubble chambers additionally use acoustic measurements to make possible the rejection of additional backgrounds such as alpha decays, and also feature the ability to change target nuclei in the same experiment in order to confirm the properties of dark matter.

56. **Jasper Hasenkamp**, New York University
Talk: Tight Bonds between Sterile Neutrinos and Dark Matter

August 26, 2014 (3:40 PM - 4:00 PM)
Parallel session: Dark Matter

Co-authors: Torsten Bringmann, Joern Kersten
Despite the astonishing success of standard ?CDM cosmology, there is mounting evidence for a tension with observations at small and intermediate scales. We introduce a simple model where both, cold dark matter (DM) and sterile neutrinos, are charged under a new U(1)_X gauge interaction. The resulting DM self-interactions resolve the tension with the observed abundances and internal density structures of dwarf galaxies. At the same time, the sterile neutrinos can account for both the small hot DM component favored by cosmological observations and the neutrino anomalies found in short-baseline experiments.

57. **César Hernández-Aguayo**, Universidad de Guanajuato
Poster: Spherical collapse of cosmological scalar field: The approach of the numerical relativity

August 26, 2014

Co-authors: Luis A. Ureña-López, Miguel Alcubierre, Darío Núñez, José M. Torres
We study the formation of structure in the Universe assuming that dark matter can be described by a scalar field phi with a potential $V(phi)=m^2phi^2/2$. We derive the evolution equations of the scalar field in the linear regime of perturbations. In order to study the nonlinear regime, we use the spherical collapse model. The spherical collapse model is a simple, but fundamental tool for understanding the growth of fluctuations in the Universe. This model considers that the formation of gravitational structures in the Universe can be described by the evolution of an overdense spherical region. In this work, we adapt a numerical relativity code to evolve cosmological scenarios and deal with the nonlinear problem of structure formation in situations where a description of matter in terms of scalar fields is necessary.

58. **Mark P Hertzberg**, MIT
Talk: Baryogenesis from the Inflaton Field

August 29, 2014 (4:40 PM - 5:00 PM)
Parallel session: Formal/Inflation

Co-authors: Johanna Karouby
In this talk I show that the inflaton can generate the cosmological baryon asymmetry. I take the inflaton to be a complex scalar field with a weakly broken global symmetry and develop a new variant on the Affleck-Dine mechanism. I show that a conserved particle number can be produced in the latter stage of inflation, which can later decay to baryons, and mention possible embeddings in particle physics. I discuss important observational consequences, including a prediction of isocurvature fluctuations, whose amplitude is just below current limits, and a possible large scale dipole. I also discuss self resonance after inflation in these models, which causes the inflaton to fragment into separate regions of particles and anti particles, and how the Goldstone theorem organizes the behavior of modes.

59. **Catherine Heymans**, University of Edinburgh
Invited Talk: Gravitational lensing

August 27, 2014 (9:45 AM - 10:30 AM)
Plenary session

60. **Richard J Hill**, University of Chicago
Talk: Formalism and applications of Heavy WIMP Effective Theory

August 27, 2014 (4:40 PM - 5:00 PM)
Parallel session: Dark Matter

Co-authors: Mikhail Solon, Martin Bauer, Tim Cohen
The discovery of a Standard Model-like Higgs boson and the hitherto absence of evidence for other new states may indicate that if WIMPs comprise cosmological dark matter, they are heavy compared to electroweak scale particles, M >> m_W, m_Z. In this limit, the absolute cross section for a WIMP of given electroweak quantum numbers to scatter from a nucleon becomes computable in terms of Standard Model parameters. We develop effective field theory techniques to analyze the heavy WIMP limit of WIMP-nucleon scattering, and present the first complete calculation of the leading spin-independent cross section in Standard Model extensions consisting of one or two electroweak SU(2)_W x U(1)_Y multiplets. A new extension of the effective theory to describe heavy WIMP annihilations is discussed.

61. **Craig Hogan**, KICP and Fermilab
Talk: Cosmic Acceleration and the QCD scale

August 25, 2014 (3:00 PM - 3:20 PM)
Parallel session: Dark Energy

Arguments using only quantum mechanics and gravity suggest that the scale of cosmic acceleration may be linked to the scale of strong interactions.

62. **Zhiqi Huang**, CITA
Talk: Stacking and CMB anomalies

August 27, 2014 (4:40 PM - 5:00 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: J. Richard Bond, Andrei Frolov
Stacking method was initially used by WMAP team to visualize the acoustic oscillations in CMB maps. We propose a novel concept of "oriented stacking" and extend the WMAP non-oriented method to a large class of oriented and non oriented stacking methods. These new techniques can be used to test systematics, non-Gaussianity and anomalies in CMB maps.

63. **Koji Ichikawa**, Kavli IPMU
Talk: Current and Future constraints on wino dark matter from indirect detection of dwarf spheroidal galaxies

August 29, 2014 (3:40 PM - 4:00 PM)
Parallel session: Dark Matter

Co-authors: Biplob Bhattacherjee, Masahiro Ibe, Shigeki Matsumoto, Kohei Nishiyama
We discuss the indirect detection of the wino dark matter utilizing gamma-ray observations of dwarf spheroidal galaxies (dSphs). We show prospects of the wino mass limit in future gamma-ray observation. We find that the improvement of the so-called J-factor of both the classical and the ultra-faint dSphs will play a crucial role to cover whole mass range of the wino dark matter.

64. **Akhtar Iqbal**, phd student
Poster: On formation of multibaryon proton clusters in relativistic collisions of hadrons and nuclei with carbon and neon nuclei

August 26, 2014

Co-authors: Kh. K. Olimov, Kosim Olimov,S. L. Lutpullaev, Alisher K. Olimov, V. I. Petrov, Saodat A. Sharipova, and V. V. Glagolev
Results of analysis of formation of multibaryon proton clusters in 4He+12C and 12C+12C collisions at 4.2A GeV/c, and in ??+12C and p+20Ne collisions at 40 and 300 GeV/c, respectively, were presented. The masses and widths of multibaryon proton clusters increased linearly with an increase in the number of protons (np) in a cluster. The dependences of width of proton clusters on np in ??+12C and p+20Ne collisions differed noticeably from the corresponding dependences in 4He+12C and 12C+12C collisions. In nucleus–nucleus collisions, the widths of clusters were significantly larger and grew more rapidly, as the number of protons in a cluster increased, as compared to hadron–nucleus collisions. The lifetimes of multibaryon proton clusters proved to be of the same order of magnitude with those of strongly decaying baryon resonances. The stability of multiproton clusters decreased with an increase in np.

65. **Mudit Jain**, University of Minnesota, Duluth
Poster: Gradient Inflation

August 26, 2014

Co-authors: Vitaly Vanchurin
Working with pure scalar k-essence lagrangians, we study the only other possible ansatz for the scalar field which can model a homogeneous Universe. The scalar field ? however is inhomogeneous which makes the gradient vector ??? space-like. In order to model isotropy, we can have three fields with mutualy orthogonal gradient vectors or multiple fields with randomly oriented gradient vectors. With this, we show that we cannot have a slow roll inflation and the norm field rolls independent of the lagrangian. The energy momentum tensor can be re-written in the form of that of a perfect fluid. Emphasizing on multiple fields scenario, we show that for the simplest lagrangian L ? X we have a model of Universe which mimicks that of non-relativistic matter. Adding a constant to it and making it semi-canonical, we have a cosmological constant dominated era when the norm field becomes quite smaller than this constant, and we thus have a model of Universe filled with dark matter, dark energy as the norm approaches its only fixed point zero.

66. **Elise Jennings**, KICP University of Chicago
Poster: CosmoSIS: modular cosmological parameter estimation

August 26, 2014

Co-authors: Joe Zuntz, Marc Paterno, Elise Jennings, Douglas Rudd, Alessandro Manzotti, Scott Dodelson, Sarah Bridle, Saba Sehrish, James Kowalkowski
Cosmological surveys generate copious amounts of data and are analyzed by dozens if not hundreds of collaborators scattered around the globe. To empower these researchers to work together productively, we introduce the Cosmological Survey Inference System, CosmoSIS. CosmoSIS is a framework for structuring cosmological parameter estimation in a way that eases re-usability, debugging, verifi ability, and easily sharing code as modules contained in repositories for individuals, collaborations, and the community at large. It consolidates and connects together existing code for predicting cosmic observables, and makes mapping out experimental likelihoods with a range of different techniques much more accessible. CosmoSIS is available at https://bitbucket.org/joezuntz/cosmosis

67. **Shahab Joudaki**, Swinburne University
Talk: 2dFLenS: Testing Gravity on Cosmic Scales

August 29, 2014 (2:40 PM - 3:00 PM)
Parallel session: Dark Energy

Co-authors: Chris Blake (Swinburne)
The 2-degree Field Lensing Survey (2dFLenS) will perform a new galaxy redshift survey with the Anglo-Australian Telescope (AAT) to exploit a timely scientific opportunity. The apparent existence of "dark energy" compels us to test the laws of gravity across the scale of the universe in multiple ways. Only a powerful combination of two observables, gravitational lensing and galaxy velocities, will pin down the physics of gravity. However, the world's leading deep imaging lensing surveys, such as the Kilo Degree Survey (KiDS) and the Dark Energy Survey (DES), are covering our southern skies without wide-area spectroscopic follow-up. The use of AAT over a period of 6 years beginning in Autumn 2014 will remedy this situation by mapping the 3D density field traversed by the light rays detected in these images, measuring the imprint of galaxy velocities. Along with an overview of 2dFLenS, I will discuss the constraints on gravity from existing overlapping surveys (such as RCSLenS with CFHTLenS) and the improvements expected from a joint analysis of 2dFLenS with KiDS and DES.

68. **Emre O Kahya**, Istanbul Technical University
Poster: Quantum Effects on Conformal Scalars during Inflation

August 26, 2014

Co-authors: Dr. Sohyun Park (Penn State), Sibel Boran (Istanbul Tech)
Quantum effects during Inflation are the origin of the structure that we observe today. I would like to briefly discuss quantum loop effects on Inflation in general. And specifically I will present a recent one-loop calculation of conformally coupled scalar in locally de Sitter geometry, and discuss possible implications on observables.

69. **Ryan Keisler**, Stanford University
Talk: CMB Polarization with SPTpol

August 25, 2014 (2:20 PM - 2:40 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: SPTpol Collaboration
SPTpol is the polarization-sensitive, mm-wave receiver on the 10-m South Pole Telescope, and is part of a new generation of ground-based instruments targeting CMB polarization. In this talk I will summarize the performance of SPTpol and present new measurements of the E-mode and lensing B-mode polarization patterns.

70. **Zigmund Kermish**, Princeton University
Poster: The SPIDER instrument: pre-flight characterization.

August 26, 2014

SPIDER is a balloon-borne polarimeter designed to measure the degree-scale B-mode polarization of the cosmic microwave background. With six independent telescopes housing over 2000 detectors in the 94 GHz and 150 GHz frequency bands, SPIDER will map 7.5% of the sky with a depth of 11 to 14 muK$cdot$arcmin at each frequency, which is a factor of sim5 improvement over Planck. We present the results of integration and characterization of the SPIDER instrument after the 2013 pre-flight campaign, highlighting performance of the detectors and optical systems. SPIDER is prepared for a December 2014 flight from Antarctica, and is expected to be limited by astrophysical foreground emission, and not instrumental sensitivity, over the survey region.

71. **Justin Khoury**, University of Pennsylvania
Invited Talk: Beyond the Cosmological Standard Model

August 29, 2014 (11:00 AM - 11:45 AM)
Plenary session

72. **Will Kinney**, University at Buffalo, SUNY
Invited Talk: Inflation after Planck and BICEP

August 26, 2014 (11:00 AM - 11:45 AM)
Plenary session

73. **Naoya Kitajima**, Tohoku University
Poster: Thermal Inflation and Isocurvature Bounds on String Axion Dark Matter

August 26, 2014

Co-authors: Masahiro Kawasaki and Fuminobu Takahashi
If inflation scale is high, light scalars acquire large quantum fluctuations during inflation. If sufficiently long-lived, they will give rise to CDM isocurvature perturbations, which are highly constrained by the Planck data. Focusing on string axions as such light scalars, we show that thermal inflation can provide a sufficiently large entropy production to dilute the CDM isocurvature perturbations. We also study the viability of the axion dark matter with mass of about 7keV as the origin of the 3.5keV X-ray line excess, in the presence of large entropy production.

74. **Lloyd E Knox**, UC Davis
Invited Talk: The Marvelous Success of the Standard Cosmological Model

August 25, 2014 (9:45 AM - 10:30 AM)
Plenary session

The standard model of cosmology has been remarkably successful in its predictions for current data given earlier data. One can react with sadness for the lack of evidence for new physics, chase marginal anomalies, or marvel at the success and soldier on toward better measurements knowing new physics may be just around the corner. In this talk I will reveal some of the inner workings of this success in order to communicate why I find it marvelous. For example, for the predictions to agree with cosmic microwave background (CMB) data we need, at very high statistical significance, a cosmic neutrino background, electron-positron annihilation occurring after neutrino decoupling, primordial helium and gravitational lensing. Perhaps most marvelous of all, from CMB data we can now rule out a sum of neutrino masses greater than about 1 eV because of their gravitational influence on freely streaming CMB photons.

75. **Tsutomu Kobayashi**, Rikkyo University
Poster: Generalized Galilean Genesis and Matching Conditions from Horndeski Theory

August 26, 2014

Co-authors: Sakine Nishi, Norihiro Tanahashi, Masahide Yamaguchi
I will discuss the generalization of the galilean genesis scenario in the context of the Horndeski theory, i.e., the most general second-order scalar-tensor theory. I will provide a unified description of the solutions that start expanding from the Minkowski space-time in the early universe with a stable violation of the null energy condition. The cosmological matching conditions for the background and perturbations are also derived.

76. **Fabian Koehlinger**, Leiden Observatory
Poster: Neutrinos in the lensing power spectrum

August 26, 2014

Massive neutrinos leave their physical imprints on the matter power spectrum and hence also in the lensing power spectrum. We measure the lensing power spectrum on currently available data from the Canada-France Hawaii Telescope Lensing Survey (CFHTLenS). These measurements are performed in different redshift bins and directly in multipole space in terms of adjustable band powers. This allows for an optimization with respect to these redshift-dependent neutrino features. For the extraction of the band powers from the data we have implemented a so-called quadratic estimator (Hu & White 2001) which finds the maximum likelihood and its local curvature and further allows to take into account irregular survey geometries and varying sampling densities in the error estimation. Furthermore, we use a Markov Chain Monte Carlo likelihood exploration technique to derive theoretical forecasts on the ability of current weak lensing surveys (like CFHTLenS), on-going surveys (like KiDS, DES, HSC) and future surveys (like Euclid, LSST) to constrain neutrino features. We will present here first results of this analysis.

77. **John M Kovac**, Harvard University
Invited Talk: Detection of B-mode Polarization at Degree Angular Scales with BICEP2

August 25, 2014 (9:00 AM - 9:45 AM)
Plenary session

78. **Andrei Lazanu**, DAMTP, University of Cambridge
Talk: The Power Spectrum of Nambu-Goto Cosmic Strings

August 26, 2014 (2:00 PM - 2:20 PM)
Parallel session: Formal/Inflation

Co-authors: Paul Shellard
Three state-of-the-art Nambu-Goto cosmic string simulations covering the entire period from recombination to late-time cosmological constant domination are used to calculate overall power spectra in temperature and polarization channels. Unequal time correlators (UETCs) are calculated from these simulations and are subsequently diagonalised and their eigenvectors are used to calculate the cosmic string power spectra for each of the three cases considered. These are combined together, and the final temperature and polarization power spectra are obtained for Nambu-Goto cosmic strings. The temperature power spectrum is situated between results from Abelian-Higgs and those from the phenomenological unconnected segment model. Finally, the power spectra obtained are used with the latest CMB likelihoods to obtain definitive constraints on string tension in standard inflationary scenarios. We have obtained Gmu<1.49x10^-7 with f10<0.019 at 95% confidence level in the Planck case and Gmu<1.74x10^-7 with f10<0.026 in the Planck & BICEP2 case. We explore the possibility of varying additional parameters such as r, Neff, running and ?mnu to increase the allowed contribution of the cosmic strings.

79. **Florent Leclercq**, Institut d'Astrophysique de Paris
Talk: How did structure appear in the Universe? - A Bayesian approach

August 26, 2014 (2:00 PM - 2:20 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: Jacopo Chevallard (U. São Paulo), Nico Hamaus (IAP), Jens Jasche (IAP),
Guilhem Lavaux (IAP), Emilio Romano-Díaz (U. Bonn), Paul M. Sutter (IAP/Ohio State U.),
Alice Pisani (IAP), Benjamin Wandelt (IAP/U. Illinois)
Establishing a quantitative link between cosmological observations and theories describing the early Universe has the potential to further our knowledge of fundamental physics on a wide range of energy and distance scales. In this talk, I will describe an innovative statistical data analysis approach designed for the ab initio simultaneous analysis of the formation history and morphology of the large-scale structure of the inhomogeneous Universe. I will demonstrate its application to the Sloan Digital Sky Survey data release 7 and describe the primordial and late-time large-scale structure in the Sloan volume. This approach has led to the first quantitative reconstructions of the cosmological initial conditions from galaxies, an exceptionally detailed characterization of the dynamic cosmic web underlying the observed galaxy distribution, and a new, enhanced catalog of cosmic voids probed at the level of the dark matter distribution, deeper than with the galaxies. Finally, as three-dimensional large-scale structure surveys contain a wealth of information that cannot be trivially extracted due to the non-linear dynamical evolution of the density field, I will discuss methods designed to improve upon previous approaches by including non-Gaussian and non-linear data models for the description of late-time structure formation.

80. **Boris Leistedt**, University College London
Talk: Primordial non-Gaussianity with photometric quasars

August 27, 2014 (4:00 PM - 4:20 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: Hiranya Peiris, Nina Roth
I will present robust constraints on primordial non-Gaussianity from the clustering of one million photometric quasars from the Sloan Digital Sky Survey (SDSS). The constraints on $f_{rm NL}$, its spectral index, and $g_{rm NL}$, are the tightest ever obtained from a single population of quasars or galaxies, and are competitive with the results obtained with WMAP, demonstrating the potential of quasars to probe the largest scales of the universe and complement CMB experiments. These results also take advantage of a novel technique, 'extended mode projection', to mitigate the complex spatially-varying systematics present in the survey in a blind and robust fashion. This approach is promising for exploiting the full potential of the Dark Energy Survey, Euclid and LSST, which require a careful mitigation of systematics in order to robustly constrain new physics.

81. **Alexander Leithes**, Queen Mary, University of London
Poster: Conserved Quantities in Lemaitre-Tolman-Bondi Cosmology

August 26, 2014

Co-authors: Karim A. Malik (Co-author of the paper, http://arxiv.org/abs/1403.7661, upon which this talk is based).
We study linear perturbations to a Lemaitre-Tolman-Bondi (LTB) background spacetime. Studying the transformation behaviour of the perturbations under gauge transformations, we construct gauge invariant quantities. We show, using the perturbed energy conservation equation, that there are conserved quantities in LTB.

82. **Edgar A Leon**, Universidad Autonoma de Sinaloa
Poster: Extra dimensional cosmological model from a Lagrangian perspective

August 26, 2014

Co-authors: J. A. Nieto, A. L. Gonzalez-Moran
We analyse a extra dimensional model with two homogeneous spaces. We show that the evolution of the scale parameters involved can be obtained from a Lagrangian that resembles that of a relativistic point particle. We argue that our approach allows to analyse the underlying symmetries of the model and can be generalized to other systems.

83. **Andrei Linde**, Stanford University
Invited Talk: Inflation in supergravity and cosmological attractors

August 29, 2014 (11:45 AM - 12:30 PM)
Plenary session

After a brief general review of inflation, I will describe several interesting models of chaotic inflation in supergravity. This will include polynomial inflation, natural inflation, and a broad class of cosmological attractors, the theories which lead to observational predictions that are stable with respect to significant changes of the inflationary models. I will finish with a discussion of the recently discovered way to significantly simplify construction of inflationary models in supergravity and vacua uplifting in string theory, based on the theory of nilpotent superfields.

84. **Tim Linden**, U Chicago / KICP
Talk: The Characterization of the Gamma-Ray Signal from the Central Milky Way

August 29, 2014 (2:00 PM - 2:20 PM)
Parallel session: Dark Matter

Co-authors: Daylan, Tansu; Finkbeiner, Douglas; Hooper, Dan; Portillo, Stephen; Rodd, Nicholas; Slatyer, Tracy; Cholis, Ilias
In scenarios where dark matter particles can annihilate to produce standard model, the galactic center of the Milky Way is expected to provide the highest flux from dark matter in the sky. Recently, we have worked on gamma-ray observations from the Fermi-LAT telescope, and have detected a significant extended excess, which is spherically symmetric around the position of the galactic center, and does not trace any known astrophysical emission profile. In this talk, I will summarize the current status of these observations and discuss dark matter and astrophysical interpretations of the data. I will show results which strongly constrain the properties and the possible interpretations of the observed excess. Finally, I will posit upcoming tests which will strongly suggest, or rule out, a dark matter interpretation.

85. **Tongyan Lin**, KICP
Talk: Gamma Rays from the GC: Dark Matter Interpretations and Collider Signals

August 29, 2014 (2:20 PM - 2:40 PM)
Parallel session: Dark Matter

Co-authors: Dan Hooper, Brian Batell, Prateek Agrawal
I will discuss models of dark matter (including flavored dark matter) that can reproduce the gamma-ray excess near the galactic center and possible collider probes of the models.

86. **Yu-Hsiang Lin**, National Taiwan University
Poster: CMB Low-Mode Anomaly and Two-Field Cascade Inflation

August 26, 2014

Co-authors: Pisin Chen
The CMB anisotropy spectrum observed by the Planck mission suggests a "low-l / high-l tension" at 2-sigma level: While the power spectrum for modes with l > 50 agrees very well with the single-field inflation scenario plus the Lambda-CDM model, that for modes l < 50 appears to be lower than the theoretical prediction. Though not yet a smoking gun, this low mode anomaly may indicate the existence of new physics beyond the standard single-field slow-roll inflation. Here we investigate whether the two-field cascade inflation could account for the low-mode power suppression. Specifically, we envision the inflation consists of a "rapid-fall" phase conducted by one of the two scalar fields preceding the observed 60 e fold slow-roll phase carried out by the second scalar field, where the damped oscillations of the first field in the aftermath of the rapid-fall may leave imprints on the perturbations during the transition towards the settlement into the slow-roll phase. We found that generally the CMB temperature spectrum at large scales is enhanced due to the high energy density at the rapid-fall stage.

87. **Ben Loer**, Fermilab
Talk: SuperCDMS SNOLAB: A G2 Dark Matter Search Experiment

August 27, 2014 (2:20 PM - 2:40 PM)
Parallel session: Dark Matter

The SuperCDMS SNOLAB experiment has been selected to proceed as a second generation (G2) direct dark matter search with an initial payload of 42 advance iZIP detectors. SuperCDMS SNOLAB will attain world-leading sensitivity to low mass WIMPs, increasing current best limits by several orders of magnitude and reaching the 8B neutrino limit for WIMP masses around 10 GeV. The experiment cryogenics and shielding will be designed to accommodate additional detectors, allowing for potential future upgrades. I will give a detailed overview of this new experiment scope with projected schedule and sensitivity.

88. **Andrew J Long**, Arizona State University
Talk: Detecting non-relativistic cosmic neutrinos by capture on tritium

August 26, 2014 (4:00 PM - 4:20 PM)
Parallel session: Formal/Inflation

Co-authors: Cecilia Lunardini and Eray Sabancilar
I will discuss the physics potential of the detection of the Cosmic Neutrino Background via neutrino capture on tritium. With the projected energy resolution of 0.15 eV, the proposed PTOLEMY experiment will be sensitive to neutrino masses with a degenerate spectrum m_{nu} >~ 0.1 eV. These neutrinos are non-relativistic today, and detecting them would be a unique opportunity to probe this unexplored kinematical regime. Specifically, the total capture rate is found to depend on the origin of the neutrino mass, being 4 and 8 events per year (for a 100 g tritium target) for unclustered Dirac and Majorana neutrinos, respectively. Additionally, it is shown how the signal depends upon clustering, the presence of a lepton asymmetry, and neutrino decay. Prospects for detection of sterile neutrinos is also discussed.

89. **Marilena Loverde**, University of Chicago
Talk: Neutrinos in large-scale structure

August 26, 2014 (2:20 PM - 2:40 PM)
Parallel session: CMB/Large Scale Structure

The large-scale structure of our universe (the distribution of galaxies on very large-scales for instance) contains a wealth of information about the origin, evolution, and matter content of the universe. I will discuss physical effects of the cosmic neutrino background on the process of structure formation and present new signatures of massive cosmic background neutrinos that may be used to constrain their properties from large galaxy surveys.

90. **Adam Mantz**, KICP/Chicago
Talk: Weighing the Giants: Galaxy Cluster Cosmology Anchored by Weak Gravitational Lensing

August 29, 2014 (4:00 PM - 4:20 PM)
Parallel session: Dark Energy

The gas mass fractions and the distribution in mass and redshift of the galaxy cluster population provide powerful probes of cosmology, constraining the cosmic matter density (OmegaM), the amplitude of the matter power spectrum (sigma8), properties of dark energy, and the mass of neutrinos, among other parameters. Historically, these tests have been limited by the absolute accuracy of cluster mass determinations. Here, mass measurements from weak lensing (made in the right way) have an advantage over estimates based on observations of the intracluster medium (ICM), because the former are nearly unbiased and can be straightforwardly tested against simulations. I will report new cosmological constraints obtained from an analysis of X-ray selected cluster samples, incorporating extensive gravitational lensing data from the Weighing the Giants project -- the first cluster cosmology study to consistently integrate a lensing mass calibration, including a rigorous quantification of all systematic uncertainties. Compared with earlier work, which had to incorporate larger systematic allowances associated with an ICM-based mass calibration, our joint constraints on OmegaM and sigma8 are improved by a factor of 2. Including Cosmic Microwave Background and other cosmological probes in the analysis, we find no evidence for non-zero neutrino mass in the current data. This result is directly dependent on the absolute cluster mass calibration, and conflicts with some recent cluster results using ICM-based masses, highlighting the need for an accurate mass calibration (such as lensing provides). We also obtain tight constraints on dark energy models; for flat models with a constant equation of state (w), the cluster data alone yield w=-0.98+-0.15. Our data, and their combination with other leading cosmological data sets, remain consistent with the concordance model of cosmology, with zero global curvature, dark energy as a non evolving cosmological constant (w=-1), minimal neutrino mass, and gravity described by General Relativity.

91. **Tommi Markkanen**, University of Helsinki
Poster: Spacetime curvature and the Higgs stability during inflation

August 27, 2014

Co-authors: Matti Herranen, Sami Nurmi, Arttu Rajantie
It is currently widely accepted that for a high scale of inflation the EW Higgs vacuum is unstable during inflation due to large fluctuations of order H. However, this conclusion is reached by neglecting potentially significant effects induced by the spacetime curvature. In this talk I review the derivation of a one-loop SM Higgs effective potential in curved space and discuss its implications. In particular I will show that generally a large curvature mass is generated which can stabilize the potential against fluctuations induced by inflation.

92. **Andrew Matas**, Case Western Reserve University
Talk: Deconstructing Dimensions and Massive Gravity

August 25, 2014 (3:40 PM - 4:00 PM)
Parallel session: Dark Energy

Co-authors: Claudia de Rham, Andrew Tolley
Massive Gravity is a theory of a massive graviton that propagates 5 degrees of freedom around arbitrary backgrounds, thus avoiding the Boulware-Deser ghost. The interactions of Massive Gravity must be carefully constructions to ensure the Boulware-Deser ghost does not arise. In this work we show how the special structure of Massive Gravity can be understood from an extra dimensional point of view through the idea of Dimensional Deconstruction. We will take General Relativity on a compact extra dimension, and by discretizing the extra dimension in a careful way we can see that the special structure of Massive Gravity can be derived. We will comment on other possible discretization schemes, and how to recover General Relativity in the continuum limit.

93. **Tomohiro Matsuda**, Saitama Institute of Technology
Poster: Preheating with higher dimensional interaction

August 27, 2014

Co-authors: Seishi Enomoto, Nobuhiro Maekawa
We study non-adiabatic particle production caused by non-renormalizable higher-dimensional interaction. To show why such interaction is important for the preheating mechanism, we describe resonant particle production in a simple model. In contrast to the conventional scenario of preheating, which usually assumes renormalizable coupling, our study shows that preheating can be efficient even if the field is "decoupled" in the effective action.

94. **Samuel D McDermott**, Fermilab
Talk: Simplified Dark Matter Models for the Galactic Center Gamma-Ray Excess

August 29, 2014 (2:40 PM - 3:00 PM)
Parallel session: Dark Matter

Co-authors: Asher Berlin and Dan Hooper
How difficult is it to write down a model that allows dark matter annihilation to fermion states without violating bounds from direct detection and collider production? We find that this is generically possible with chiral operators. Thus, simplified models that allow an annihilation cross section suggestive of a thermal dark matter history (suitable for producing the observed relic density) and that are capable of explaining the excess GeV emission seen in the Galactic center while respecting other observational constraints are easy to describe from a low-energy standpoint. In this talk I will describe this class of models and show how they satisfy such a wide range of positive and negative experimental results.

95. **Mikhail V. Medvedev**, University of Kansas
Poster: Cosmological Simulations of Multi-Component Cold Dark Matter

August 27, 2014

The nature of dark matter is unknown. A number of dark matter candidates are quantum flavor-mixed particles but this property has never been accounted for in cosmology. Here we explore this possibility from the first principles via extensive N-body cosmological simulations and demonstrate that the two-component dark matter model agrees with observational data at all scales. Substantial reduction of substructure and flattening of density profiles in the centers of dark matter halos found in simulations can simultaneously resolve several outstanding puzzles of modern cosmology. The model shares the "why now?" fine-tuning caveat pertinent to all self-interacting models. Predictions for direct and indirect detection dark matter experiments are made.

96. **Sebastian Mendizabal**, Universidad Tecnica Federico Santa Maria
Talk: Leptogenesis in a strong thermal bath

August 26, 2014 (3:40 PM - 4:00 PM)
Parallel session: Formal/Inflation

Co-authors: J. Hutig, O. Philipsen
Thermal Leptogenesis gives a simple and elegant solution to the baryon asymmetry in the universe problem. In this scenario the CP-violating thermal decay of a very massive Majorana neutrino accounts for this asymmetry. This mechanism requires high temperature and a strongly coupled electro-weak primordial bath. We will show a novel way to treat corrections that arises when the strong interactions of the bath are taken into account by using the collinear-thermal-loop resummation developed in QCD. We will also compare our results obtained in the Kadanoff-Baym formalism with the semi-classical Boltzmann approach.

97. **Eloisa Menegoni**, LUTH Laboratoire Univers et THéories, Observatoire de Paris
Poster: Constraints on a k-dependent bias from galaxy clustering

August 27, 2014

In the next future many experiments will use galaxy clustering to obtain simultaneous informations on the geometry of the Universe and the growth rate of density fluctuations by measuring the galaxy power spectrum or the 2-point correlation function at different cosmic epochs (e.g. eBOSS, DESI and Euclid). These studies will be based on large surveys of extragalactic objects and will allow to constrain fundamental cosmological parameters, among which the contribution of the Dark Energy to the cosmic mean, the nature of this elusive component and, finally, to test non-standard theories of gravity. Since one typically observe the spatial fluctuation in the galaxy, not in the mass, some independent estimate or theoretical insight of the mapping from one to the other is mandatory. This mapping, which is commonly referred to as galaxy bias, parametrises our ignorance on the physics of galaxy formation and evolution and represents one of the main source of uncertainties in the study of the large scale structure of the Universe. In this talk I would like to show the constraints on k dependent parameterizations of the galaxy bias obtained from forecast of future satellite observations (Euclid). I used representative assumptions for the parameters of the Euclid survey to provide a baseline for future experiments and I focused on of how well one can constrain the bias function from the analysis of the power spectrum itself in two models: in the first I taken in account a model in which the bias is written as a power law, in the second I studied a model based on the Cole et al. model.

98. **James Mertens**, Case Western Reserve University
Poster: Gravitational radiation from first-order phase transitions in the presence of a fluid

August 27, 2014

First-order phase transitions are a source of stochastic gravitational radiation. Precision calculations of the gravitational waves emitted during these processes sourced by both the degrees of freedom undergoing the transition and the anisotropic stress of the ambient constituents have reached an age of maturity. Here we present numerical simulations of a scalar field coupled to a fluid for a set of models that represent different types of first-order phase transitions. We parametrize the final gravitational wave spectrum as a function of the ratio of the energies of the constituents and the coupling between the two sectors. In most of the cases we study, the field sector is the dominant source of gravitational radiation, but it is possible in certain scenarios for the fluid to have the most important contribution.

99. **Philipp Mertsch**, KIPAC, Stanford University
Talk: Fingerprints of Galactic Loop I on the Cosmic Microwave Background

August 25, 2014 (3:40 PM - 4:00 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: Hao Liu, Subir Sarkar
We investigate possible imprints of galactic foreground structures such as the "radio loops" in the derived maps of the cosmic microwave background. Surprisingly, there is evidence for these not only at radio frequencies through their synchrotron radiation, but also at microwave frequencies where emission by dust dominates. This suggests the mechanism is magnetic dipole radiation from dust grains enriched by metallic iron or ferrimagnetic materials. This new foreground we have identified is present at high galactic latitudes, and potentially dominates over the expected B-mode polarization signal due to primordial gravitational waves from inflation. We conclude with a couple of remarks on implications for large scale CMB anomalies.

100. **Marius Millea**, University of California, Davis
Talk: Neutrino Physics with the Planck Satellite

August 25, 2014 (4:40 PM - 5:00 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: The Planck Collaboration
With an eye towards the 2014 release of Planck temperature and polarization data, we review some of the results from the 2013 release and set the stage for what's to come from the new data. We'll focus in particular on neutrinos, and describe the origin and robustness of constraints on the sum of their masses and the effective number of relativistic degrees of freedom from neutrinos (and possibly other particles). Doing so will give a natural explanation for the tightening and shifts in parameters when adding in BAO and local H0 measurements to the CMB data. Finally, we will give some forecasts for the 2014 constraints.

101. **Mehrdad Mirbabayi**, Institute for Advanced Study
Talk: Gravitational waves and the scale of Inflation

August 29, 2014 (3:40 PM - 4:00 PM)
Parallel session: Formal/Inflation

Co-authors: L. Senatore, E. Silverstein, M. Zaldarriaga
We revisit alternative mechanisms of gravitational wave production during inflation and argue that they generically emit a large amount of scalar fluctuations. The scalar power is by a factor of order $1/ep^2$ larger than the tensor power, hence for an appreciable tensor contribution the associated scalar emission completely dominates the zero-point fluctuations of inflaton, resulting in a tensor-to-scalar ratio $r~ep^2$. A more quantitative result can be obtained if one further assumes that gravitational waves are emitted by localized sub-horizon processes, giving $r_{max} simeq 0.3 ep^2$. We calculate the scalar 3-point correlation function in the same class of models and show that non-Gaussianity cannot be made arbitrarily small, i.e. $f_nl >> 1$.

102. **Audrey T Mithani**, Tufts Institute of Cosmology
Poster: Instability of oscillating universes

August 27, 2014

Absolutely stable models describing a universe that can exist forever in a static or oscillating state have been proposed as a starting point for the emergent universe scenario, avoiding an initial singularity. We show that such universes are quantum mechanically unstable and can collapse by quantum tunneling. However, we note that stability may be possible for some specially fine-tuned states. Based on the following works: A. T. Mithani and A. Vilenkin, JCAP 1201, 028 (2012) arXiv:1110.4096 [hep-th] A. T. Mithani and A. Vilenkin, JCAP 1405, 006 (2014) arXiv:1403.0818 [hep-th] A. T. Mithani and A. Vilenkin, arXiv:1407.5361 [hep-th]

103. **Shuntaro Mizuno**, WIAS, Waseda University
Poster: Combined features in the primordial spectra induced by a sudden turn in two-field DBI inflation

August 27, 2014

Co-authors: Ryo Saito and David Langlois
We investigate the features generated by a sharp turn along the inflationary trajectory in a two-field model of Dirac-Born Infeld inflation, where one of the fields is heavy. Distinct features are generated by two different effects: the mixing of the light and heavy modes during the turn, on the one hand, and the resonance between the oscillations along the heavy direction after the turn, on the other hand. Contrary to models with standard kinetic terms, the resonance effect is not strongly suppressed because the action contains derivative interactions. Working in the potential basis, we study the oscillations after the turn and compute the amplitude of the mixing and resonance features in the power spectrum, as well as in the bispectrum for the latter effect. We find that the amplitudes and positions of these combined features obey specific consistency relations, which could be confronted with cosmological data.

104. **Hayato Motohashi**, University of Chicago
Poster: Stability of cosmological solutions in extended quasidilaton massive gravity

August 27, 2014

Co-authors: Wayne Hu
We consider the stability of self-accelerating solutions to extended quasidilaton massive gravity in the presence of matter. By making a second or extended fiducial metric dynamical in this model, matter can cause it to evolve from a Lorentzian to Euclidean signature, triggering a ghost instability. We study this possibility with scalar field matter as it can model a wide range of cosmological expansion histories. For the LCDM expansion history, stability considerations substantially limit the available parameter space while for a kinetic energy dominated expansion, no choice of quasidilaton parameters is stable. More generally these results show that there is no mechanism intrinsic to the theory to forbid such pathologies from developing from stable initial conditions and that stability can only be guaranteed for particular choices for the matter configuration.

105. **Eva-Maria Katar Mueller**, Cornell
Talk: Constraining gravity using the kinetic SZ effect

August 27, 2014 (3:40 PM - 4:00 PM)
Parallel session: Dark Energy

Co-authors: Francesco de Bernardis, Rachel Bean, Michael Niemack
The kinetic SZ signal is a secondary anisotropy of the cosmic microwave background that can be used to constrain dark energy and modified gravity. Even though the signal is small we can can extract information from the kinetic SZ effect by cross-correlating the signal with large red galaxy (LRG) positions and redshifts from a spectroscopic large scale survey such as the Dark Energy Spectroscopic Instrument (DESI). We explore the strength of the mean pairwise velocity of clusters measured by the kinetic SZ effect to to constrain modifications to General Relativity for upcoming surveys CMB surveys.

106. **Tomohiro Nakama**, Research Center for the Early Universe, the University of Tokyo
Poster: Scalar perturbations generated by the second-order effects of gravitational waves and their cosmological implications

August 27, 2014

Co-authors: Teruaki Suyama
In cosmological linear perturbation theory, scalar type perturbations and tensor type perturbations evolve independently. However, these two types are coupled at the second-order level of perturbed quantities. If the amplitude of tensor type perturbations is larger than that of scalar perturbations on small scales, the effect of the generation of scalar perturbations due to the second-order effects of tensor type perturbations can be important. The upper bounds on the amplitude of scalar perturbations on small scales have been obtained using several techniques, so the corresponding upper bounds on the amplitude of tensor type perturbations can be obtained because of the aforementioned second-order effects.

107. **Ali Nayeri**, Institute for Quantum Studies, Chapman University
Talk: String Gas Cosmology and a Possible Explanation of the Blue Tilt in Gravitational Waves

August 26, 2014 (2:20 PM - 2:40 PM)
Parallel session: Formal/Inflation

Co-authors: Robert H. Brandenberger and Subodh P. Patil
The BICEP-2 team has reported the detection of primordial cosmic microwave background B-mode polarization, with hints of a suppression of power at large angular scales relative to smaller scales. Provided that the B-mode polarization is due to primordial gravitational waves, this might imply a blue tilt of the primordial gravitational wave spectrum. Such a tilt would be incompatible with standard inflationary models, although it was predicted some years ago in the context of a mechanism that thermally generates the primordial perturbations through a Hagedorn phase of string cosmology. The purpose of this note is to encourage greater scrutiny of the data with priors informed by a model that is immediately falsifiable, but which predicts features that might be favored by the data-- namely a blue tensor tilt with an induced and complimentary red tilt to the scalar spectrum, with a naturally large tensor to scalar ratio that relates to both.

108. **Jayanth Neelakanta**, Syracuse University
Poster: Diffeomorphism-Invariance Constraints on Cosmological Correlators

August 27, 2014

Co-authors: Cristian Armendariz-Picon, Riccardo Penco
I shall discuss the extent to which diffeomorphism invariance can constrain the properties of primordial perturbations in single scalar field models. I shall sketch the derivation of a set of identities that constrain the connected correlators of the cosmological perturbations, as well as the one-particle-irreducible vertices of the theory. Both these identities follow solely from diffeomorphism invariance, without any further assumptions. Using these identities, I shall show how consistency relations between cosmological correlators can be obtained. I shall also seek to clarify a few technical aspects regarding gauge fixing and gauge-invariant observables.

109. **Laura Newburgh**, Dunlap Institute
Talk: Measuring Dark Energy with CHIME

August 29, 2014 (3:00 PM - 3:20 PM)
Parallel session: Dark Energy

Co-authors: CHIME collaboration
The Canadian Hydrogen Intensity Mapping Experiment (CHIME) is a new radio transit interferometer currently being built at the Dominion Radio Astrophysical Observatory (DRAO) in Penticton, BC, Canada. We will use the 21cm emission line of neutral hydrogen to map baryon acoustic oscillations between 400-800MHz across 3/4 of the sky. These measurements will yield sensitive constraints on the dark energy equation of state between redshifts 0.8 -- 2.5, a fascinating but poorly probed era corresponding to when dark energy began to impact the expansion history of the Universe. I will describe the CHIME instrument, the analysis challenges, the calibration requirements, and current status.

110. **Phuc H Nguyen**, University of Texas at Austin
Poster: Brownian motion and pair production in de Sitter space: a holographic viewpoint

August 27, 2014

Co-authors: Juan Pedraza, Walter Tangarife, Willy Fischler
In the first half of the poster, we study Brownian motion of a heavy field in de Sitter space using AdS/CFT techniques. We find that, similarly to the field theory computation, the rms displacement of the brownian particle saturates to a finite value at late time, and that moreover, the fluctuation-dissipation theorem is verified. In the second half of the talk, we present the computation of the Schwinger effect (pair production in a strong electric field) in de Sitter space, also from the holographic viewpoint. We found that the production rate agrees with the computation using Bogoliubov coefficients, with an extra correction due to the large-N, strong coupling effect. Furthermore, we establish that the holographic dual to the nucleated pair has the causal structure of a wormhole, in agreement with the ER=EPR conjecture.

111. **Johannes Noller**, University of Oxford
Talk: Multi-Gravity as an effective field theory

August 29, 2014 (2:20 PM - 2:40 PM)
Parallel session: Formal/Inflation

Co-authors: Parts of the talk are based on work carried out in collaboration with Pedro Ferreira and James Scargill.
In this talk I will present a systematic way of investigating Massive and Multi-Gravity models (or equivalently: theories of interacting spin-2 fields). I will discuss several intriguing features of these models, such as their strong coupling scale and low energy effective behaviour, as well as their consequences for the cosmology of Multi-Gravity.

112. **Toshifumi Noumi**, RIKEN Nishina Center
Poster: Effects of heavy fields on primordial spectra

August 27, 2014

Co-authors: Masahide Yamaguchi
Inflationary models based on high energy theory such as supergravity or superstring theory generically contain heavy scalar fields in addition to the inflaton. Such heavy fields can be therefore considered as a probe of very high energy physics. When heavy fields are excited during inflation and oscillate around the bottom of the potential, the following two effects are generically induced: deformation effects of the inflationary background spacetime and conversion effects between adiabatic and isocurvature perturbations. In this presentation, I would like to discuss such effects on primordial spectra.

113. **Nikhil Padmanabhan**, Yale University
Invited Talk: BAO

August 27, 2014 (9:00 AM - 9:45 AM)
Plenary session

114. **Sohyun Park**, Pennsylvania State University
Talk: Nonlocal gravity and structure in the universe

August 25, 2014 (4:20 PM - 4:40 PM)
Parallel session: Dark Energy

Co-authors: Scott Dodelson
The observed acceleration of the Universe can be explained by modifying general relativity. One such attempt is the nonlocal model of Deser and Woodard. Here we fix the background cosmology using results from the Planck satellite and examine the predictions of nonlocal gravity for the evolution of structure in the universe, confronting the model with three tests: gravitational lensing, redshift space distortions, and the estimator of gravity EG. Current data favor general relativity (GR) over nonlocal gravity: fixing primordial cosmology with the best fit parameters from Planck leads to weak lensing results favoring GR by 5.9 sigma; redshift space distortions measurements of the growth rate preferring GR by 7.8 sigma; and the single measurement of EG favoring GR, but by less than 1-sigma. The significance holds up even after the parameters are allowed to vary within Planck limits. The larger lesson is that a successful modified gravity model will likely have to suppress the growth of structure compared to general relativity.

115. **Youngsoo Park**, KICP/UChicago
Poster: Combined Probes Analysis in Dark Energy Survey

August 27, 2014

The Dark Energy Survey (DES) will provide measurements of both the distribution of galaxies on the sky and the tangential shear of background galaxies induced by these foreground lenses. While stand-alone measurements of such signals may be used for contraining cosmological parameters, doing so leaves the analyses vulnerable to significant systematic effects. A combined probes analysis solves this problem by systematically combining information from multiple probes, so that the probes effectively cross-calibrate one another. In this analysis, we study the feasibility and effectiveness of such an analysis within DES. By jointly modeling galaxy clustering and galaxy-galaxy lensing with shared systematics and model assumptions, we develop a practical approach towards a combined probes parameter estimation in DES.

116. **Hiranya Peiris**, University College London
Invited Talk: Cosmological inflation: from observations to fundamental physics

August 26, 2014 (9:45 AM - 10:30 AM)
Plenary session

117. **Qiuhe Peng**, Nanjing University
Poster: Possible evidence of magnetic monopole existence? ---Discovery of strong radial magnetic field at the center of the Galaxy

August 27, 2014

A strong radial magnetic field in the central region of the Galactic Center has been detected. he strong radial magnetic field is hardly produced by a accretion disk. This is may be evidence of magnetic monopole existence. This radial magnetic field is just one which was predicted by our theoretical model of the active galactic nuclei with magnetic monopole(2001,ApJL.,551, L23-L26.)

118. **Maria Elidaiana da S. Pereira**, Brazilian Center for Physics Research
Poster: Measuring galaxy morphologies in the CFHT Stripe 82 Survey

August 27, 2014

Co-authors: A. Charbonnier, B. Moraes, M. Makler, E. Bertin and R. Pereira
We present the determination of galaxy structural parameters in the CFHT Stripe 82 Survey (CS82) stacked images. The CS82 survey covered an area of $sim170$ square degrees with the CFHT $3.6m$ telescope in a field determined by $ 40<RA<45$ and $-1<DEC<1$ (within the SDSS stripe-82 region) in i-band to a depth of $mag_{AB}sim24$. Its excellent image quality (mean seeing of $sim0.6$) and uniformity makes CS82 specially suitable for applications involving gravitational lensing and galaxy morphology. The determination of galaxy structural parameters has applications to galaxy evolution studies, weak lensing, and the improvement of the photometry in other surveys (e.g. SDSS), through the ``forced photometry'' method. The morphological analysis of galaxies is performed through a profile-fitting method implemented with a combination of SExtractor v2.14.7 (which has model-fitting features) and PSFEx. First, we use SExtractor to perform the detection and obtain basic measurements of objects, then we use PSFEx to model the PSF across the field, and finally, we run SExtractor again to perform the model-fitting of objects. In particular we use 4 models implemented in SExtractor: S'ersic, de Vaucouleurs, exponential and 2-component de Vaucouleurs$+$exponential. In this work we outline the procedure described above and focus on a quality assessment of the determination of the ellipticities, through a comparison with the CS82 weak lensing catalogue obtained with the state-of-the-art code lensfit (Miller et al. 2007).

119. **Cyril Pitrou**, IAP, Institut d'Astrophysique de Paris, France
Poster: xPand: An algorithm for perturbing homogeneous cosmologies

August 27, 2014

Co-authors: Xavier Roy and Obinna Umeh are co-authors of the paper on which this presentation is based.
In the context of cosmological perturbations, the main aspects of large scale structure dynamics is understood by linearization of equations of General Relativity (GR) around a background cosmological solution. Indeed, it enables to compute the power spectrum of fluctuations in the metric and the matter. However, the intrinsic non-linear features of GR are lost with this approximation and it can be necessary to rely on higher order perturbations when dealing with higher order statistics due to mode-mode coupling. Since the derivation of the equations themselves can be very involved, we developed a new method to obtain systematically a perturbative expansion when the background spacetime is homogeneous but not necessarily isotropic, encompassing most cosmological backgrounds. Based on geometrical methods, and implemented in a computer algebra system (xAct), this package named 'xPand' allows to obtain very efficiently the equations which rule the non-linear dynamics, thus avoiding the long and tedious computations generally associated with such expansions.

120. **Paolo Privitera**, University of Chicago
Talk: DAMIC - a novel experiment for low mass dark matter

August 27, 2014 (3:00 PM - 3:20 PM)
Parallel session: Dark Matter

Co-authors: DAMIC Collaboration
The DAMIC (Dark Matter In CCDs) experiment employs scientific grade CCDs as a novel technique to search for low mass WIMPs. The electronic readout noise (R.M.S. ~ 2 electrons) of the DAMIC detectors corresponds to an unprecedently low energy threshold of few tens of eV, particularly suited to detect Silicon recoils induced by low mass WIMPs In addition, the excellent energy response and high spatial resolution of a CCD image provides a powerful background characterization. Several prototypes of the DAMIC detector have been installed at the SNOLAB underground laboratory to demonstrate the feasibility of the technique. We will present results of this R&D phase, and the design of DAMIC-100, a 100 g detector to be installed at SNOLAB in 2014.

121. **Miguel Quartin**, UFRJ, Rio de Janeiro
Talk: Measuring cosmic structure with supernovae

August 26, 2014 (4:20 PM - 4:40 PM)
Parallel session: CMB/Large Scale Structure

I present a method which allows measurement of weak-lensing effects in the supernova Hubble diagram using observed SN magnitudes only. Such signal can be used as a measurement of growth of structure and in particular ?_8, independently from traditional methods. I then show that current data already allows a consistency check and the first measurement of ?_8 using SN magnitudes alone. Although this first result is imprecise, future surveys will make this new method competitive and valuable.

122. **Rudnei O. Ramos**, Rio de Janeiro State University
Poster: Isocurvature perturbations in warm inflation and observational effects

August 27, 2014

Co-authors: Mar Bastero-Gil, Arjun Berera and João G. Rosa
Warm inflation has the potential of generating both baryonic and dark matter asymmetries as a consequence of intrinsic particle production and nonequilibrium processes in the presence of B- and CP-violating interactions. The inflaton perturbations generated during the inflationary phase can get imprinted in the produced baryon and dark matter in the form of isocurvature perturbations. We show how these isocurvature perturbations can make a large tensor-to-scalar ratio, as recently measured by the BICEP2 experiment, consistent with the PLANCK and WMAP results. We also discuss other implications of having "mattergenesis" during warm inflation.

123. **Amid Ranjkesh Siahkal**, University of Maribor
Poster: Simulation study of domain patterns in randomly nematic liquid crystals

August 27, 2014

Co-authors: M. Ambroži?, S. Kralj, T. Sluckin
Glassy liquid crystalline systems are expected to show significant history-dependent effects. Two model glassy systems are the Random Anisotropic Nematic (RAN) and sprinkled Silica Spin (SSS)lattice models. The RAN model is a Lebwohl Lasher lattice model with locally coupled nematic spins, together with uncorrelated random anisotropy fields at each site, while the SSS model has a finite concentration of impurity spins frozen in random directions. Here Brownian simulation is used to study the effect of different sample histories in the low temperature regime in a three dimensional (d = 3) model intermediate between SSS and RAN, in which a finite concentration p < pc (pc the percolation threshold) of frozen spins interacts with neighboring nematic spins with coupling W. Simulations were performed at temperature T ? TNI /2 (TNI the bulk nematic-isotropic transition temperature) for temperature-quenched and field-quenched histories (TQH and FQH respectively), as well as for temperature-annealed histories (AH). The first two of these limits represent extreme histories encountered in typical experimental studies. Using long-time averages for equilibrated systems, we calculate orientational order parameters and two-point correlation functions. Finite size-scaling was used to determine the range of the orientational ordering, as a function of coupling strength W; p and sample history. Sample history plays a significant role; for given concentration p, as disorder strength W is increased, TQH systems sustain quasi-long-range (QLRO) and short range-order (SRO). The data are also consistent with a long-range order (LRO) phase at very low disorder strength. By contrast, for FQH, only LRO and QLRO occur within the range of parameters investigated. The crossover between regimes depends on history, but in general, the FQH phase is more ordered than the AH phase, which is more ordered than the TQH phase. In the weak-disorder limit the Larkin-Imry-Ma scaling is observed.

124. **Sebastien Renaux-Petel**, LPTHE, Paris
Talk: Spectral distortions in the cosmic microwave background polarization

August 26, 2014 (4:00 PM - 4:20 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: Based on 1312.4448, with Christian Fidler (Portsmouth), Cyril Pitrou (IAP), Guido W. Pettinari (Sussex).
Deviations of the cosmic microwave background (CMB) spectrum from the one of a blackbody, so-called spectral distortions, have recently emerged as a powerful probe of many physical phenomena, ranging from inflation to dark matter and reionization. However, most studies so far have concentrated on the distortions of the monopole of the CMB intensity, while future missions will characterize the spectrum of its anisotropies, both in intensity and in polarization. In this context, we have computed the leading-order unavoidable spectral distortions of the CMB polarization, which turn out to be induced by the non-linear effects in the Compton interactions between CMB photons and the flow of intergalactic electrons. We show that this effect is one order of magnitude larger than the non-linear kinetic Sunyaev-Zel'dovich effect in galaxy clusters, and that it directly probes the optical depth to reionization.

125. **Raquel H Ribeiro**, Case Western Reserve University
Talk: Riding on irrelevant operators: applications to Cosmology

August 25, 2014 (4:40 PM - 5:00 PM)
Parallel session: Formal/Inflation

Co-authors: Claudia de Rham
In this talk I will discuss the stability of a class of derivative theories known as $P(X)$ against corrections generated by quantum effects, and clarify the role played by the symmetries. I will explore the implications of our results to both early and late universe contexts. Interestingly, when applied to static and spherical screening, I will show that the regime of validity of certain sub-classes of $P(X)$ theories may be more appealing than others.

126. **Tanja Rindler-Daller**, University of Michigan
Talk: Supermassive dark stars: improved models and first pulsation results

August 26, 2014 (2:20 PM - 2:40 PM)
Parallel session: Dark Matter

Co-authors: Katherine Freese
Among the first stars to form in the Universe may be "dark stars", i.e. stars of primordial composition but powered by the heating released in the process of dark matter (DM) particle self-annihilation. It has been shown that this mechanism is feasible due to the high DM densities in the centers of early, primordial minihalos and the efficiency of DM annihilation. Self-annihilating DM could thereby be responsible for an entirely new class of stellar objects, while detection of the latter would provide a smoking gun for the presence of self-annihilating DM. Previous investigations have found that DM powered dark stars could become very massive (M > 10^5 M_solar), bright, cool and puffy objects. We use the stellar evolution code MESA in order to improve upon previous models, which were limited to polytropic equilibria, and to address several key issues of dark star astrophysics. We consider different halo environments, as well as different DM particle parameters, also in light of recent DM detection limits. We will present a detailed comparison between our numerical and previous polytropic models, as well as the first results on low-order p-mode pulsations of dark stars. The implications are important in order to be able to address observability of dark stars with future space-based telescopes, in particular the JWST.

127. **Elinore Roebber**, McGill University
Talk: A numerical calculation of the gravitational wave signal in the low frequency regime produced by binary supermassive black holes

August 26, 2014 (3:00 PM - 3:20 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: Gilbert Holder, Daniel Holz
We model the population of binary supermassive black holes at $z < 4$ using recent large-scale numerical simulations. We relate galaxies to the dark matter halos using calibrated relations between the halo and stellar mass functions. Galaxies are populated with supermassive black holes according to recent correlations between galaxy bulge mass and black hole mass, and the distribution of binary supermassive black holes is calculated from this population and the galaxy merger rate inferred from the simulations. We calculate the expected gravitational wave signal available to pulsar timing arrays by performing monte-carlo selection from this distribution.

128. **Laura Sagunski**, DESY Hamburg
Poster: The Time-Flow Approach as a Tool for Large-Scale Structure

August 29, 2014

Co-authors: Ido Ben-Dayan, Thomas Konstandin, Rafael Porto
We discuss how the time-flow approach of cosmological perturbation theory can be used as a tool for large-scale structure. In particular, we show that the flow equations allow to straightforwardly derive consistency relations for equal-time correlators involving both density and velocity fields and underlying different background cosmologies. Furthermore, we use the time-flow approach to proof the intricate cancellation of soft loop momenta in the power spectrum of standard perturbation theory at any loop order.

129. **Ryo Saito**, APC
Poster: Geodesic curve-of-sight formulae for the cosmic microwave background: a unified treatment of redshift, time delay, and lensing

August 29, 2014

Co-authors: Naruko Atsushi (TITECH), Takashi Hiramatsu (YITP), Misao Sasaki (YITP)
We introduce a new approach to a treatment of the gravitational effects (redshift, time delay and lensing) on the observed cosmic microwave background (CMB) anisotropies based on the Boltzmann equation. From the Liouville's theorem in curved spacetime, the intensity of photons is conserved along a photon trajectory when non-gravitational scatterings are absent. Motivated by this fact, we derive a second-order line-of-sight formula by integrating the Boltzmann equation along a "perturbed" geodesic (curve) instead of a background geodesic (line). In this approach, the separation of the gravitational and intrinsic effects are manifest. This approach can be considered as a generalization of the remapping approach of CMB lensing, where all the gravitational effects can be treated on the same footing.

130. **Marcelo Salgado**, Instituto de Ciencias Nucleares, UNAM, MEXICO
Talk: The equation of state of geometric dark energy in f(R) cosmology

August 25, 2014 (4:40 PM - 5:00 PM)
Parallel session: Dark Energy

I shall briefly review the nonequivalent equations of state (EOS) of "geometric dark energy" that have been proposed recently in the literature within the framework of f(R) cosmology and discuss their differences, advantages and drawbacks. This issue is particularly important in view of the forthcoming experiments designed to determine with a better precision the EOS of dark energy which can lead us to a better understanding about its nature.

131. **Emmanuel N Saridakis**, Physics Department, Baylor University
Poster: Modified torsional gravity and cosmology

August 29, 2014

132. **Ignacy Sawicki**, University of Geneva
Talk: Minimal parameterisation for general modifications of gravity

August 29, 2014 (2:00 PM - 2:20 PM)
Parallel session: Formal/Inflation

I will discuss a formulation of perturbation theory inspired by an effective-field theory approach, showing that linear perturbations in the most general scalar-tensor theory can be described without approximations by four functions of time only, each related to particular physical effects. The majority of dark-energy models can be reformulated in this way and therefore this is a unified approach to testing, constraining and selection of models.

133. **Ignacy Sawicki**, University of Geneva
Poster: Model-independent observables in dark-energy cosmologies

August 29, 2014

I will discuss how far we can go without assuming a particular model of gravity and therefore what model-independent observables we can measure. For example, the gravitational slip parameter can be reconstructed, providing unambiguous information as to the coupling of gravity. This method allows us to formulate a set new null tests for the growth of perturbations in LCDM or in other models.

134. **Carol Y Scarlett**, Florida A&M University
Poster: Cavity Searches for Dark Matter

August 29, 2014

Recent simulations of beam splitting in a mirror cavity environment suggest it may be possible to extend the sensitivity of cavity searches for exotic particles. Earlier searches using cavities sought second order effects, and were significantly limited. The renewed interest in beam splitting effects, first explored by G. Raffelt and extended to astrophysical observables by E. Guendleman, has opened up a new possibility for extending these searches. Building on simulations to explore the types of measureables due to this splitting effect, this work looks at what happens when quantization of the photon is considered.

135. **Kai Schmitz**, Kavli IPMU, University of Tokyo
Talk: Generating fractional power inflationary potentials

August 25, 2014 (3:00 PM - 3:20 PM)
Parallel session: Formal/Inflation

Co-authors: Keisuke Harigaya, Masahiro Ibe, and Tsutomu T. Yanagida
In view of the recent BICEP2 data, chaotic inflation based on a simple monomial potential, V(phi) ~ |phi|^p, is certainly among the most attractive inflationary models capable of generating a sizeable tensor-to-scalar ratio r. Here, ordinary perturbative QFT, however, only admits positive integer values for the power p. In order to obtain fractional values, such as p = 2/3 or p = 2/5, one conventionally has to rely on the mechanism of axion monodromy in string theory. As I will demonstrate in this talk, this is not necessarily so. In fact, in strongly interacting supersymmetric gauge theories, it turns out to be possible to dynamically generate inflation potentials featuring almost arbitrary fractional powers via the effect of dimensional transmutation. This opens up the intriguing possibility that inflation is nothing but a mere consequence of strong dynamics around the scale of grand unification. A very precise determination of the inflationary CMB observables would then di rectly allow to pinpoint the gauge structure of the inflaton sector.

136. **Gizem Sengor**, Syracuse University
Poster: Black-hole Constraints on the post-Inflationary Epoch

August 29, 2014

Co-authors: Julian Georg, Scott Watson
In models of split SUSY, scalar superpartners and light scalar fields are at the SUSY breaking scale whereas fermion superpartners can lie below at hundreds of GeV -- making the lightest a good dark matter candidate. The light scalar fields often arise from shift symmetric fields (moduli) and can decay into other particles through gravitational strength couplings. Dark matter being one of the fermion superpartners has lower mass then the moduli, therefore it may be the case that dark matter is produced from the moduli decay. Being shift symmetric, the moduli has zero potential but this symmetry is broken both during inflation and at the time of low-scale SUSY breaking. This leads to energy stored in the coherent oscillations of the field as the minimum changes between the two scales leading to the formation of a scalar condensate. These oscillations scale like matter and lead to a new, matter dominated non-thermal history just after inflation and before BBN. Depending on the mass the field decays into radiation and dark matter without disturbing BBN. In a matter dominated universe, sub horizon density perturbations can grow to form structures. As moduli decay late this matter dominated era may last long enough to lead to formation of primordial black holes (PBH) in an unacceptable abundance. In this project we ask, does this lead to constraints on non-thermal post-inflationary histories? In considering massive scalar fields, the common assumption is that they are pressureless and the speed of sound is zero. However, this is only true up to a certain scale. For scales where the pressure is nonnegligible, it effects the perturbed Einstein Equations via a nonzero sound speed. This effect is important in an analysis of density perturbations on sub-horizon scales. The purpose of this work is to consider the effect of nonzero sound speed on moduli density perturbations in nonthermal cosmologies. These density perturbations can be used to predict mass fraction of PBH formed in sub-horizon scales within the non-thermal era. Based on the mass fraction one may be able to put constraints on non-thermal cosmology scenarios and also discuss how much a consideration of the nonzero pressure effects small scale structures.

137. **Daniel Shafer**, University of Michigan
Talk: Is There Evidence for Phantom Dark Energy?

August 29, 2014 (4:40 PM - 5:00 PM)
Parallel session: Dark Energy

Co-authors: Dragan Huterer
Some recent observations provide > 2-sigma evidence for phantom dark energy - a value of the dark energy equation of state less than the cosmological-constant value of w = -1. I will discuss the constraints on w from current SN Ia, BAO, and CMB data sets, highlighting which data are responsible for the push towards a more negative equation of state. I will go on to discuss systematics in SN Ia data and new tests we performed. I will end by explaining how the current tension in measurements of the Hubble constant may relate to the dark energy equation of state.

138. **Daniel Shafer**, University of Michigan
Poster: Type Ia Supernovae and Evidence for a Phantom Dark Energy Equation of State

August 29, 2014

Co-authors: Dragan Huterer
Some recent observations provide > 2-sigma evidence for phantom dark energy - a value of the dark energy equation of state less than the cosmological-constant value of -1. We focus on constraining the equation of state by combining current data from the most mature geometrical probes of dark energy: Type Ia supernovae (SNe Ia), baryon acoustic oscillations (BAO), and the cosmic microwave background (CMB). The combined data are consistent with w = -1 for the Union2.1 SN sample, though they present moderate (~1.9-sigma) evidence for a phantom value when either the SNLS3 or PS1 SN sample is used instead. We study the dependence of the constraints on the redshift, stretch, color, and host galaxy stellar mass of SNe, but we find no unusual trends. In contrast, the constraints strongly depend on any external H_0 prior: a higher adopted value for the direct measurement of the Hubble constant (H_0 > 71 km/s/Mpc) leads to > 2-sigma evidence for phantom dark energy. Given Planck data, we can therefore make the following statement at 2-sigma confidence: either the SNLS3 and PS1 data have systematics that remain unaccounted for or the Hubble constant is below 71 km/s/Mpc; else the dark energy equation of state is indeed phantom.

139. **Sarah Shandera**, Pennsylvania State University
Invited Talk: Non-Gaussianity and tests of inflation in a finite universe

August 26, 2014 (9:00 AM - 9:45 AM)
Plenary session

The possibility of measuring or constraining correlations of the primordial curvature fluctuations beyond the power spectrum has opened up promising new avenues to differentiate models of inflation. Interestingly, mode coupling also introduces a new and significant uncertainty in matching observations to theory. In a universe much larger than our current Hubble volume, our local background need not agree with the global average background often used to theoretically predict the homogeneous and isotropic perturbations. If modes are coupled, the statistics of perturbations we observe (including the amplitude of non-Gaussianity) can depend on the long wavelength background which is not independently observable to us. I will discuss the implications of this result for interpreting the Planck satellite (and BICEP2) results and on the potential of future data to constrain the particle physics of inflation.

140. **Paul R Shapiro**, The University of Texas at Austin
Talk: Simulating Cosmic Reionization and Its Observable Consequences

August 27, 2014 (2:40 PM - 3:00 PM)
Parallel session: CMB/Large Scale Structure

The first billion years of cosmic time witnessed the formation of the first galaxies and stars, whose UV radiation gradually burned through the surrounding intergalactic medium, transforming it from a cold, diffuse gas of neutral atoms to a 10,000 K hot gas of ions and electrons. This ``epoch of reionization" (EOR) filled space with a patchwork quilt of giant ionized zones and neutral zones, until the ionized zones eventually grew to fill all of space. The EOR is one of the last unexplored windows of cosmic time subject to direct observation, and a crucial missing link in our astronomical confirmation of the current standard theory of cosmology, the Cold Dark Matter model. Towards that end, we have pioneered the large-scale numerical simulation of this phenomenon, to predict a host of observable consequences with which to test the theory, ranging from the redshifted cosmic 21cm background from hydrogen atoms in the neutral zones during the EOR, to the angular fluctuations of the cosmic microwave background introduced when those photons scatter off free electrons in the ionized zones, to the quenching of light from the earliest galaxies when their Lyman alpha emission lines resonantly scatter off the trace of neutral atoms left behind inside the ionized zones. I will report some of the latest developments.

141. **Christopher Sheehy**, University of Chicago
Talk: BICEP2 Instrumental Systematics

August 25, 2014 (2:00 PM - 2:20 PM)
Parallel session: CMB/Large Scale Structure

In this talk, I will discuss the recent detection of B-mode polarization by the BICEP2 experiment, focusing on the characterization and mitigation of instrumental systematics.

142. **Blake D Sherwin**, University of California, Berkeley
Talk: Mapping Mass at High Redshifts: CMB Lensing Measurements with ACTPol and POLARBEAR

August 25, 2014 (2:40 PM - 3:00 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: ACTPol and POLARBEAR Collaborations
Measurements of gravitational lensing in the Cosmic Microwave Background (CMB) directly probe the projected distribution of mass out to high redshifts. The CMB lensing maps thus encode a wealth of information about neutrino and dark energy properties, and can also be used to improve constraints on inflationary tensor fluctuations and measure the relation between dark and luminous matter at high redshifts. After briefly reviewing what we have learned from past work on CMB temperature lensing (e.g., with ACT and Planck), I will discuss new, exploratory CMB polarization lensing measurements with the POLARBEAR and ACTPol experiments. Finally, I will explain the great scientific returns we can expect from such CMB polarization lensing surveys in just the next few years.

143. **Masato Shirasaki**, University of Tokyo
Talk: Cross-Correlation of Cosmic Shear and Extragalactic Gamma-ray Background

August 27, 2014 (4:20 PM - 4:40 PM)
Parallel session: Dark Energy

Co-authors: Naoki Yoshida, Shunsaku Horiuchi
We present the first measurement of the cross-correlation of weak gravitational lensing and the extragalactic gamma-ray background emission using data from the Canada-France-Hawaii Lensing Survey and the Fermi Large Area Telescope. The cross-correlation is a powerful probe of signatures of dark matter annihilation, because both cosmic shear and gamma-ray emission originate directly from the same DM distribution in the universe, and it can be used to derive constraints on dark matter annihilation cross-section. We show that the measured lensing-gamma correlation is consistent with a null signal. Comparing the result to theoretical predictions, we exclude dark matter annihilation cross sections of <sigma v> =10^{-24} 10^{-25} cm^3 s^-1 for a 100 GeV dark matter. If dark matter halos exist down to the mass scale of 10^-6 M_sun, we are able to place constraints on the thermal cross sections <sigma v> ~ 3 x 10^{-26} cm^3 s^-1 for a 10 GeV dark matter annihilation into tau^{+} tau^{-}. Future gravitational lensing surveys will increase sensitivity to probe annihilation cross sections of <sigma v> ~ 3 x 10^{-26} cm^3 s^-1 even for a 100 GeV dark matter. Detailed modeling of the contributions from astrophysical sources to the cross correlation signal could further improve the constraints by ~ 40-70 %.

144. **Gary Shiu**, University of Wisconsin & HKUST
Talk: New and Simpler Monodromy Inflation

August 25, 2014 (2:00 PM - 2:20 PM)
Parallel session: Formal/Inflation

Co-authors: Fernando Marchesano, Angel Uranga
The continuous shift symmetry of axions is at the heart of several realizations of inflationary models. In particular, axion monodromy inflation aims at achieving super-Planckian field ranges for the inflaton in the context of string theory. Despite the elegant underlying principle, explicit models constructed hitherto are exceedingly complicated. We propose a new and better axion monodromy inflationary scenario, where the inflaton potential arises from an F-term. We present several scenarios, where the axion arises from the Kaluza-Klein compactification of higher dimensional gauge fields (or p-form potentials) in the presence of fluxes and/or torsion homology. The monodromy corresponds to a change in the background fluxes, and its F-term nature manifests in the existence of domain walls interpolating among flux configurations. Our scenario leads to diverse inflaton potentials, including linear large field behaviour, chaotic inflation, as well as potentials with even higher powers.

145. **Benjamin Shlaer**, Tufts Institute of Cosmology
Poster: What we know about cosmic string loops

August 29, 2014

Co-authors: Jose Blanco-Pillado, Ken Olum
Recent numerical progress on Nambu-Goto strings has enabled us to determine the mass, velocity, and cusp spectrum of cosmic string loops.

146. **Saga Shohei**, Nagoya university
Poster: The impact of anisotropic stress of free-streaming particles on gravitational waves induced by cosmological density perturbations

August 29, 2014

Co-authors: Kiyotomo Ichiki, Naoshi Sugiyama
Gravitational waves (GWs) are inevitably induced at second-order in cosmological perturbations through non-linear couplings from first order scalar perturbations, whose existence is well established by recent cosmological observations. So far, the evolution and the spectrum of the secondary induced GWs have been derived by taking into account only the sources of GWs from the product of first order scalar perturbations. Here we newly investigate the effects of purely second order anisotropic stress of photons and neutrinos on the evolution of GWs.

147. **Eva Silverstein**, Stanford University
Invited Talk: The structure of large-field inflation in string theory and CMB phenomenology

August 25, 2014 (11:00 AM - 11:45 AM)
Plenary session

148. **Tracy Slatyer**, Massachusetts Institute of Technology
Invited Talk: Dark matter indirect detection

August 28, 2014 (11:45 AM - 12:30 PM)
Plenary session

149. **Marcelle Soares-Santos**, Fermilab
Talk: DES galaxy cluster science results

August 27, 2014 (2:00 PM - 2:20 PM)
Parallel session: Dark Energy

The Dark Energy Survey (DES) Collaboration has started a 5000 square degree imaging survey of the southern galactic cap using a new 3 sq. deg., 520 Megapixel CCD camera, the Dark Energy Camera (DECam), mounted on the Blanco 4-meter telescope at the Cerro-Tololo Inter-American Observatory in Chile. DECam has achieved first-light in September 2012. Commissioning and science verification were successfully finished in February 2013 and the survey proper started on August 31, 2013. DES data will be used to place new and tight constraints on the nature of dark energy via the history of the cosmic expansion rate and the growth of large-scale structure, using the four complementary techniques recommended by the Dark Energy Task Force: weak gravitational lensing, galaxy cluster counts, large-scale structure, and Type Ia supernovae. In this talk, I present galaxy cluster science results from the DES science verification data.

150. **Flavia Sobreira**, Fermilab
Talk: DES Large Scale Structure First Results

August 29, 2014 (2:20 PM - 2:40 PM)
Parallel session: Dark Energy

In this talk I will present some general results and challenges on the Large Scale Structure after the first year of DarK Energy Survey observation.

151. **Douglas Spolyar**, University of Amsterdam (GRAPPA)
Talk: GAIA searching for DM sub-halos

August 26, 2014 (2:40 PM - 3:00 PM)
Parallel session: Dark Matter

Co-authors: Robert Feldmann
Cold Dark Matter (CDM) theory, a pillar of modern cosmology and astrophysics, predicts the existence of a large number of starless dark matter halos surrounding the Milky Way (MW). However, clear observational evidence of these "dark" substructures remains elusive. Here, we present a detection method based on the small, but detectable, velocity changes that an orbiting substructure imposes on the stars in the MW disk. Using high-resolution numerical simulations we estimate that the new space telescope Gaia should detect the kinematic signatures of a few starless substructures provided the CDM paradigm holds. Such a measurement will provide unprecedented constraints on the primordial matter power spectrum at low-mass scales and offer a new handle onto the particle physics properties of dark matter.

152. **Albert Stebbins**, Fermilab
Talk: Fast Radio Bursts as Triggers for Neutrino and Gravitational Wave Telescopes

August 27, 2014 (4:40 PM - 5:00 PM)
Parallel session: Dark Energy

Current and near future neutrino nu and gravitational wave (GW) telescopes by themselves can only detect relatively nearby events, e.g. supernovae or compact binary coalescences. If we had a trigger for when these events happened one study far more distant events by cross-correlating the signal with the trigger. Fast Radio Bursts (FRBs) occur a million times a year (more frequently than GRBs) and having millisecond time accuracy would be the best known trigger if they are also a byproduct of these events. In this presentation the potential for using FRBs as triggers is explored

153. **David Stefanyszyn**, University of Nottingham
Talk: Unitarity and the Vainshtein Mechanism

August 25, 2014 (4:00 PM - 4:20 PM)
Parallel session: Dark Energy

Infra-red modifications of gravity generically introduce new scalar propagating degrees of freedom in addition to the 2 degrees of freedom of the graviton. Either at face value, or in some decoupling limit, these scalar modes usually acquire self interactions allowing the theory to reproduce GR in the solar system. These interaction terms are often non renormalisable and suppressed by an energy scale way below the Planck scale; signalling the break down of perturbative QFT at a much smaller scale than that of GR. Presented with a scalar interaction of this type, one could conclude there are two different scales at which the interactions become strong, namely, a vacuum strong coupling scale and an environmental scale, which depends on the background field profile. In most known examples, the environmental scale is higher and therefore more appealing. This talk will discuss which scale should be taken seriously as the break down of the low energy effective theory by studying the low energy interactions of a fully UV complete theory.

154. **James D. E. Stokes**, UPenn
Poster: A holographic realization of an alternative to inflation

August 29, 2014

Co-authors: Kurt Hinterbichler, Mark Trodden
We construct the gravitational dual to the pseudo-conformal universe scenario proposed as an alternative to inflation. The problem is mapped to finding five-dimensional domain-wall spacetimes with anti-de Sitter asymptotics, where the wall has the symmetries of four-dimensional de Sitter space. This holographically realizes the symmetry breaking pattern $O(2,4) to O(1,4)$ which is required to generate scale-invariant density perturbations in the early universe. We present an explicit example using a massless scalar field and obtain the general expressions for the renormalized scalar and stress-tensor one point functions in arbitrary Fefferman-Graham gauge as a byproduct. We discuss the relationship between our proposal and four-dimensional holographic defect conformal field theories which break $O(2,4) to O(2,3)$.

155. **Naonori Sugiyama**, University of Tokyo
Poster: Using Lagrangian Perturbation Theory for Precision Cosmology

August 29, 2014

We explore the Lagrangian perturbation theory (LPT) at 1-loop order with Gaussian initial conditions. We present an expansion method to approximately compute the power spectrum and two-point correlation function using LPT in real and redshift spaces. Our approximate solution has good convergence in the series expansion and enables us to compute the power spectrum and correlation function in LPT accurately and quickly. Non-linear corrections in the Lagrangian perturbation theory naturally satisfy the law of conservation of mass because the relation between matter density and the displacement vector of dark matter corresponds to the conservation of mass. This property of LPT has an advantage to predict the power spectrum and correlation function in the redshift space without any free parameter.

156. **Meng Su**, MIT
Talk: Probing Dark Matter with Future Gamma-ray Space Telescopes

August 29, 2014 (4:20 PM - 4:40 PM)
Parallel session: Dark Matter

Gamma-ray observations as an indirect probe of dark matter particle plays an important rule to our approach to unveil the nature of dark matter. Data from the Fermi Gamma-ray Space Telescope has provided strong constraints on what dark matter could be. I'm going to introduce several future space gamma-ray missions: DArk Matter Particle Explorer (DAMPE), PAir-productioN Gamma-ray Unit (PANGU), and High Energy cosmic-Radiation Detection (HERD) Facility onboard China's Future Space Station. I will focus on the predicted power of these missions on improving our knowledge of dark matter, with a hope of detecting potential signal of dark matter from the gamma-ray sky.

157. **Yuichiro Tada**, KavliIPMU
Poster: Non-perturbative approach for curvature perturbations in stochastic-delta N formalism

August 29 - 25, 2014

Co-authors: Tomohiro Fujita, Masahiro Kawasaki
In our previous paper (JCAP1312,036(2013)), we have proposed a new algorithm to calculate the power spectrum of the curvature perturbations generated in inflationary universe with use of the stochastic approach. Since this algorithm does not need the perturbative expansion with respect to the inflaton fields on super-horizon scale, it works even in highly stochastic cases. For example, when the curvature perturbations are very large or the non-Gaussianities of the curvature perturbations are sizable, the perturbative expansion may break down but our algorithm enables to calculate the curvature perturbations. We apply it to two well-known inflation models, chaotic and hybrid inflation, in this paper. Especially for hybrid inflation, while the potential is very flat around the critical point and the standard perturbative computation is problematic, we successfully calculate the curvature perturbations.

158. **Gianmassimo Tasinato**, ICG, Portsmouth
Talk: Cosmic Acceleration from Abelian Symmetry Breaking

August 25, 2014 (2:20 PM - 2:40 PM)
Parallel session: Dark Energy

I will discuss a consistent theory for a self-interacting vector field, breaking an Abelian symmetry in such a way to obtain an interesting behavior for its longitudinal polarization. In an appropriate decoupling limit, the dynamics of the longitudinal mode is controlled by Galileon interactions. The full theory away from the decoupling limit does not propagate ghost modes, and can be investigated in regimes where non-linearities become important. When coupled to gravity, this theory provides a candidate for dark energy, since it admits de Sitter cosmological solutions characterized by a technically natural value for the Hubble parameter. I will also consider the homogeneous evolution when, besides the vector, additional matter in the form of perfect fluids is included. Finally, I will describe how to spontaneously break the gauge symmetry so to generate the desired vector self-interactions via a Higgs mechanism.

159. **Matteo Tellarini**, Institute of Cosmology and Gravitation (ICG), University of Portsmouth
Poster: Primordial non-Gaussianity in the bispectra of large-scale structure

August 29, 2014

Co-authors: Gianmassimo Tasinato, Ashley J. Ross, David Wands
The statistics of large-scale structure in the Universe can be used to probe non-Gaussianity of the primordial density field, complementary to existing constraints from the cosmic microwave background. In particular, the scale dependence of halo bias, which affects the halo distribution at large scales, represents a promising tool for analyzing primordial non Gaussianity of local form. Future observations, for example, may be able to constrain the trispectrum parameter gNL that is difficult to study and constrain using the CMB alone. We investigate how galaxy and matter bispectra can distinguish between the two non-Gaussian parameters fNL and gNL, whose effects give nearly degenerate contributions to the power spectra. We use a generalization of the univariate bias approach, making the hypothesis that the number density of halos forming at a given position is a function of the local matter density contrast and of its local higher-order statistics. Using this approach, we calculate the halo-matter bispectra and analyze their properties. We determine a connection between the sign of the halo bispectrum on large scales and the parameter gNL. We use a specific halo mass-function to calculate numerically the bispectra in appropriate squeezed limits, confirming our theoretical findings.

160. **Takahiro Terada**, University of Tokyo
Poster: Large field inflation in supergravity with a single chiral superfield

August 29, 2014

Co-authors: Sergei V. Ketov
We propose a framework for inflationary model building in supergravity which requires only one chiral superfiled in addition to the standard gravity supermultiplet. A stabilization mechanism for the non-inflaton field in the inflaton supermultiplet is required, for which we take a higher dimensional term in the Kahler potential. This framework allows one to construct a very wide range of inflationary potentials consistent with observations with a minimal set-up.

161. **Alexandra Terrana**, York University and Perimeter Institute
Talk: Time-dependence in massive gravity

August 25, 2014 (4:20 PM - 4:40 PM)
Parallel session: Formal/Inflation

Theories of massive gravity have been shown to modify GR on large distance scales to produce accelerated expansion without an explicit cosmological constant. In decoupling limit of the DGP model and ghost-free massive gravity, the modification to gravity lies in an extra scalar degree of freedom. In this limit, the scalar field can be decoupled from gravity, and is essentially a galileon field propagating on flat space. It is crucial for phenomenological applications that this extra degree of freedom be screened at short distance scales to recover continuity with GR. It is known that theories of massive gravity admit static spherically symmetric solutions that exhibit the Vainshtein screening mechanism. In this work, we generalize to solve for time-dependent spherically symmetric solutions in the decoupling limit of DGP and massive gravity through numerical methods. We address if and when the known static solutions are obtained dynamically and identify conditions for well-defined evolution of the field. We also analyze linear perturbations which resemble scalar waves with quasi-normal modes and late-time asymptotic tails.

162. **Mark Trodden**, University of Pennsylvania
Invited Talk: Theoretical Aspects of Cosmic Acceleration

August 27, 2014 (11:45 AM - 12:30 PM)
Plenary session

163. **Sebastian Trojanowski**, National Center for Nuclear Research, Warsaw, Poland
Talk: Neutralino and gravitino dark matter with low reheating temperature

August 29, 2014 (4:00 PM - 4:20 PM)
Parallel session: Formal/Inflation

Co-authors: Leszek Roszkowski, Krzysztof Turzynski
We examine a scenario in which the reheating temperature T_R after inflation is so low that it is comparable to, or lower than, the freeze out temperature of ordinary WIMPs. In this case the relic abundance of dark matter is reduced, thus relaxing the impact of the usually strong constraint coming from the requirement that the universe does not overclose. We first re examine the dynamics of freezeout during reheating. Next we apply a Bayesian approach to study the parameter space of the MSSM with ten free parameters, the CMSSM and the singlino-dominated regions of the NMSSM. In each case we often find dramatic departures from the usually considered regime of high T_R, with important implications for direct detection dark matter searches. In particular, in the MSSM we examine WIMP mass range up to ~5 TeV, and we find regions of bino dark matter over the whole mass range, and of higgsino dark matter with mass over a similar range but starting from the ~1 TeV value of the standard high T_R scenario. We show that the prospects for bino detection strongly depend on T_R, while the higgsino is for the most part detectable by future one-tonne detectors. The wino, which is excluded in the standard scenario, becomes allowed again if its mass is roughly above 3.5 TeV, and can be partially detectable. In the CMSSM, the bino and higgsino mass ranges become more constrained although detection prospects remain similar. In the Next-to-MSSM we show that, at low enough T_R wide ranges of singlino-dominated parameter space of the model become cosmologically allowed, although detection prospects remain nearly hopeless. Finally, in the framework of the MSSM we consider the case of a gravitino as dark matter. We find strong bounds from overclosure and Big Bang Nucleosynthesis, and derive lower limits on T_R which depend on the gravitino mass and on the nature of the lightest ordinary superpartner.

164. **Krzysztof Turzynski**, University of Warsaw
Poster: The effects of a fast-turning trajectory in multiple-field inflation

August 29, 2014

Co-authors: Maciej Konieczka, Raquel H. Ribeiro
We analyse the possibility of particle production induced by sharp turns of the trajectory in field space in inflation models with multiple fields. Although the evolution of the background fields can be altered by particle production, we find rather modest changes in the power spectrum even for the most extreme case in which the entire kinetic energy of the scalar fields is converted into particles. We also study implications of such particle production for reheating

165. **Amol Upadhye**, University of Wisconsin, Madison
Talk: Large-scale structure formation with dynamical dark energy and massive neutrinos

August 25, 2014 (2:40 PM - 3:00 PM)
Parallel session: Dark Energy

Co-authors: Rahul Biswas, Adrian Pope, Katrin Heitmann, Salman Habib, Hal Finkel, Nicholas Frontiere
Over the next decade, cosmological measurements of the large-scale structure of the Universe will be sensitive to the combined effects of dynamical dark energy and massive neutrinos. The matter power spectrum is a key repository of this information. I use higher-order perturbative methods for computing the power spectrum to investigate these effects on quasi linear scales. Through comparison with N-body simulations I establish the validity of a Time-Renormalization Group (Time-RG) perturbative treatment that includes dynamical dark energy and massive neutrinos. I also quantify the accuracy of Standard (SPT), Renormalized (RPT), and Lagrangian (LPT) Perturbation Theories without massive neutrinos. I show that an approximation which neglects neutrino clustering as a source for matter clustering predicts the Baryon Acoustic Oscillation (BAO) peak position to 0.25% accuracy for red shifts $1 < z < 3$, justifying the use of Lagrangian perturbation theory for BAO reconstruction in upcoming surveys. Finally, I discuss possible applications and future prospects for perturbative calculations in cosmology.

166. **Joaquin D Vieira**, University of Illinois at Urbana-Champaign
Talk: High redshift starburst galaxies revealed by SPT, ALMA, and gravitational lensing

August 25, 2014 (3:00 PM - 3:20 PM)
Parallel session: CMB/Large Scale Structure

The South Pole Telescope (SPT) has systematically identified a large number of high-redshift strongly gravitationally lensed starburst galaxies in a 2500 square degree cosmological survey of the millimeter (mm) sky. With ALMA, we have performed an unbiased spectroscopic redshift survey with these sources and determined that roughly 40% lie at z>4. Two sources are at z=5.7, placing them among the highest redshift starbursts known, and demonstrating that large reservoirs of molecular gas and dust can be present in massive galaxies near the end of the epoch of cosmic reionization. These sources were additionally targeted with high resolution imaging with ALMA, unambiguously demonstrating them to be strongly gravitationally lensed by foreground structure. We are undertaking a comprehensive and systematic followup campaign to use these ``cosmic magnifying glasses'' to study the infrared background in unprecedented detail, inform the condition of the interstellar medium in starburst galaxies at high redshift, and place limits on dark matter substructure. I will discuss the scientific context and potential for these strongly lensed starburst galaxies, give an overview of our team's extensive followup efforts, and describe our latest science results.

167. **José P. P. Vieira**, Centre of Astrophysics of the University of Porto
Poster: Wiggly cosmic string evolution

August 29, 2014

Co-authors: C. J. A. P. Martins, E. P. S. Shellard
The Velocity-dependent One-Scale model (VOS) is a simplified but quantitative analytic model for cosmic string evolution, which accurately captures the behaviour of the network across early regimes with frictional damping and the important matter-radiation transition. Nevertheless, despite its remarkable performance when it comes to calculating large-scale qualitative properties of a string network, it is intrinsically limited in how much it can tell us about the small-scale structure. In this talk, a natural generalisation of the VOS which takes into account the evolution of small-scale structure will be introduced. The main challenges to the development of this novel approach will be discussed, as well as the insight provided by its application to a number of physically relevant limits. This work was done in collaboration with C.J.A.P. Martins and E.P.S. Shellard, and is available online at arXiv:1405.7722

168. **Branislav Vlahovic**, North Carolina Central University
Poster: Can Cosmological Spherical Shell Model be Geometrical Substitution for Inflation?

August 29, 2014

Co-authors: Maxim Eingorn
The conventional LCDM cosmological model supplemented by the inflation concept explains the Universe evolution well. However, there are still a few concerns: new Planck data impose a non-trivial constraint on the shape of the inflation potential, which excludes a lot of inflationary models; dark matter is not detected directly; and dark energy is not described theoretically on a satisfactory level. Within FLRW formalism considered will be a variant of the cosmological spherical shell model and constraints imposed on it by cosmological principles and observable data, as for instance the range for the size and the allowed thickness of the shell, the supernovae luminosity distance, and CMB data. In this topological model propagation of light is confined along the shell, which has as a consequence that the observed CMB originated from one point or a limited space region. This allows to interpret the uniformity of the CMB without inflation scenario. In addition it removes any constraints on the uniformity of the Universe at the early stage and opens a possibility that the Universe was not uniform and that creation of galaxies and large scale structures is due to the inhomogeneities that originated in the Big Bang.

169. **Neal Weiner**, New York University
Invited Talk: Dark matter overview

August 25, 2014 (11:45 AM - 12:30 PM)
Plenary session

170. **William Wester**, Fermilab
Talk: Status of Dark Energy Survey's Type IA Supernova Program

August 29, 2014 (2:00 PM - 2:20 PM)
Parallel session: Dark Energy

Co-authors: on behalf of the Dark Energy Survey Collaborations
The Dark Energy Survey includes repeated optical observations of 10 three degree fields between Aug and Feb over at least five years to identify Type IA supernovae, measure the corresponding light curves, and extract cosmologically interesting parameters including those associated with Dark Energy. A status of this program is given.

171. **William Wester**, Fermilab
Poster: Search for Dark Sector Particles with MiniBooNE at Fermilab

August 29, 2014

Co-authors: on behalf of the MiniBooNE Collaboration
The MiniBooNE neutrino experiment at Fermilab has been altered in a beam dump configuration to suppress the focused production of neutrinos onto the detector. In this mode, the experiment has improved sensitivities to search for possible dark sector particles such as a hidden photon mediator that also accounts for the muon g-2 anomaly.

172. **Lee R Whittaker**, Manchester University
Poster: Weak lensing using only galaxy position angles

August 29, 2014

Co-authors: Richard Battye, Michael Brown
We develop a method for performing a weak lensing analysis using only measurements of galaxy position angles. By analyzing the statistical properties of the galaxy orientations, given a known intrinsic ellipticity distribution, we show that it is possible to obtain estimates of the shear. The method is demonstrated using a set of simulations, and using a number of different intrinsic ellipticity distributions. Uncertainties on the position angle measurements introduce a bias into the shear estimates which can be reduced to negligible levels by introducing a correction term into the formalism. We compare the performance of the position angle only method with the standard method based on full ellipticity measurements by reconstructing lensing convergence maps from both numerical simulations and from the CFHTLenS data. We find that the position angle only method exhibits a performance comparable with that of the standard estimator in the case where the intrinsic ellipticity distribution is accurately known.

173. **Clemens Wieck**, DESY Hamburg
Talk: Chaotic Inflation, Supersymmetry Breaking, and Moduli Stabilization

August 25, 2014 (2:20 PM - 2:40 PM)
Parallel session: Formal/Inflation

Co-authors: Wilfried Buchmüller, Emilian Dudas, Lucien Heurtier
We investigate the interplay between large-field (chaotic) inflation and supersymmetry breaking. We study the minimal model of chaotic inflation in supergravity and add a Polonyi field. In all investigated setups the gravitino mass is bounded parametrically by the inflaton mass, by the requirement of successful inflation. Furthermore, we show that the supergravity description of phi-squared inflation without a stabilizer field can not be cured by the presence of a supersymmetrically stabilized modulus.

174. **Danielle E Wills**, Durham University
Poster: Cosmic strings and rotating black holes

August 29, 2014

Co-authors: Ruth Gregory, Peter C Gustainis, David Kubiznak, Robert B Mann
Rotating black holes can support cosmic string hair, which leads to novel phenomenology around these objects. The strings, modeled as Abelian Higgs vortices, are composed of a scalar core threaded with magnetic flux, but the rotation generates electric flux close to the event horizon. While for large mass black holes, the flux lines of the string pierce the event horizon, low mass extremal black holes exhibit a Meissner effect and expel the flux lines from the interior of the black hole. In addition, the gravitational back-reaction of the string can shift the ergosphere and geodesics around the black hole, potentially leading to new observational signatures of these systems. Finally, these systems may be generalised to AdS spacetimes.

175. **Hao-Yi Wu**, University of Michigan
Talk: Probing growth of cosmic structure using galaxy dynamics: a converging picture of velocity bias

August 27, 2014 (3:00 PM - 3:20 PM)
Parallel session: Dark Energy

Co-authors: Dragan Huterer, August Evrard
The dynamics of galaxies observed by redshift surveys reflects the gravitation potential of collapsed structure in the Universe, thus providing a sensitive probe of growth of structure and dark energy. To interpret the survey results, numerical simulations are commonly employed; however, these simulations do not always provide realistic galaxy properties due to our limited understanding of baryon physics. In this talk, I will first discuss the impact of uncertainties in simulations on the cosmological results and show that the velocity bias --- the fact that galaxies could have different velocities from dark matter --- can be a dominating source of systematic error. I will then present a study of the velocity bias of cluster galaxies using both N-body and hydrodynamical simulations. I will demonstrate how different physical processes can result in different dynamic properties of galaxy tracers, and and how a consistent picture emerges using state-of-the-art methods for tracking galaxy dynamics.

176. **Hao-Yi Wu**, University of Michigan
Poster: Cosmology with gas and stellar content of galaxy clusters: results from Rhapsody-G hydrodynamical simulations

August 29, 2014

Co-authors: August Evrard, Oliver Hahn, Davide Martizzi, Romain Teyssier, and Risa Wechsler
The gas and stellar content of galaxy clusters provides valuable information about cosmology. For example, galaxy number, stellar mass, and gas mass of clusters are useful for calibrating the total mass of clusters; the gas mass fraction of galaxy clusters provides distance information. In this talk, I will present a new set of hydrodynamical simulations - Rhapsody-G - which aims for pinning down the scatter and covariances of gas and stellar properties of galaxy clusters. I will present the discovery of several covariances between gas and stellar properties, and how these covariances can improve cluster mass calibration. I will also present new theoretical calibration of gas mass fraction and discuss how the current theoretical uncertainties can impact the cosmological results.

177. **Amanda Yoho**, Case Western Reserve University
Talk: Using B-modes in the CMB to Constrain the Lack of Large Angular Correlation

August 25, 2014 (4:20 PM - 4:40 PM)
Parallel session: CMB/Large Scale Structure

Co-authors: Glenn D. Starkman, Arthur Kosowsky, Simone Aiola, Craig J. Copi
The recent release of the BICEP II power spectrum of the B-mode autocorrelation from the CMB polarization field has generated much excitement in the field of Cosmology. In this work, we investigate the possibility of using the two-point correlation function of the CMB B-modes to shed light on the measured lack of correlation in CMB temperature data. We present two methods for calculating correlation functions from tensor-only modes, and investigate the viability a PIXIE-like next generation full-sky CMB satellite to shed more light on the anomaly.

178. **Jun'ichi Yokoyama**, RESCEU, The University of Tokyo
Talk: Prospects of determination of thermal history after inflation with DECIGO

August 26, 2014 (3:00 PM - 3:20 PM)
Parallel session: Formal/Inflation

Co-authors: Sachiko Kuroyanagi, Kazunori Nakayama, and Takashi Hiramatsu
From BICEP2 and forthcoming Planck results we may be able to fix the amplitude of tensor perturbations on large angular scales. Then the future space-based laser interferometer such as DECIGO may be able to determine the reheating temperature after inflation. We discuss the range of the reheating temperature that can be measured by DECIGO by improving its specifications. We may also discuss the case other gravitational wave background such as that from a global phase transition is also present.

179. **Mijin Yoon**, University of Michigan
Poster: Dipolar modulation in number counts of WISE-2MASS sources

August 29, 2014

Co-authors: Dragan Huterer, Cameron Gibelyou, Andras Kovacs, and Istvan Szapudi
We test the statistical isotropy of the universe by analyzing the distribution of WISE extragalactic sources that were also observed by 2MASS. We pay particular attention to color cuts and foreground marginalization in order to cull a uniform sample of extragalactic objects and avoid stars. We detect a dipole gradient in the number-counts with an amplitude of ~0.05, somewhat larger than expectations based on local structures corresponding to the depth and (independently measured) bias of our WISE-2MASS sources. The direction of the dipole, (l,b)~(310, -15) deg, is in reasonably good agreement with that found previously in the (shallower) 2MASS Extended Source Catalog alone. Interestingly, the dipole direction is not far from the direction of the dipolar modulation in the CMB found by Planck, and also fairly closely matches large-scale-structure bulk-flow directions found by various groups using galaxies and type Ia supernovae. It is difficult, however, to draw specific conclusions from the near-agreement of these directions.

180. **Daisuke Yoshida**, Tokyo Institute of Technology
Poster: Stuckelbelg analysis in dRGT massive gravity on general fiducial metric

August 29, 2014

Co-authors: Xian Gao, Tsutomu Kobayashi, Masahide Yamaguchi
The dRGT massive gravity is a candidate of modified gravity theory, which has a possibility to explain current accelerated universe. By Hamiltonian analysis, it is proved that this theory is BD ghost free even on general fiducial metric. However this fact have not been understood in Stuckelberg language. We extend Stuckelberg analysis in flat fiducial case to general fiducial case. Especially, we give the covariant definition of perturbed Stuckelberg field and extended decoupling limit. As a result, we proof, when the mass scale of graviton is mach smaller than the curvature scale of fiducial metric, the equation of motion of the helicity-0 mode only include up to 2nd derivative term as in the flat fiducial case.

181. **George A Zahariade**, UC Davis
Talk: Massive gravity and caustics: a definitive covariant constraint analysis.

August 29, 2014 (2:40 PM - 3:00 PM)
Parallel session: Formal/Inflation

Co-authors: Stanley Deser, McCullen Sandora, Andrew Waldron
We perform a covariant constraint analysis of massive gravity valid for all values of its parameter space. This gives an extremely simple proof that the model generically propagates five degrees of freedom. It also yields a simple covariant expression for the scalar constraint required for an analysis of the model's caustics. For generic couplings the model seems to exhibit the same pathologies uncovered in earlier work–superluminality and acausalities, although particular well-behaved cases cannot be ruled out.

182. **Jun Zhang**, Tufts University
Poster: Topological defects from the multiverse

August 27, 2014

Co-authors: Jose Juan Blanco-Pillado, Jaume Garriga and Alexander Vilenkin
If indeed we live in an expanding bubble, our bubble will collide with topological defects that spontaneously nucleate in the inflating parent vacuum. We study the dynamics of these intruding defects and their resulting distribution inside our bubble, and present a new potentially observable manifestation of the multiverse.