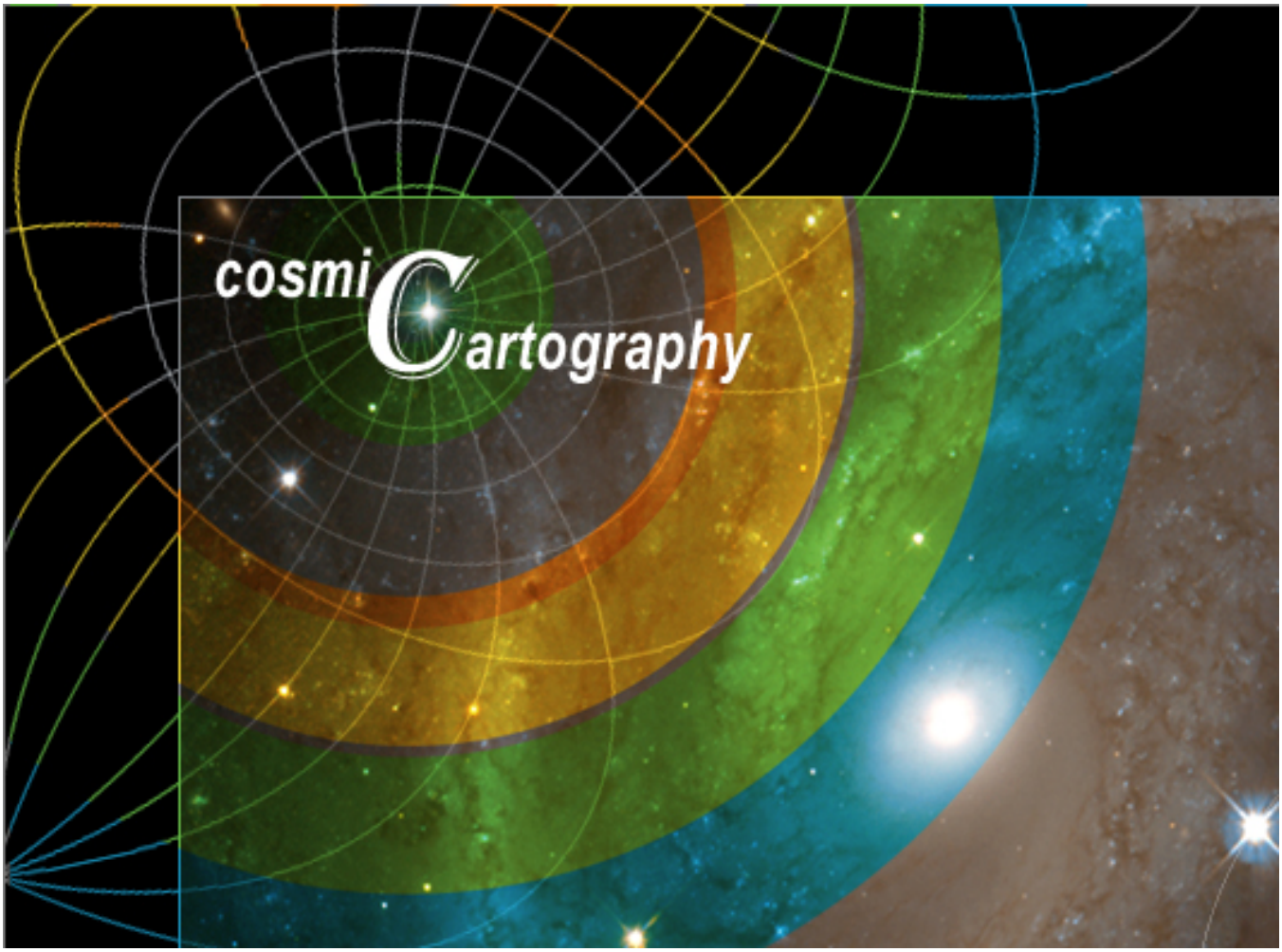
Cosmic Cartography: Mapping the Universe from the Big Bang to the Present

December 3 - 6, 2007 **Chicago, IL**



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CONFERENCE ABSTRACTS

KICP
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THE UNIVERSITY OF CHICAGO
DEPARTMENT OF ASTRONOMY AND ASTROPHYSICS
http://astro.uchicago.edu/

FESTIVAL OF MAPS
http://www.festivalofmaps.com/

1. **Andrew Baker** (Rutgers University)
   Talk: **Mapping Star and Galaxy Formation with ALMA**
   Mapping the Future: *December 6, 2007 (09:50 - 10:15)*

   The Atacama Large Millimeter Array (ALMA), already under construction in Chile and due to begin full science operations in 2012, will soon be the premier facility for studying the formation of stars and galaxies at long wavelengths. By probing chemical and dynamical evolution at high angular resolution, independent of dust obscuration, ALMA will shed light on the key baryonic processes that govern the relationships between dark matter haloes and luminous galaxies. In this talk, I will discuss ALMA's performance and role as a mapping instrument, including its relationship to other planned (sub)millimeter facilities and the valuable third (i.e., frequency) dimension of the maps it will produce.

2. **Nicholas Ball** (University of Illinois at Urbana-Champaign)
   Poster II-D: **Robust Machine Learning Applied to Terascale Astronomical Datasets**
   Mapping the Future: *December 6, 2007*

   We present recent results from the Laboratory for Cosmological Data Mining (http://lcdm.astro.uiuc.edu) at the National Center for Supercomputing Applications (NCSA) to provide robust classifications and photometric redshifts for objects in the terascale-class Sloan Digital Sky Survey (SDSS). Through a combination of machine learning in the form of decision trees, k-nearest neighbor, and genetic algorithms, the use of supercomputing resources at NCSA, and the cyberenvironment Data-to-Knowledge, we are able to provide improved classifications for over 100 million objects in the SDSS, improved photometric redshifts, and a full exploitation of the powerful k-nearest neighbor algorithm. This work is the first to apply the full power of these algorithms to contemporary terascale astronomical datasets, and the improvement over existing results is demonstrable. We discuss issues that we have encountered in dealing with data on the terascale, and possible solutions that can be implemented to deal with upcoming petascale datasets.

3. **Matthew Bayliss** (University of Chicago)
   Poster II-A: **Observing the Distant Universe with Gravitational Lensing**
   Mapping the Largest Sources: *December 5, 2007*

   Galaxy clusters are the largest virialized objects in the universe, and strong gravitational lensing around clusters is a visually pectacular phenomena that provides us with a "natural telescope" for observing the most distant objects in the universe. By studying a significant sample of galaxy clusters which produce strong lensing - selected from the RCS2 survey - we can identify those cases where the magnificationn due to lensing allows us to measure both the morphological and the spectral properties of distant galaxies which would otherwise be unobservable.

4. **Gary Bernstein** (University of Pennsylvania)
   Invited Talk: **Mapping Dark Matter in 3d with Gravitational Lensing**
   Mapping the Largest Structures: *December 3, 2007 (14:00 - 14:40)*

   Gravitational lensing observations uniquely enable high-precision mapping of the dark components of the Universe. Determining line-of-sight distances is always the greatest challenge for astronomical mapping: lensing observations can resolve this third dimension as well. I review the principles, progress, problems, and prospects of lens mapping.

5. **Ken Chambers** (Insititute for Astronomy, University of Hawaii)
   Talk: **Mapping the universe with Pan-STARRS PS1 System**
   Mapping the Future: *December 6, 2007 (14:10 - 14:35)*

   The PS1 System is in the commissioning stage and expects to begin the sky surveys of the PS1 Science Mission by summer 2008. The anticipated performance, survey depths, cadences and data products will be discussed as well as specific applications to mapping structure on all scales. Preliminary images from the 1.4 Gigapixel camera and PS1 telescope will be shown.

6. **Kim Coble** (Chicago State University)
   Talk: **Radio Sources Toward Galaxy Clusters at 30 GHz**
   Mapping the Largest Sources: *December 5, 2007 (10:50 - 11:10)*

   Extra-galactic radio sources are a significant contaminant in cosmic microwave background and Sunyaev-Zel'dovich effect experiments. Deep interferometric observations with the BIMA and OVRO arrays are used to characterize the spatial, spectral, and flux distributions of radio sources toward massive galaxy clusters at 28.5 GHz. We compute counts of mJy source fluxes from 89 fields centered on known massive galaxy clusters and 8 non-cluster fields. We find that source counts in the inner regions of the cluster fields (within 0.5 arcmin of the cluster center) are a factor of 8.9 (+4.3,-2.8) times higher than counts in the outer regions of the cluster fields (radius greater than 0.5 arcmin). Counts in the outer regions of the cluster fields are in turn a factor of 3.3 (+4.1,-1.8) greater than those in the non-cluster fields. Counts in the non-cluster fields are consistent with extrapolations from the results of other surveys. We compute spectral indices of mJy sources in cluster fields between 1.4 and 28.5 GHz and find a mean spectral index of alpha = 0.66 with an rms dispersion of 0.36, where flux is proportional to frequency raised to negative alpha. The distribution is skewed, with a median spectral index of 0.72 and 25th and 75th percentiles of 0.51 and 0.92, respectively. This is steeper than the spectral indices of stronger field sources measured by other surveys.

7. **Soma De** (University of Oklahoma)
Poster I-D: **Peaks in cosmological density field**
Mapping Local Structures: *December 4, 2007*

We use the number density of maxima in the cosmological galaxy density field smoothed with a filter as a probe of the power spectrum of mass fluctuations. In previous work it has been shown that this statistic is closely related to the slope of the linear power spectrum, even when the directly measured power spectrum is non linear. In this poster we first investigate the sensitivity of the peak number density to various models with differing power spectra including rolling index models, cosmologies with massive neutrinos and different baryon densities. Using N-body simulations, we also investigate how the peak density is modified in the presence of redshift distortions. Redshift distortions cause a suppression of the number of peaks, largely due to fingers of God overlapping in redshift space. This effect can be modelled by using a modification of the input power spectrum. The peak density results are also minimally affected by populating dark matter halos with galaxies, using a halo occupation distribution formalism. We then analyze observational data from the 2dF Galaxy Redshift Survey, making measurements of the peak density for a range of smoothing filter scales from $4-33 hmpc$. We use these measurements to constrain the cosmological parameters, finding $n=0.93^{+0.31} _{-0.40}$, $m_{nu} < 0.84 eV$, dn$/dln$k$=-0.002^{-0.102}_{+0.091}$, at the 68 % confidence level, where m_{nu} is the total mass of three massive neutrinos. At 95% confidence we find $m_{nu}< 1.96 eV$. These measurements represent an alternative way to constrain cosmological parameters to the usual direct fits to the galaxy power spectrum, and are expected to be relatively insensitive to non-linear clustering evolution and galaxy biasing.

8. **Matt Dobbs** (McGill University)
Invited Talk: **Observing the Sunyaev-Zeldovich Effect**
Mapping the Largest Sources: *December 5, 2007 (08:50 - 09:30)*

9. **Juan Estrada** (Fermilab)
Poster II-D: **Dark Energy Survey**
Mapping the Future: *December 6, 2007*

The Dark Energy Survey plans to map 5000 sq-deg of the sky starting in 2010. The status of the new instrument being built for this project will be presented, and the science potential discussed.

10. **August Evrard** (University of Michigan)
Talk: **Covariance in Galaxy Cluster Scaling Relations**
Mapping the Largest Sources: *December 5, 2007 (16:30 - 16:55)*

For the massive halo population housing clusters of galaxies, there are a number of reasons to anticipate an approximately log-normal covariance among observable measures of halos and their masses. I will present evidence for such a model from numerical simulations, consider specific implementations for X-ray and optical scaling relations, and offer suggestions for using future deep cluster surveys to characterize the diagonal and off-diagonal elements of the covariance among basic bulk cluster properties.

11. **Wenjuan Fang** (Physics Department, Columbia University)
Talk: **Constraining Dark Energy by Combining Cluster Counts and Shear-Shear Correlations in a Weak Lensing Survey**
Mapping the Largest Sources: *December 5, 2007 (15:20 - 15:40)*

We study the potential of a large future weak-lensing survey to constrain dark energy properties by using both the number counts of detected galaxy clusters (sensitive primarily to density fluctuations on small scales) and tomographic shear-shear correlations (restricted to large scales). We use the Fisher matrix formalism, assume a flat universe and parameterize the equation of state of dark energy by w(a)=w_0+w_a(1-a), to forecast the expected statistical errors from either observable, and from their combination. We show that the covariance between these two observables is small, and argue that therefore they can be regarded as independent constraints. We find that when the number counts and the shear-shear correlations (on angular scales l < 1000) are combined, an LSST (Large Synoptic Survey Telescope)-like survey can yield statistical errors on (Omega_DE, w_0, w_a) as tight as (0.003, 0.03, 0.1). These values are a factor of 2-25 better than using either observable alone. The results are also about a factor of two better than those from combining number counts of galaxy clusters and their power spectrum.

12. **Wenjuan Fang** (Physics Department, Columbia University)
Poster II-B: **An Evolving Entropy Floor in the Intracluster Gas?**
Mapping the Largest Sources: *December 5, 2007*

Non-gravitational processes, such as feedback from galaxies and their active nuclei, are believed to have injected excess entropy into the intracluster gas, and therefore to have modified the density profiles in galaxy clusters during their formation. Here we study a simple model for this so-called preheating scenario, and ask (i) whether it can simultaneously explain both global X-ray scaling relations and number counts of galaxy clusters, and (ii) whether the amount of entropy required evolves with redshift. We adopt a baseline entropy profile that fits recent hydrodynamic simulations, modify the hydrostatic equilibrium condition for the gas by including approx. 20% non-thermal pressure support, and add an entropy floor K_0 that is allowed to vary with redshift. We find that the observed luminosity-temperature (L-T) relations of low-redshift (z=0.05) HIFLUGCS clusters and high-redshift (z=0.8) WARPS clusters are best simultaneously reproduced with an evolving entropy floor of K_0(z)=341(1+z)^{-0.83}h^{-1/3} keV cm^2. If we restrict our analysis to the subset of bright (kT > 3 keV) clusters, we find that the evolving entropy floor can mimic a self-similar evolution in the L-T scaling relation. This degeneracy with self-similar evolution is, however, broken when (0.5 < kT < 3 keV) clusters are also included. The approx. 60% entropy increase we find from z=0.8 to z=0.05 is roughly consistent with that expected if the heating is provided by the evolving global quasar population. Using the cosmological parameters from the WMAP 3-year data with sigma_8=0.76, our best-fit model underpredicts the number counts of the X-ray galaxy clusters compared to those derived from the 158 deg^2 ROSAT PSPC survey. Treating sigma_8 as a free parameter, we find a best-fit value of sigma_8=0.80+/- 0.02.

13. **Francesc Ferrer** (Case Western Reserve University)
Poster I-A: **Degree-scale anomalies in the CMB: localizing the first peak dip to a small patch of the north ecliptic sky**
Mapping the Largest Structures: *December 3, 2007*

Noticeable deviations from the prediction of the fiducial LCDM cosmology are found in the angular power spectrum of the CMB. Besides large-angle anomalies, the WMAP 1st year data revealed a dip in the power spectra at l~200, which was more evident in the ecliptic poles region. Using the latest WMAP 3-year data release, we study the intensity and spatial distribution of this feature in order to unveil its origin and its implications for the cosmological parameters. We show that in both first and third year WMAP data there is a substantial suppression of the first Doppler peak in a region near the north ecliptic pole.

14. **James Fry** (University of Florida)
Talk: **Probing Dark Matter Substructure with Pulsar Timing**
Mapping Local Structures: *December 4, 2007 (14:40 - 15:00)*

I will discuss a suggestion that precision pulsar timing may be able to detect dark matter substructure from the Shapiro time delay as the structure transits near the line-of-sight between a pulsar and the observer. Dark matter substructures above 0.01 solar masses ought to be detectable at present by these means, and with small advances the method may be able to distinguish between baryonic, thermal non-baryonic, and non-thermal non-baryonic types of dark matter. Information about structure formation on small scales and the density profiles of galactic dark matter substructure can be extracted via this method.

15. **Krzysztof Gorski** (JPL Caltech)
Talk: **Planck**
Mapping the Future: *December 6, 2007 (09:00 - 09:25)*

I will describe the prospects of Planck for full sky, high resolution mapping of the temperature and polarization anisotropies from 30 to 850 GHz.

16. **Lutz Haberzettl** (Department of Physics and Astronomy, University of Louisville)
Poster II-B: **Quasars and Galaxies in Large Quasar Groups at zsim1**
Mapping the Largest Sources: *December 5, 2007*

Large quasar groups (LQGs) form structures on 100-200~Mpc scales, and offer unique opportunities to trace matter and star formation in dense quasar environments. We report results from a $1^circ times 2^circ$ multifrequency survey toward $zsim 0.8$ and 1.2 LQGs, the latter of which is the largest and densest LQG known. The overdensity of bright quasars is $sim 3$x for $M_I<-25$. Models predict that there should then be an overabundance of star-forming galaxies concentrated on ~1 Mpc scales around the quasars. We observed the field with GALEX and use the Sloan Digital Sky Survey (SDSS) for optical galaxy colours. We find sim 1000 Lyman break galaxies (LBGs) with SDSS counterparts. The best-fit galaxy age is $sim 3.5$~Gyr, though ages as young as 300~Myr are allowed. We find evidence of LBG-LBG clustering stronger than L^* galaxies at $zsim 1$, but no significant angular quasar-LBG clustering.

17. **Salman Habib** (Los Alamos National Laboratory)
Talk: **Percolation and the Large Scale Structure of the Universe**
Mapping the Largest Structures: *December 3, 2007 (17:10 - 17:30)*

The large-scale structure of the Universe, as traced by the distribution of galaxies, is now being revealed by large-volume cosmological surveys. The structure is characterized by galaxies distributed along filaments, the filaments connecting in turn to form a percolating network. In addition to conventional statistical measures such as two-point functions and power spectra, percolation theory provides a useful set of global quantitative measures of cosmological structure. In this talk, as a first introductory example, I will discuss the application of percolation to statistics of cosmic voids. I will then discuss how a combination of percolation-based analyses and N-body simulations of the gravitational instability can provide insights into the formation of the cosmic network. In particular, the properties of the network are seen to originate in the properties of the initial density field ("nature") and how its contrast is then amplified by the nonlinear evolution of the Universe ("nurture").

18. **David Hambrick** (Princeton University, Dept. of Astrophysical Sciences)
Talk: **Genus Topology of the Large Scale Structure**
Mapping the Largest Structures: *December 3, 2007 (12:10 - 12:30)*

By creating a smoothed density contour map of the spectroscopic galaxy sample, we measure the three-dimensional topology of large-scale structure in the Sloan Digital Sky Survey (SDSS). This allows the genus statistic to be measured with unprecedented statistical accuracy. The sample size is now sufficiently large to allow the topology to be an important tool for testing galaxy formation models. For comparison, we make mock SDSS samples using several state-of-the-art N-body simulations, including the Millennium run of Springel et al. (2005) and the Kim & Park (2006) CDM models. Each of these simulations uses a different method for modeling galaxy formation. The SDSS data show a genus curve that is broadly characteristic of that produced by Gaussian random phase initial conditions, so the data strongly support the standard model of inflation. But on top of this general shape there are measurable differences produced by non-linear gravitational effects and biasing connected with galaxy formation. The N-body simulations have been tuned to reproduce the power spectrum and multiplicity function but not topology, so topology is a strong independent test for these models. The data show a "meatball" shift in topology (only partly due to the Sloan Great Wall of Galaxies) which differs at the $2.5sigma$ level from the results of the Millennium run and the Kim & Park dark halo models, even including the effects of cosmic variance.

19. **Alice Harding** (NASA Goddard Space Flight Center)
Invited Talk: **A High-Energy View of the Nearby Universe**
Mapping Local Structures: *December 4, 2007 (16:30 - 17:10)*

The sky seen from above the Earth’s atmosphere at X-ray and gamma-ray wavelengths shows a picture quite different from the more familiar sky at optical wavelengths. The high-energy sky is dominated by sources with extreme temperatures or relativistic particle accelerators. The sky if also quite variable at high energies, which introduces a necessary time-dependence to the maps. I will review the most recent data from X-ray and gamma-ray detectors that have mapped our Galaxy and its neighbors, the correspondence of high-energy sources with those at other wavelengths, and what high-energy mapping has taught us about the more violent aspects of our local environment.

20. **Katrin Heitmann** (Los Alamos National Laboratory)
Poster I-B: **Cosmic Calibration**
Mapping the Largest Structures: *December 3, 2007*

The complexity and accuracy of current and future precision cosmology observational surveys has made it essential to develop an efficient technique for directly combining simulation and observational datasets to determine cosmological and model parameters; a procedure we term calibration. Once a satisfactory calibration of the underlying cosmological model is achieved, independent predictions for new observations become possible. For this procedure to be effective, robust characterization of the uncertainty in the calibration process is highly desirable. In this talk, I will describe a statistical methodology which can achieve both of these goals. An application example based around dark matter structure formation and CMB simulations will be used to demonstrate the approach.

21. **Gary Hinshaw** (NASA/GSFC)
Invited Talk: **Mapping the CMB with the Wilkinson Microwave Anisotropy Probe**
Mapping the Largest Structures: *December 3, 2007 (08:50 - 09:30)*

The data from the Wilkinson Microwave Anisotropy Probe (WMAP) satellite provide detailed full-sky maps of the cosmic microwave background temperature anisotropy and new full-sky maps of the polarization. Together, the data provide a wealth of cosmological information, including the age of the universe, the epoch when the first stars formed, and the overall composition of baryonic matter, dark matter, and dark energy. The results also provide constraints on the period of inflationary expansion in the very first moments of time. These and other aspects of the mission results will be discussed and commented on.
WMAP, part of NASA's Explorers program, was launched on June 30, 2001. The WMAP satellite was produced in a partnership between the Goddard Space Flight Center and Princeton University. The WMAP team also includes researchers at the Johns Hopkins University; the Canadian Institute of Theoretical Astrophysics; University of Texas; University of Chicago; Brown University; University of British Columbia; and University of California, Los Angeles.

22. **Gil Holder** (McGill University)
Talk: **Minimally Invasive CMB Mapmaking**
Mapping the Largest Sources: *December 5, 2007 (16:55 - 17:20)*

Atmospheric fluctuations show up in scanned 2D arrays as features that are strongly localized in Fourier space. A simple model for the atmosphere and 1/f noise shows that almost all such signals can be removed with simple filtering without much loss of signal, particularly for scales smaller than the array field of view.

23. **Scott Hughes** (Massachusetts Institute of Technology)
Talk: **Standard sirens: Precision distance measurements using gravitational waves**
Mapping the Future: *December 6, 2007 (11:00 - 11:25)*

Future gravitational-wave (GW) observations will make possible precise measurements of the distance to cataclysmic cosmic events in a manner that will be complementary to "electromagnetic" probes. In particular, GW measurements directly determine the luminosity distance to an event, but provide no direct information about the event's redshift. Combining GW data with information from telescopes may make it possible to simultaneously determine distance and redshift, producing a standard "siren" (the GW analog of a standard candle, so-called because GWs are best regarded as auditory rather than visual). In this talk, I will explain the physics behind the standard siren idea, and present results showing how well planned future observatories should be able to perform these tests.

24. **Lam Hui** (Columbia University)
Talk: **Anisotropic Magnification Distortion of the Galaxy Correlation Function**
Mapping the Largest Structures: *December 3, 2007 (15:00 - 15:20)*

I will discuss how gravitational lensing introduces a large scale anisotropy to the observed 3D galaxy/quasar correlation function. This presents an interesting opportunity and a challenge: on the one hand, it offers a way to separately measure the galaxy-galaxy, galaxy-mass and mass-mass power spectra without using galaxy shapes; on the other hand, it complicates the interpretation of baryon oscillation measurements, especially in the LOS direction.

25. **Brian Humensky** (University of Chicago, Enrico Fermi Institute)
Talk: **The Excited State of Galactic TeV Astronomy**
Mapping Local Structures: *December 4, 2007 (17:10 - 17:30)*

The last few years has seen dramatic progress in the mapping of the TeV sky by ground-based observatories including H.E.S.S., MAGIC, Milagro, and VERITAS. As recently as three years ago there were roughly half a dozen galactic sources, but now, with the advent of more sensitive instruments and dedicated surveys, the galactic TeV sky contains on the order of 40 sources from at least six different classes - the largest of which consists of "unidentified" objects, for which there is no clear counterpart at other wavelengths. In some cases this is due to source confusion, but in many cases it is because X-ray, optical, and radio observations have yet to reveal any likely counterpart! This talk will review the highlights of the galactic TeV sky, including the lessons learned from surveys of the galactic plane, the mapping of extended structures, and possible implications and counterparts for the unidentified TeV sources.

26. **Kathryn Johnston** (Columbia University)
Invited Talk: **Mapping the Local Group**
Mapping Local Structures: *December 4, 2007 (10:50 - 11:30)*

In the last decade, the stellar halos of the Milky Way and Andromeda galaxies have been mapped in exquisite detail, revealing abundant substructure and many new satellites. These observations are qualitatively consistent with our expectations for large galaxies formed hierarchically from smaller galaxies, but are they actually telling us anything more quantifiable? In this talk I will review the origin of these substructures and discuss possible interpretations. I will finish by outlining near-future extensions to mapping the Local Group in abundance-space.

27. **Christine Jones** (Center for Astrophysics)
Invited Talk: **Tracing the Thermal and Metal Content in Clusters and the Effects of AGN Outbursts on the Hot Gas**
Mapping the Largest Sources: *December 5, 2007 (09:30 - 10:10)*

In clusters of galaxies, the dominant luminous baryonic component is the hot gas. X-ray imaging and spectroscopic observations of the hot intracluster medium are yielding insights into how the total cluster mass in these systems is distributed, how the gas is enriched in heavy elements, and what fraction of the total mass is baryonic. In addition to tracing the dynamical state of a cluster, the X-ray images show the presence of shocks, jets and cavities in the cluster gas, all of which owe their origin to outbursts from the supermassive black holes in the nuclei of the central cluster galaxies. This talk will provide an overview of cluster properties and the effects of AGN outbursts on the intracluster medium.

28. **Stelios Kazantzidis** (Kavli Institute for Particle Astrophysics and Cosmology, Stanford University)
Talk: **Cold Dark Matter Substructure and Galactic Disks: Morphological and Dynamical Signatures of Hierarchical Satellite Accretion**
Mapping Local Structures: *December 4, 2007 (15:00 - 15:20)*

The Cold Dark Matter (CDM) model of hierarchical structure formation has emerged as the dominant paradigm in galaxy formation theory owing to its remarkable ability to explain a plethora of observations on large scales. Yet, on galactic and sub-galactic scales the CDM model has been neither convincingly verified nor disproved, and several outstanding issues remain unresolved. Using high-resolution N-body simulations I investigate whether the abundance of substructure predicted by CDM models is in conflict with the existence of thin, dynamically fragile galactic stellar disks. The simulation campaign is based on a hybrid approach combining cosmological simulations of galaxy-sized CDM halos to derive the properties of infalling subhalo populations and controlled numerical experiments of repeated satellite impacts on an initially-thin Milky Way-type disk galaxy. In contrast to what can be inferred from statistics of the z=0 surviving substructure, accretions of massive satellites onto the central regions of host halos, where the galactic disk resides, since z ~ 1 should be common. I show that these accretion events severely perturb the galactic disk and produce a wealth of distinctive morphological and dynamical signatures including: long-lived, low-surface brightness, ring-like features in the outskirts; significant flares; central bars; faint filamentary structures that (spuriously) resemble tidal streams in configuration space; tilting; warping thickening; and heating. The final distribution of disk stars exhibits a complex vertical structure that is well-described by a standard "thin-thick" disk decomposition, where the "thick" disk component has emerged primarily as a result of the interaction with the most massive subhalo. Subhalo passages are also responsible for causing a velocity offset and displacement of the galactic disk with respect to the center of the host dark matter halo. These results highlight the significant role of CDM substructure in setting the structure of disk galaxies and driving galaxy evolution. Upcoming galactic structure surveys and astrometric satellites may be able to distinguish between competing cosmological models by testing whether the detailed structure of galactic disks is as excited as predicted by the CDM paradigm.

29. **Francisco Kitaura** (Max Planck Institute for Astrophysics)
Talk: **Bayesian Reconstruction of the Large-Scale Structure: Joint Density, Velocity and Power-Spectrum Reconstruction**
Mapping Local Structures: *December 4, 2007 (11:50 - 12:10)*

We present ARGO a Bayesian reconstruction algorithm, which jointly reconstructs the density field, the power spectrum, and the velocity field. A novel Krylov, operator based scheme permits us to perform accurate and fast reconstruction steps. This efficient algorithm is exploited in order to explore high dimensional distributions with MCMC sampling techniques.

30. **Ben Koester** (University of Chicago)
Talk: **Statistics of the Largest Structures from MaxBCG Galaxy Clusters**
Mapping the Largest Sources: *December 5, 2007 (15:00 - 15:20)*

With 13,823 galaxy clusters at $0.1 < z < 0.3$, the MaxBCG catalog is one of the largest constructed to date. In addition to providing a new view of cosmology with galaxy clusters, the large number of objects and the well-understood selection function enable the robust determination of cluster weak lensing and dynamical masses, the scaling of X-ray luminosity with optical richness, and the average properties of cluster galaxy populations. In this presentation, we cover the highlights of these recently published results, and conclude with a brief summary of a range of ongoing studies based on the MaxBCG catalog.

31. **Savvas Koushiappas** (Los Alamos National Laboratory)
Poster II-A: **Probing non-thermal emission from clusters with angular fluctuations in the gamma-ray background**
Mapping the Largest Sources: *December 5, 2007*

The pressence of a large pressure component from relativistic cosmic rays formed at shock fronts can stronly affect thermal properties of clusters. One way to probe the significance of non-thermal processes in clusters is through the angular power spectrum of intensity fluctuations in the gamma-ray background. I will show that angular fluctuations of the order of few tens of arcminutes to several degrees in the upcoming GLAST gamma-ray background all sky map implies the presence of a significant non-thermal component in clusters.

32. **Tsz Yan Lam** (University of Pennsylvania)
Poster II-C: **Perturbation theory and excursion set estimates of the probability distribution function of dark matter, and a method for reconstructing the initial fluctuation field**
Mapping the Future: *December 6, 2007*

Nonlinear evolution is sometimes modeled by assuming there is a deterministic mapping from initial to final values of the overdensity. However, if an underdense region is embedded in a denser one, then it is possible that its evolution is determined by its surroundings, so the mapping between initial and final overdensities is not as "local" as perturbation theory assumes. If this source of nonlocality is not accounted for, then it appears as stochasticity in the mapping between initial and final densities.
Perturbation theory methods ignore this "cloud-in-cloud" effect, whereas methods based on the excursion set based approach do account for it; as a result, one may expect the two approaches to provide different estimates of the shape of the nonlinear counts in cells distribution. We show that, on scales where the rms fluctuation is small, this source of nonlocality has only a small effect, so the predictions of the two approaches differ only on the small scales on which perturbation theory is no longer expected to be valid anyway.
We illustrate our results by comparing the predictions of these approaches when the initial-final mapping is given by the spherical collapse model. Both are in reasonably good agreement with measurements in numerical simulations on scales where the rms fluctuation is of order unity or smaller.
In the Zeldovich approximation, the mapping between initial and final densities is stochastic because the initial tidal field, and not just the initial density, plays an important role in determining the evolution. Once this has been accounted for, the evolution is again assumed to be deterministic. We show how the predictions of this approximation compare with those based on the spherical collapse model, both before and after accounting for the "cloud-in-cloud" effect. Our analysis accounts approximately for the fact that the shape of a cell at the present time is different from its initial shape; ignoring this makes a noticable difference on scales where the rms fluctuation in a cell is of order unity or larger.
On large scales, methods based on the spherical model are sufficiently accurate to permit a rather accurate reconstruction of the shape of the initial distribution from the nonlinear one. This can be used as the basis for a method for constraining the statistical properties of the initial fluctuation field from the present day field, under the hypothesis that the evolution was purely gravitational.
We illustrate by showing how the highly non-Gaussian nonlinear density field in a numerical simulation can be transformed to provide an accurate estimate of the initial Gaussian distribution from which it evolved.

33. **Maxim Markevitch** (Harvard-Smithsonian Center for Astrophysics)
Talk: **Mapping the destruction of cluster cool cores during mergers**
Mapping the Largest Sources: *December 5, 2007 (14:40 - 15:00)*

I will present detailed X-ray derived maps of the gas temperature for two merging galaxy clusters with cool cores in the prosess of disintegration, A520 and the Bullet Cluster 1E0657-56. Both clusters exhibit shock fronts that provide accurate estimates of the merger velocity and ram pressure. The two systems illustrate different stages of disruption of their dense cores by ram pressure and gasdynamic instabilities.

34. **Timothy McKay** (University of Michigan)
Talk: **The Dark Energy Survey**
Mapping the Future: *December 6, 2007 (13:45 - 14:10)*

The Dark Energy Survey is constructing a new wide field camera for the Blanco 4m telescope at CTIO. This camera will be used to conduct a 5 year, 5 color optical imaging survey of 4000 square degrees in the South Galactic Cap. This imaging data will support a wide variety of science programs. The survey is especially designed to probe dark energy through studies of galaxy clusters, gravitational lensing, supernovae, and baryon acoustic oscillations.

35. **Steven Myers** (National Radio Astronomy Observatory)
Talk: **The Radio Synoptic Survey Telescope (RSST): A SKA Concept**
Mapping the Future: *December 6, 2007 (09:25 - 09:50)*

The next generation of radio arrays are being designed under the umbrella of the "Square Kilometer Array" project. The leading concept for a "mid-frequency" (0.3-3 GHz) SKA is the Radio Synoptic Survey Telescope (RSST), which is being developed for presentation to the upcoming Astronomy and Astrophysics Decadal Survey. The RSST is targeted at obtaining HI observations of a billion galaxies out to redshift z=1.5 over 10000 square degrees, and synoptic mapping of the radio sky for transient detection and monitoring. In this talk I will outline the design and technical challenges facing the RSST, and discuss the path forward towards construction and operation of the RSST.

36. **Heidi Newberg** (Rensselaer Polytechnic Institute)
Invited Talk: **The Observed Structure of the Milky Way Spheroid**
Mapping Local Structures: *December 4, 2007 (09:30 - 10:10)*

Stellar photometry from the Sloan Digital Sky Survey has revealed previously unforseen substructure in the stellar spheroid of the Milky Way: enormous tidal streams from known and from unidentified progenitor, lumps of unknown origin, hints of triaxiality, along with new dwarf galaxies and star clusters. I will outline the new techniques that are being used to identify density substructure statistically, without precise information about the spacial position of each star. We are just beginning to tap the potential of velocity information for large numbers of Galactic stars, which will eventually allow us to piece together the merger history of our Galaxy, and may allow us to trace the dark matter potential. We currently get our velocity information from Sloan Extension for Galactic Understanding and Exploration (SEGUE) data, and we are exploring the possibility of future collaborations with the Chinese LAMOST project.

37. **Takahiro Nishimichi** (University of Tokyo)
Talk: **Reliability of N-body Simulations at the Subpercent Level**
Mapping the Largest Structures: *December 3, 2007 (17:30 - 17:50)*

Using baryon acoustic oscillations (BAO) as a standard ruler, one can constrain the equation of state of dark energy. To place constraints on the equation of state of dark energy at the few percent level, theoretical predictions of the characteristic scale of BAO must also be accurate at the subpercentage level.

One must very carefully incorporate non-linear growth, redshift-space distortion, and galaxy bias in one's theoretical prediction. N-body simulation is thought to be a power tool to tackle these issues. However, one must pay attention to the precision of N-body simulations to achieve the desired accuracy. We studied the possible systematic effects caused by the adopted initial conditions, the time integration method, periodic boundary conditions, and differences such as the number of particles, box size, and so on. We studied how these details affect the growth of the density contrast.

38. **Brian Nord** (University of Michigan)
Poster II-B: **Selection and Covariance in Galaxy Cluster Scaling Relations: Deciphering Mixed Messages from X-ray Selected Clusters**
Mapping the Largest Sources: *December 5, 2007*

A precise model for the L-M relation has emerged from constraints from the REFLEX catalog. We extend this model to include temperature variations, modeled with log-normal covariance, and intrinsic correlation betwen luminosity and temperature. We then show that X-ray flux-limited samples generally deviate from power-law mean behavior, except for deep surveys which become complete in mass above 10^14 solar masses. We derive analytic expressions for the geometric mean and variance of the luminosity distribution at fixed temperature to reveal that the observed slope and scatter of the L-T relation strongly depends on the intrinsic correlation between L and T. Finally, the redshift characteristics of cluster surveys demonstrate a strong degeneracy between intrinsic scatter and the true scaling. Placing limits on the true physical evolution of the cluster population therefore requires a holistic approach of constraining simultaneously the evolution and L-T covariance.

39. **Nikhil Padmanabhan** (LBNL)
Talk: **BOSS : The Baryon Oscillation Spectroscopic Survey**
Mapping the Future: *December 6, 2007 (15:30 - 15:55)*

I will introduce BOSS, a proposed precision baryon oscillation survey using the SDSS 2.5m telescope. The survey plans on surveying 10000 sq. deg of the sky, and measuring the redshifts to 1.5 million luminous red galaxies to a redshift of 0.8. It also will target 160,000 quasars between z=2.0 and 3.0, making the first measurement of BAO with the Lyman-alpha forest. I will discuss the dark energy forecasts for this survey, both from Fisher matrices as well as from recent simulation efforts, as well as the broader science potential of the survey.

40. **Vasiliki Pavlidou** (University of Chicago)
Talk: **Mapping the Ultra-high--energy Cosmic-ray Sky with the Pierre Auger Observatory**
Mapping the Future: *December 6, 2007 (11:50 - 12:15)*

At the highest energies, even charged particles can point back to their sources. Recent results from the Pierre Auger observatory suggest that the ultra-high--energy cosmic ray sky is indeed anisotropic. This talk will discuss the current state and prospects of ultra-high--enery astronomy, a new window to mapping highest-energy particle sources in the local universe.

41. **John Pretz** (Los Alamos National Lab)
Talk: **Mapping the TeV Gamma-Ray Sky with HAWC**
Mapping the Future: *December 6, 2007 (11:25 - 11:50)*

The High Altitude Water Cherenkov (HAWC) detector is a planned extensive air shower array optimized for measuring TeV gamma-rays with a high duty cycle and a wide field of view. HAWC utilizes the water-Cherenkov technique pioneered by the Milagro experiment. I will discuss the water-Cherenkov technique and the science accessible by mapping the TeV sky.

42. **Clem Pryke** (University of Chicago)
Talk: **CMB Polarization Measurements with QUaD**
Mapping the Largest Structures: *December 3, 2007 (11:30 - 11:50)*

QUaD is a state of the art CMB polarimeter making power spectrum measurements in the multipole range 200 to 2000. The experiment, analysis and first season results will be presented, and the quality of the 2nd+3rd season results will be shown.

43. **Mary Putman** (University of Michigan)
Invited Talk: **Mapping the Gaseous Local Universe**
Mapping Local Structures: *December 4, 2007 (14:00 - 14:40)*

44. **Elena Rasia** (Department of Physics, University of Michigan)
Talk: **Studying scaling relation and their scatter with 10000+1 galaxy clusters**
Mapping the Largest Sources: *December 5, 2007 (11:10 - 11:30)*

In next few years large sky surveys will be underway with the aim of identifyig and characterizing galaxy clusters over large portion of the sky. The astronomical community will deal with tens thousands of clusters observed in optical (e.g., with DES survey), millimetric (e.g., with South Pole Telescope survey) or X-ray (e.g., with e-Rositamission). With this ambitious and promising expectation in mind, now it is the right time to investigate the systematics that could affect the analysis of real data and provide a concrete framework for the statistical studies we will performed. To address questions both of cosmology and the smaller-scale astrophysics, we are deciphering the various connections among observable cluster properties (SZ decrement, X-ray luminosity and temperature), the intrinsic quantities(temperature spectroscopic-like and concentration), and the underlying mass distribution including this evolution with redshift. I will present some first results based on a sample of 10000 clusters of the gas millenium simulations plus one bullet-like cluster.

45. **Michael Rauch** (Carnegie Observatories)
Invited Talk: **The Gaseous Cosmic Web - from the Intergalactic Medium to Galaxies, and Back**
Mapping the Largest Structures: *December 3, 2007 (16:30 - 17:10)*

We shall discuss how spectroscopy of the intergalactic medium in absorption and emission can be used to produce maps of the density, temperature, kinematics, metallicity, and ionization state of the universe at high redshift, as a function of spatial scale, time, and galactic environment. We'll briefly describe some cosmological applications, the search for galactic feedback, and discuss some very recent results that promise to answer longstanding questions about the relation between QSO absorption systems and galaxies.

46. **Dinesh Raut** (UIUC)
Poster I-D: **Cosmology through galaxy cluster statistics**
Mapping Local Structures: *December 4, 2007*

The matter power spectrum and the cluster mass function are two of the prominent probes that can be used to constrain cosmological parameters. We present an analysis of an SDSS cluster sample using both cluster counts and clustering. The observed number of clusters in a redshift bin is used to determine the effective bias for clustering measurement in that bin. With a known bias factor, the information in the amplitude of the cluster power spectrum and its redshift evolution then provides a direct constraint on the growth of density perturbations. Two probes together can thus reduce the available parameter space and deliver more accurate measurements of cosmological parameters.

47. **Luis Reyes** (University of Chicago, KICP)
Poster II-C: **The Study of Extragalactic Gamma-ray Sources: An Ongoing Revolution**
Mapping the Future: *December 6, 2007*

The field of high energy astrophysics is experiencing a revolution thanks to the advent of a new generation of ground-based telescopes such as HESS, MAGIC and VERITAS. Their improved sensitivity with respect to previous instruments has led to a dramatic increase in the number and type of Active Galactic Nuclei (AGN) detected at the highest energies (100 GeV - 10 TeV), and to a richer picture of their spectra and variability. This ongoing revolution is set to gain even more momentum with the upcoming launch of GLAST, a space-borne instrument which will cover the gamma-ray sky in the energy range 20 MeV to >300 GeV with unprecedented sensitivity and uniform exposure across the whole sky. The combined capabilities of space-borne and ground-based instruments (broad energy coverage, continuous all-sky monitoring, good source localization, and sensitivity to different variability scales) will revamp our knowledge of the gamma-ray sky. This talk will review recent observational highlights in the study of extragalactic gamma-ray sources, their implications for our understanding of the AGN-blazar phenomenon, and prospects for the imminent partnership of GLAST and ground-based instruments.

48. **Megan Roscioli** (University of Chicago)
Poster II-A: **Radio Sources in Galaxy Clusters**
Mapping the Largest Sources: *December 5, 2007*

We present a study of the population of radio sources in galaxy clusters over wide redshift and mass ranges. Optically-selected galaxy clusters (in the redshift range $0.3 < z < 1.0$) from the RCS1 and part of the RCS2 catalogs are matched with the FIRST and NVSS catalogs of 1.4 GHz radio sources over several hundred square degrees of sky. We present a statistical analysis of the radio sources associated with galaxy clusters, investigating the radial distribution of radio sources around cluster centers and the evolution with redshift of the number of radio sources in clusters.

49. **Graziano Rossi** (University of Pennsylvania)
Poster II-C: **Photometric redshift surveys: towards unbiased scaling relations**
Mapping the Future: *December 6, 2007*

Current (i.e. SDSS, MUSYC) and planned surveys (e.g. DES, LSST, SNAP) go considerably deeper in multicolor photometry than in spectroscopy, or are entirely photometric. For such surveys, reasonably accurate photometric redshift estimates are or will be made. The question then arises as to which galaxy observables and correlations are affected by the noisy distance estimate associated with a photometric rather than spectroscopic redshift. Since the transformation from observable to physical quantity is often distance-dependent, noise in the distance estimate will lead to biased estimates of these correlations, thus compromising the ability of photometric redshift surveys to constrain galaxy formation models. I will describe a simple deconvolution algorithm which allows one to remove this bias.

50. **Shun Saito** (Department of Physics, University of Tokyo, Japan)
Poster I-C: **The impact of non-linear matter power spectrum on the measurement of neutrino masses**
Mapping Local Structures: *December 4, 2007*

Next-generation galaxy redshift surveys will open up an exciting opportunity for precision determinations of neutrino masses. Here, we discuss the prospects for measuring the neutrino masses, including properly the non-linear gravitational evolution of matter power spectrum for a mixed dark matter model (neutrinos plus cold dark matter) for the first time. Based on the perturbation theory, the effect of non-linearity is quantified. We find that the suppression of growth of matter perterbation by neutrino's free-streming is enhanced through the gravitational non-linear evolution. Moreover, using Fisher matrix analysis, we present how the neutrino masses will be determined for future galaxy redshift survey. We show that our non-linear theory can improve the detectability of neutrino masses compared to linear theory.

51. **Ryan Scranton** (Google, Inc.)
Invited Talk: **CMB and Galaxy Survey Cross-Correlation**
Mapping the Largest Structures: *December 3, 2007 (10:50 - 11:30)*

The integrated Sachs-Wolfe effect offers a means to detect dark energy that is completely independent of the usual methods. Rather than rely on measurements of the accelerated expansion, the ISW is sensitive to dark energy's effect on the growth of structure. Unfortunately, the ISW signal is only present on large angular scales, requiring large-area galaxy and CMB anisotropy maps. We present the latest results in this quest, combining the results of all available large-scale galaxy data sets to arrive at a global detection significance for the ISW effect.

52. **Sanjib Sharma** (Columbia University)
Poster II-D: **Group finding in high-dimensional data-sets: Method and application to the identification of substructures in the stellar halo**
Mapping the Future: *December 6, 2007*

Numerous upcoming missions will map our universe in unprecedented detail, and will create large and complex datasets with multiple dimensions. To efficiently and accurately analyze such datasets we develop a group finding algorithm which can work in a space of arbitrary number and type of dimensions. At the heart of all group finding schemes lies the choice of the distance metric. We develop a novel scheme which uses the idea of Shannon entropy to calculate a locally adaptive distance metric for each data point which maximizes the information content extracted from the data. A density and nearest neighbor based scheme is then employed to identify groups in the data. As an application we apply this group finding algorithm to identify tidal streams produced by accretion of satellite galaxies in simulated stellar halos.

53. **Ravi Sheth** (University of Pennsylvania)
Invited Talk: **On standard rods when making maps**
Mapping the Largest Structures: *December 3, 2007 (09:30 - 10:10)*

The baryon acoustic oscillation signal in the galaxy distribution provides a standard rod which can be used to constrain models of the dark energy equation of state. These constraints depend on just how standard, or standardizable, this rod is. I will review the measurements to date, for which the rod is rigid enough, and will then describe efforts to standardize the rod for use in the next generation of maps.

54. **Meir Shimon** (UCSD)
Talk: **CMB Polarization Systematics Due to Beam Asymmetry: Impact on Inflationary Science**
Mapping the Largest Structures: *December 3, 2007 (11:50 - 12:10)*

CMB polarization provides a unique window into cosmological inflation; the amplitude of the B-mode polarization from last scattering is uniquely sensitive to the energetics of inflation. However, numerous systematic effects arising from optical imperfections can contaminate the observed B-mode power spectrum. In particular, systematic effects due to the coupling of the underlying temperature and polarization fields with elliptical or otherwise asymmetric beams yield spurious systematic signals. We present a non-perturbative analytic calculation of some of these signals. We show that results previously derived in real space can be generalized by including corrections which can be summed and represented as analytic functions when a fully Fourier-space approach is adopted from the outset. The formalism and results presented here can serve to determine the susceptibility of CMB polarization probes of the primary gravitational wave signal as well as in the analysis of gravitational lensing of the CMB by the large scale structure.

55. **Jennifer Siegal-Gaskins** (University of Chicago and KICP)
Talk: **Evidence of dark matter substructure in tidal debris**
Mapping Local Structures: *December 4, 2007 (12:10 - 12:30)*

In the past decade surveys such as SDSS and 2MASS have revealed a number of stellar streams in the Milky Way, the remnants of tidally disrupted dwarf galaxies and globular clusters. I will discuss recent work examining whether substructure in the dark matter halo of our Galaxy may be detectable by its influence on the formation and properties of tidal streams. By simulating the tidal disruption of a self-gravitating satellite under a wide range of conditions, I find that the detection of a coherent tidal stream would not be inconsistent with the level of substructure predicted by LCDM, in contrast with the conclusions of previous work. I will also present evidence for a unique signature of the presence of substructure in the halo, which may be detectable by current and upcoming surveys.

56. **Rebecca Stanek** (University of Michigan)
Poster II-B: **The Effect of Baryonic Physics on the Halo Mass Function**
Mapping the Largest Sources: *December 5, 2007*

The era of precision cosmology requires a well-calibrated halo mass function (the differential space density of halos as a function of mass and redshift) for interpreting observed cluster surveys. To date, most work has focused on calibrating the space density from dark matter-only simulations. We measure the halo mass function in the Millennium Gas Simulations, a series of hydrodynamic simulations in a 500 Mpc/h box with the same initial conditions as the (dark matter only) Millennium Simulation, but somewhat reduced in resolution. We consider two treatments of the gas physics: an adiabatic model (including shock heating) and a preheated model. We see differences in number density at the level of ~ 15%, greater than the currently measured uncertainty in the halo mass function from dark matter-only simulations. Preheating reduces the baryon fraction in the inner regions of halos, leading to a suppressed mass function.

57. **Albert Stebbins** (Fermilab)
Talk: **New Information From New Maps**
Mapping the Largest Sources: *December 5, 2007 (17:20 - 17:45)*

How does one quantify the "value added" by making better maps? One can define an "invariant" quantitative "information-added" measure for new surveys which is a count of the number of possibilities which can be distinguished by a survey. This measure can be defined in terms of a maps or in terms of parameters describing the map. This is illustrated in terms all-sky CMBR temperature maps and parametric cosmology.

58. **Daniel Stern** (JPL/Caltech)
Talk: **NIRSS - the Near Infrared Sky Surveyor**
Mapping the Future: *December 6, 2007 (15:00 - 15:15)*

The Near-Infrared Sky Surveyor (NIRSS), recently submitted as a NASA Astrophysics Strategic Mission concept, is a medium-class mission that will take advantage of the low background of space to deeply map the entire sky at near-IR wavelengths. Using a 1.5 meter class telescope to reach micro-Jansky sensitivities in four passbands at 1-4 microns, NIRSS will enable diverse scientific discoveries that will fundamentally alter the understanding of our cosmic origins. NIRSS will directly measure the diffuse extragalactic background produced by the ensemble of primordial galaxies. NIRSS will fundamentally alter the landscape of early Universe studies by identifying large samples of quasars in the first billion years after the Big Bang. NIRSS fills a pivotal gap in our knowledge of the celestial sphere and is a natural complement to WISE and the new generation of deep, ground-based optical surveys.

59. **Daniel Stern** (JPL/Caltech)
Talk: **NuSTAR: the Nuclear Spectroscopic Telescope Array**
Mapping the Future: *December 6, 2007 (15:15 - 15:30)*

The Nuclear Spectroscopic Telescope Array is a pathfinder mission, scheduled for launch in 2011, that will open the high energy X-ray sky for sensitive study for the first time. X-ray telescopes like Chandra and XMM-Newton have peered deep into the X-ray universe at low X-ray energy (X-ray energies less than 10 keV). By focusing X-rays at higher energy; up to 80 keV, NuSTAR will answer fundamental questions about the Universe: How are black holes distributed through the cosmos? How were the elements that compose our bodies and the Earth forged in the explosions of massive stars? What powers the most extreme active galaxies? Perhaps most exciting is the opportunity to fill a blank map with wonders we have not yet dreamed of: NuSTAR offers the opportunity to explore our Universe in an entirely new way.

60. **Molly Swanson** (Massachusetts Institute of Technology)
Poster II-A: **Using Galaxies as Cosmic Tracers**
Mapping the Largest Sources: *December 5, 2007*

A widely used cosmic mapping technique is to use galaxies as tracers of the underlying cosmic matter distribution. I will address some of the challenges of this method with SDSS measurements of galaxy bias that quantify its stochasticity and its dependence on scale, luminosity, and color. I will also present new tools I have developed for the MANGLE software package for managing angular masks of next-generation galaxy surveys and other cartographic applications that have recently been made publicly available.

61. **Brent Tully** (University of Hawaii)
Talk: **Peculiar Velocities in the Local Supercluster**
Mapping Local Structures: *December 4, 2007 (11:30 - 11:50)*

Interactive software enables the presentation of complex patterns in the distribution of galaxies and their motions. A large compilation of accurate galaxy distances has been assembled and provides an extensive map of peculiar velocities in the Local Supercluster. A remarkable outflow is seen from the Local Void. Our motion associated with this phenomenon is a significant part of our overall motion manifested in the Cosmic Microwave Background dipole.

62. **Alexey Vikhlinin** (SAO)
Invited Talk: **X-ray Cluster Studies**
Mapping the Largest Sources: *December 5, 2007 (11:50 - 12:30)*

Observations of the evolving cluster mass function provide a sensitive cosmological test which internally combines the geometric and growth of structure components. If cluster masses can be measured reliably from observables, I will discuss the issues which have to be solved in working with the current-generation experiments and present results from a 400 square degrees X-ray survey.

63. **Stephanie Wissel** (University of Chicago)
Talk: **The Morphology of Shell-type Supernova Remnants in Very-High-Energy Gamma Rays**
Mapping Local Structures: *December 4, 2007 (15:20 - 15:40)*

Shell-type supernova remnants (SNRs) are widely believed to be the primary sources of galactic cosmic rays, due to energetic and spectral arguments. Recently, imaging atmospheric Cerenkov telescopes have been able to map the morphology of SNRs with unprecedented resolution in very-high-energy gamma rays. These gamma rays can be used to trace the sites of cosmic-ray production within the SNR. Cosmic rays produce gamma rays either through inverse Compton scattering of high-energy electrons with ambient photons, or via pion decay from proton-proton interactions. A review of recent results on supernova remnants such as RX J1713-3646 will be discussed.

64. **Stephanie Wissel** (University of Chicago)
Poster I-D: **The VERITAS Survey of the Galactic Plane**
Mapping Local Structures: *December 4, 2007*

Recently the number of known TeV gamma ray sources has been extended to 58, largely due to surveys of the galactic plane, including 24 objects unseen at other wavelengths. The angular resolution of very-high-energy (E>200GeV) gamma-ray telescopes permits the localization of sources to within arcminutes. This permits multi-wavelength studies of nonthermal sources as well as deep probes of dark accelerators discovered in the very-high-energy regime. Sited in southern Arizona, VERITAS employs an array of four 12-m imaging atmospheric Cerenkov telescopes with a 3.5 degree FOV to conduct a survey of the Northern galactic plane. The science prospects and current status of the survey will be presented.

65. **Edward Wright** (UCLA)
Invited Talk: **Seeing the Forest Through the Trees: Cosmic Backgrounds**
Mapping Local Structures: *December 4, 2007 (08:50 - 09:30)*

The total light from the sky contains many contributions arising at distances from 50 billion light years down to 1 light minute. In the millimeter band the Cosmic Microwave Background radiation left over from the Big Bang overwhelming dominates the total light from the sky allowing not just the CMB, but its anisotropy, and even the polarization of this anisotropy to be measured. In the X-ray band the cosmic background is larger than the foregrounds but not nearly as dominant. At other wavelengths the foregrounds from the Milky Way and the Solar System are brighter than the cosmic backgrounds greatly impeding our ability to study the Universe as a whole. I will discuss the situation in the infrared in detail.

66. **Edward Wright** (UCLA)
Talk: **The Wide-field Infrared Explorer (WISE)**
Mapping the Future: *December 6, 2007 (14:35 - 15:00)*

WISE will map the entire sky in 4 infrared bands at 3.3, 4.7, 12 and 23 micron wavelength with angular resolution of 6" (12" at 23 microns). The 5 sigma point source sensitivity will be 120, 160, 650 and 2600 microJy in the 4 bands, producing a catalog with hundreds of millions of sources and an all-sky image atlas. Launch is scheduled for Nov 2009, with data releases in 2011 and 2012.

67. **Amit Yadav** (University of Illinois at Urbana-Champaign)
Poster I-A: **Utilizing combined CMB T and E-polarization data to constrain primordial non-Gaussianity**
Mapping the Largest Structures: *December 3, 2007*

The potential of constraining models of the early universe using the non-Gaussian signatures they can imprint on the CMB has been well studied. Currently the constraints on the non-Gaussinity (fNL) come from temperature anisotropy data alone. It has been shown that by also having the E-polarization information of the CMB, one can improve sensitivity to primordial fluctuations. The upcoming CMB experiments will characterize polarization anisotropy to high accuracy. Are we ready to use future polarization data for testing Gaussianity of primordial fluctuations? Do we have a fast estimator which allows us to measure fNL from the combined analysis of temperature and polarization data? In my talk I will first review how combining temperature and E-polarization information of CMB can improve the constraints on the primordial non-Gaussianity. Second, I will talk about our fast bispectrum estimator for the primordial non-Gaussinity (fNL) using combined CMB temperature and E-polarization information. Using Planck satellite as an example I will show the quality of the estimator in the presence of the realistic effects such as inhomogeneous noise, finite resolution, and partial sky coverage. At the end I will briefly mention some of the challenges involved in the analysis, especially the non-Gaussianity from polarization foregrounds.

68. **Yuxuan Yang** (UIUC)
Poster I-B: **Clustering of X-ray selected AGNs in the Chandra Lockman Hole NW region**
Mapping the Largest Structures: *December 3, 2007*

We present our preliminary results of an extended study of the redshift-space 2pt correlation function of the Chandra detected AGNs in the Lockman Hole NW region. Spectroscopic redshifts have been obtained for > 50% of the X-ray point sources. Data from Chandra deep field north/south have also been included in the study, resulting in the largest sample of X-ray selected AGNs with a high fraction redshift measurements. The correlation function for the whole sample can be roughly described by a power-law with gamma~1.48 and s0~9.0 h_71^-1 Mpc. Correlation function in redshift 4 bins between z=0.1-3 suggest the bias increases rapidly with redshift, consistent with measurements from optical quasar surveys. The inferred typical halo mass of AGN hosts are consistent with being constant, with <M> ~ 2.5x10^12 M_sun.

69. **Howard Yee** (University of Toronto)
Invited Talk: **Optical/IR Surveys for High-Redshift Galaxy Clusters**
Mapping the Largest Sources: *December 5, 2007 (14:00 - 14:40)*

70. **Andrew Zentner** (University of Pittsburgh)
Talk: **Ensuring the Robustness of Dark Energy Constraints in Light of Galaxy Formation**
Mapping the Largest Sources: *December 5, 2007 (11:30 - 11:50)*

Recent numerical studies indicate that uncertainties in the treatment of baryonic physics can affect predictions for weak lensing shear power spectra at a level that is significant for several forthcoming surveys such as the Dark Energy Survey (DES), the SuperNova/Acceleration Probe (SNAP), and the Large Synoptic Survey Telescope (LSST). These effects significantly bias dark energy parameter measurements. I explore the ability of future weak lensing surveys to constrain both the baryonic process and the dark energy simultaneously to eliminate such biases. In this approach, parameter biases are greatly reduced and no parameter constraint is degraded by more than $sim 40%$ in the case of LSST or $30%$ in the cases of SNAP or DES. Modest prior knowledge of the halo concentration relation and its redshift evolution greatly improves even these promising forecasts. In addition, we find that these surveys can constrain effective halo concentrations themselves usefully with shear power spectra alone. In the case of a power-law relation for halo concentration as a function of mass and redshift, the concentrations of halos of mass $m sim 10^{14} hMsun$ at $z sim 0.2$ can be constrained to better than $10%$. Our results suggest that inferring dark energy parameters through shear spectra can be made robust to baryonic physics and that this procedure may even provide useful constraints on galaxy formation models.

71. **Jun Zhang** (UC Berkeley)
Talk: **Measuring the Cosmic Shear in Fourier Space**
Mapping the Largest Structures: *December 3, 2007 (14:40 - 15:00)*

I propose to measure the weak cosmic shear using the spatial derivatives of the galaxy surface brightness field. The measurement should be carried out in Fourier space, in which the point spread function (PSF) can be transformed to a desired form with multiplications, and the spatial derivatives can be easily measured. This method is mathematically well defined regardless of the galaxy morphology and the form of the PSF, and involves simple procedures of image processing. Furthermore, with high resolution galaxy images, this approach allows one to probe the shape distortions of galaxy substructures, which can potentially provide much more independent shear measurements than the ellipticities of the whole galaxy. We demonstrate the efficiency of this method using computer-generated mock galaxy images.

72. **Pengjie Zhang** (Shanghai Astronomical Observatory)
Talk: **Mapping dark matter with cosmic magnification**
Mapping the Largest Structures: *December 3, 2007 (15:20 - 15:40)*

We develop a new tool to generate statistically precise dark matter maps from the cosmic magnification of galaxies with distance estimates. We show how to overcome the intrinsic clustering problem using the slope of the luminosity function, because magnificability changes strongly over the luminosity function, while intrinsic clustering only changes weakly. This may allow precision cosmology beyond most current systematic limitations. SKA is able to reconstruct projected matter density map at smoothing scale $sim 10^{'}$ with S/N$geq 1$, at the rate of 200-4000 deg^2 per year, depending on the abundance and evolution of 21cm emitting galaxies. This power of mapping dark matter is comparable to, or even better than that of cosmic shear from deep optical surveys or 21cm surveys.
Based on Zhang & Pen, Phys.Rev.Lett. 95 (2005) 241302. [astro-ph/0506740]