Drifting through the Cosmic Web: the Evolution of Galaxies within the Large Scale Structure

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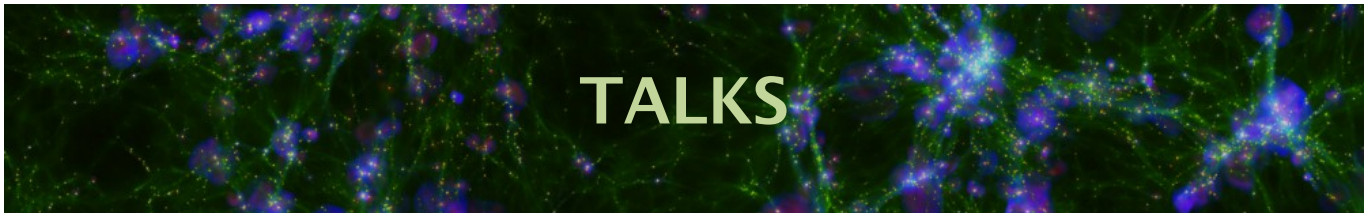

List of Abstracts

Athanassoula Lia Formation of Disc Galaxies in Major Mergers

We use high resolution numerical simulations, including gas and its physics, to discuss a novel method of forming disc galaxies. We show that, contrary to what occurs in the nearby Universe, at intermediate and higher redshifts the merging of two disc proto-galaxies results in a disc galaxy, and not in an elliptical. We describe the physical processes leading to this result and its impact on the Hubble sequence. We also discuss how this mechanism should be applied to semi-analytic modelling of galaxy formation and evolution and how it will influence the results of such models.

Bland-Hawthorn Joss The Hector Survey: an Integral Field Spectrograph Survey of 100,000 Galaxies

Over the past six years, we have developed and demonstrated a new photonic technology -- the hexabundle -- a special imaging fibre bundle designed to replace individual fibres in multi-object spectrographs. This technology lies at the heart of the newly commissioned SAMI instrument at the AAT which offers 13 bundles over a one-degree field (Croom et al 2012). SAMI has already observed more than 1000 galaxies as part of a 3000 galaxy survey. We are now moving beyond the SAMI prototype towards a much larger concept known as Hector. This will feature 100 hexabundles and robotic (starbug) positioning over a three-degree field at the AAT. We propose to trace galaxy properties over large-scale structure in unprecedented detail, in particular, mass and angular momentum correlations with environment.

Bolzonella Micol The VIPERS Survey

VIPERS (VIMOS Public Extragalactic Redshift Survey, PI Luigi Guzzo, http://vipers.inaf.it/) is a 24 sq. deg. spectroscopic survey of about 90,000 galaxies brighter than i(AB)=22.5 at 0.5<z<1.2, which observations concluded at the end of 2014. One of the main goal of the survey is understanding how galaxies evolve in relation with the environments in which they reside, along with the galaxy clustering to obtain constraints on the growth rate of structures and eventually on the cosmological parameters. Thanks to the precision of spectroscopic redshifts, we obtained the 3D mapping of the cosmic web in the VIPERS fields. Taking advantage of the multi-band coverage from CFHTLS data, ancillary photometry from UV to IR, and spectra, we derived the physical properties of galaxies and their evolution. I will briefly review how the survey has been conceived, and show in detail the main results, published and relative to ongoing analyses, for cosmology and in particular for galaxy evolution studies.

Bray Aaron Galactic Conformity in the Illustris Simulation

We use the Illustris Simulation to investigate the presence of assembly bias in the formation of galaxies. Dividing a sample of ~18,000 isolated galaxies with stellar mass $M_* > 2e9\ M_\odot$ into quenched and star-forming populations, we find a galactic conformity signal. Namely, the neighbors of isolated quenched galaxies are preferentially quenched, out to a 3D radius of up to 10 Mpc. We further find a correlation between galaxy colors and the formation time of their halos, at fixed stellar mass, which is strongest at lower stellar masses. We show how the color-halo age relation combined with dark matter-only conformity can reproduce the observed galaxy conformity signal.

Brown Tobias The Effect of Star Formation and Environment on the Cold Gas Content of Nearby Galaxies

The importance of cold gas in the picture of galaxy evolution is well known, as is its role as a probe of recent environmental effects on galaxies in the nearby universe. However, the extent to which structure, star formation and

environment impact the gas cycle of galaxies remains unclear. In this talk I will describe results based upon an unparalleled, multi-wavelength sample of ~25,000 nearby galaxies, selected according to stellar mass and redshift from the Sloan Digital Sky Survey, and with atomic hydrogen (HI) data from the ALFALFA survey, spanning the full range of environments from isolation to cluster. Taking advantage of the powerful HI spectral stacking technique to quantify the gas content for the entire gas-poor to -rich regime, I will present HI scaling relations with key structural, star formation and environmental metrics. Such relations provide strong constraints for galaxy formation and evolution models by disentangling the influence of these properties on gas content. I will discuss the importance of specific star formation as a tracer of gas content and give observational evidence for significant and systematic gas suppression across the group regime, well before galaxies enter the dense cluster environment. I will comment on the implications of these results for our understanding of the gas cycle in galaxies.

Cautun Marius Rotating Planes of Satellite Galaxies: Ubiquitous Yet Unique

The spatial and kinematical distribution of satellite galaxies is the product of the connection between individual galaxies and the large scale cosmic web that determines preferential directions for accretion onto haloes. This has been questioned recently in a number of studies that claim to have found planar configurations of satellites, both in the Local Group and around external galaxies, that are inconsistent with LCDM. I will summarize two recent papers that challenge this claim and that have important consequences for studies of satellites galaxies. The first work compares the planes of satellites around the Milky Way and Andromeda with the expectations of mock LCDM catalogues constructed from the Millennium-II and other even higher resolution cosmological simulations. We introduce a new, objective, method for identifying planar configurations and show that not only are planes of satellites very common in LCDM, but 10% of systems have more prominent planes than those identified in the Milky Way and Andromeda. More importantly, no two planar configurations are the same, which has two major implications. Firstly, the discrepancy with LCDM found by previous authors is a manifestation of this diversity and does not rule out the current paradigm. Secondly, the diversity of satellite distributions means that one needs a large sample of such systems for a meaningful comparison between observations and theoretical predictions. In a second paper, we analyzed a large sample of satellite systems around isolated SDSS galaxies similar to Andromeda, focusing on the projected distribution of satellites and on kinematic signatures of coherent rotation. We detect significant signatures of anisotropic filamentary accretion in agreement with theoretical predictions from simulations. In addition, we find that the excess of satellite pairs sharing the same sense of rotation reported by Ibata et al. is likely a random fluctuation.

Chisholm John Galactic Outflow Scaling Relations and Their Impact on Galactic Evolution

Feedback from massive stars plays a critical role in regulating star formation. In galaxies with high star formation rates, the collective energy/momentum input from massive stars drives gas out of the star-forming region, and into a galactic outflow. By studying how the outflow properties scale with the host galaxy properties, we can gain insight into the detailed feedback mechanisms at work (e.g., ram pressure from supernovae ejecta, radiation pressure on dust grains). However, these outflow "scaling relations" have been challenging to observe because there are few robust interstellar gas tracers in the optical. Here we present results of a Hubble Space Telescope Archival project using the Cosmic Origins Spectrograph to study outflows emanating from galaxies in the local universe ($z < 0.27$) using ultraviolet absorption lines. We form a sample of 50 galaxies, spanning four decades of stellar mass and star formation rate, and use the Si II ultraviolet absorption lines to probe the warm ($T \sim 10^4$ K) phase of galactic outflows. We study how the outflow velocities scale with host galaxy properties (SFR, mass, etc.), and relate these scaling relations to the feedback processes that generate the outflows. We find a critical stellar mass above which outflows do not escape the gravitational potential of the galaxy, unless the galaxy undergoes an interaction. Rather, normal high mass galaxies retain their baryons and recycle them in a galactic fountain. We provide scaling relations suitable for comparisons with star formation theory.

Conidis George The Origin of Spin Alignment in the Local Sheet

Giant galaxies in the Local Sheet surrounding the Local Group have spins systematically deflected from the Sheet's midplane, at odds with tidal torque theory. It has been suggested that the asymmetrical mass distribution embodied by the Local Group is the culprit. An investigation into the origin of the anomalous spin organization in the Local Sheet has been carried out using analogues of the Local Sheet found in SDSS DR9. Control sheets preserving the quantities of the Local Sheet but lacking an isolated pair of interacting galaxies (i.e an analogue of the Local Group) were also employed. Unlike most investigations of the spin alignment, which are based upon projected galaxy orientations, both analogues and controls were measured in three dimensions. Results are presented for over 150 galaxies in 13 sheets. Implications for tidal torque theory and the origin of the arrangement of spin vectors in the Local Sheet are discussed.

Courtois Hélène Cosmic Bulk Flow and the Local Motion from Cosmicflows-2

Full sky surveys of peculiar velocity are arguably the best way to map the large scale structure (LSS) out to distances of a few x 100 Mpc/h. Using the largest and most accurate ever catalog of galaxy peculiar velocities *Cosmicflows-2*, the LSS has been reconstructed by means of the Wiener filter (WF) and constrained realizations (CRs) assuming as a Bayesian prior model the ΛCDM standard model of cosmology. The present paper focuses on studying the bulk flow of the local flow field, defined as the mean velocity of top-hat spheres with radii ranging out to R=500 Mpc/h. Our main results is that the estimated bulk flow is consistent with the ΛCDM model with the WMAP inferred cosmological parameters. At R=50 (150) Mpc/h the estimated bulk velocity is 250 ± 21 (239 ± 38) km/s. The corresponding cosmic variance at these radii is 126 (60) km/s, which implies that these estimated bulk flows are dominated by the data and not by the assumed prior model. The estimated bulk velocity is dominated by the data out to R~200 Mpc/h, where the cosmic variance on the individual Supergalactic Cartesian components (of the r.m.s. values) exceeds the variance of the CRs by at least a factor of 2. The SGX and SGY components of the CMB dipole velocity are recovered by the WF velocity field down to a very few km/s. The SGZ component of the estimated velocity, the one that is most affected by the Zone of Avoidance, is off by 126 km/s (an almost 2 sigma discrepancy). The bulk velocity analysis reported here is virtually unaffected by the Malmquist bias and very similar results are obtained for the data with and without the bias correction.

Croft Rupert Galaxy Gravitational Redshifts and Lyman-α Emission Intensity: Results from SDSS/BOSS

The enormous number of spectra in modern cosmology surveys has opened up the possibility to search for physical effects that were not part of survey planning. These nevertheless may contain valuable information about galaxies and cosmology and guide thedesign of future instruments. I will present brief results from two analyses of the BOSS galaxy redshift survey, one a search for gravitational redshifts caused by the large-scale structure of the Universe and the other a measurement of three dimensional clustering in the cosmological Lyman-α emission intensity.

Davidzon Iary A Journey in the VIPERS Environments

With almost 90,000 objects over ~24 deg^2, the VIMOS Public Extragalactic Redshift Survey (VIPERS) represents the largest spectroscopic galaxy sample between redshift 0.5 and 1.2. In this talk, I will review the main results obtained with VIPERS, regarding galaxy evolution and environment. Thanks to the accurate spectroscopic redshifts of this catalogue, we are able to trace the 3-dimensional structure of the galaxy density field. In addition, we recover the LSS skeleton and provide a complementary definition of environment by identifying filaments, walls, and voids. We investigate the role of the environment in quenching star formation at intermediate redshifts, testing the phenomenological description of Peng et al. (2010) as well as the predictions of semi-analytical models. From a different point of view, we search for correlations between physical/structural properties of galaxies and their distance from filaments.

Devriendt Julien ISM Physics vs. LSS: a Glimpse into the Difficulty of Solving the Nature vs. Nurture Issue

In this talk I will discuss recent results obtained by running a suite of high resolution cosmological zoom simulation of a single galaxy called the "NUT suite", for which the Large Scale Structure environment is identical but the modelling of the ISM physics varies. More specifically, I will show how taking advantage of the high resolution of such simulations to better model star formation and SN feedback impacts the global properties (mass, angular momentum, scale length and height, rotation velocity and velocity dispersion) of galaxies. Finally I will discuss which (if any) of these properties are driven by the large scale environment in the sense that they are robust to changes in the modelling of the ISM.

Domínguez-Tenreiro Rosa The Dynamics of the Cosmic Web as a Driver of the Fine Structure of Late Type Galaxies

Models of the advanced stages of gravitational instability predict that baryons that form the stellar populations of current galaxies at z=0 displayed a web-like structure at high *z*, as part of the cosmic web (CW). Details of these predictions are explored using cosmological hydrodynamical simulations to try to disentangle the origin of the fine structure of late type galaxies (LTGs). When the stellar populations of the spheroid and disk components of simulated late type galaxies are traced back separately to high *z*, we found CW-like structures where the former are more evolved dynamically than the later. Similarly, when the disk stellar populations are split into their thick and thin components in terms of their age and [alpha/Fe] content, the thick disk-to-be stellar populations display at high *z* CW-like structures that are, in turn, more evolved than those traced by the thin disk-to-be ones. Specific angular momentum *j* content drives the low *z* distinction among these three components, a fact that can be explianed as a consequence of the different CW evolution rate at high *z*, complemented by two lower *z* processes. The first one is the strong *j* losses of the spheroid-to-be material at halo collapse, while these are insignificant for the ancestors of both, thick and thin, disk components. The second has to do with a first settlemnt of an old disk (i.e., the thick one), following the dominant filaments *j* structure, and the ensuing alignments with the thin disk-to-be material, possibly resulting from

circumgalactic, old-disk-induced gravitational torques. This contrasts with the lack of alignment, at assembly, between the spheroid-to-be material and the already settled old/thick disk. It is worth noting that the different final outcomes of these low *z* processes have their origins in the different initial conditions driven by the CW dynamics.

Dubois Yohan Dancing in the Dark: how Galaxies Swing in the Cosmic Web

A large-scale hydrodynamical cosmological simulation, Horizon-AGN, is used to investigate the alignment between the spin of galaxies and the large-scale cosmic filaments. The analysis of more than 150 000 galaxies with morphological diversity shows that the spin of low-mass is preferentially aligned with their neighbouring filaments. High-mass galaxies tend to have a spin perpendicular to nearby filaments. I will show how the combination of mergers and AGN feedback lead to such results.

Durret Florence Detection of Filaments and Large Scale Structures around Clusters up to Redshift ~1

Based on numerical simulations of the formation of large scale structures in the universe, galaxy clusters are believed to be at the intersection of cosmic filaments, and to be continuously accreting galaxies or groups along these directions. However, due to their relatively low contrast with respect to the field, they are difficult to detect unambiguously, particularly at high redshift. We are presently searching for such large scale optical filaments around two samples of clusters. First, in the DAFT/FADA survey of massive clusters in the redshift range $0.4<z<0.9$. For 23 clusters with large field images (CFHT/Megacam or Subaru/SuprimeCam), we have selected galaxies along the red sequence in a colour-magnitude diagram and drawn density maps of these samples with an adaptive kernel technique. We detect elongated structures in at least 11 clusters, and in most cases they match well the matter distribution derived from our weak lensing mass reconstruction and/or the elongation of the X-ray emission (when available). Second, we are presently searching for filaments around the clusters detected in the CFHTLS (up to redshift z=1.5 in the Deep fields), this time based on photometric redshifts, and will present preliminary results on the CFHTLS-D1 field.

Dvorkin Irina Environmental Origin of Dispersion in DLA Metallicities

Damped Lyman-alpha absorbers (DLA) dominate the neutral gas content of the Universe in the redshift range z=0-5 and are likely the progenitors of low redshift galaxies. The chemical properties of DLAs can be determined with great precision, and provide a unique probe of the properties of cold neutral gas out of which stars form at high redshifts. Recent chemical abundance measurements of DLAs revealed a large intrinsic scatter in their metallicities. In this talk I will discuss a semi-analytic model that was specifically designed to study this scatter. This model accurately traces the chemical evolution of the interstellar matter in small regions of the Universe with different mean density, from over- to underdense regions. I will show that the different histories of structure formation in these regions, namely halo abundance, mass and stellar content are reflected in the chemical properties of the proto-galaxies, and that the dispersion arising from this environmental effect is an important contribution to the overall intrinsic scatter.

Einasto Jaan The Formation and Evolution of the Cosmic Web

I shall include an historical overwiev of the study of the subject. Actually we have now exacly 40 years from the publication of first papers on the 3D distribution of galaxies, one our own paper and the other by Chincarini et al. At the 1977 Tallinn Symposium the subject was discussed in detail.

Erfanianfar Ghazaleh Non-Linearity and Environmental Dependence of the Star Forming Galaxies Main Sequence

Using data from four deep fields (COSMOS, AEGIS, ECDFS, and CDFN), we study the correlation between the position of galaxies in the star formation rate versus stellar mass plane and local environment at $z<1.1$. To accurately estimate the galaxy star formation rate, we use the deepest available Spitzer MIPS 24 and Herschel PACS 100 and 160 micrometer datasets for all considered fields. We distinguish group environments ($M_{halo} \sim 10^{12.5\text{-}14.2}\ M_{\odot}$) based on the available deep X-ray data and lower halo mass environments based on the local galaxy density. We confirm that the Main Sequence (MS) of star forming galaxies is not a linear relation and there is a flattening towards higher stellar masses ($M_{*} > 10^{10.5}\ M_{\odot}$), across all environments. At high redshift ($0.5 < z < 1.1$), the MS varies little with environment, while group galaxies tend to deviate from the mean MS towards the region of quiescence with respect to isolated galaxies and less-dense environments at low redshifts ($0.15 < z < 0.5$). We also investigate the dependence of galaxy structure (Sersic index) on the MS and find no differential distribution in the morphological type of MS galaxies in different environments. We also find while early-type galaxies show no notable difference in SFR-M relation between field - filament - groups, there is -at low redshift- a difference for disks in groups, in that they have a lower SFing activity. Our results imply that in mass quenching, there is a morphological transformation (bulge growth) preceding quenching, but in environmental quenching the quenching happens before any morphological transition (if the latter happens at all).

Evrard August Galaxy Clusters as Closed Baryonic Boxes

On linear cosmic scales, simple conservation of baryons implies that variations in the mass fractions of hot and cold/galactic phases must be anti-correlated. Using RAMSES simulations that include star formation and AGN feedback (the Rhapsody-G sample), we show that this anti-correlation is likely to be preserved into the non-linear, readily-observable regions of galaxy clusters. Studying the baryon content within R500c of a sample of ~100 halos above 5e13 $M_\odot$ and with 0<z<1, we find that deviations in X-ray gas mass and galactic mass fractions about mean halo mass trends have a rank correlation coefficient of –0.7 in our default runs. An implication is that total baryon content should be a better proxy of total cluster mass than either stellar or gas mass alone. I'll discuss the scale-dependence, physics treatment sensitivity, and observable implications of this result.

Gonzalez Roberto Subhalos Accreted through Filaments

We study the accretion history and orbits of subhalos accreted from filaments in MW-sized halos, and we found they have longer lifetimes when compared with subhalos accreted from random directions. We also explore the survivality of subhalo pairs and groups, planes of satellites and their relation with directions of connected filaments.

Haehnelt Martin AGN Feedback and the Growth of Supermassive Black Holes from the Cosmic Web

Supermassive black holes with masses of several billion solar masses are already in place at z~6-7. I will discuss models and numerical simulations of the (early) growth of supermassive black holes and their environment with an emphasis on: - the feeding of supermassive black holes from the cosmic web, - the role of AGN feedback in driving outflows into the inter-/circumgalactic medium and regulating the growth of supermassive black holes and the star formation in massive galaxies.

Haider Markus Large-Scale Mass Distribution in the Illustris-Simulation

We study the large-scale baryon and dark matter mass distribution using data from the Illustris simulation and measure the mass and volume fraction of halos, filaments and voids. Furthermore we study to what extend the baryons trace the dark matter and investigate the effect of feedback on the large-scale baryon distribution.

Hellwing Wojciech The Dynamical Character of Cosmic Web

We present results of analysis of the dark matter (DM), halo and galaxy velocity statistics in different Cosmic Web environments. We use the DM velocity and density field from the Millennium 2 and COCO simulations together with the NEXUS+ algorithm to segment the simulation volume into voxels uniquely identifying one of the four possible environments: nodes, filaments, walls or cosmic voids. We show that the PDFs of the mean infall velocities as well as its spatial dependence together with the perpendicular and parallel velocity dispersions and velocity correlations bear a significant signal of the large-scale structure environment in which DM particle pairs are embedded. The flows are notably colder and have smaller mean magnitude in wall and voids, when compared to much denser environments of filaments and nodes. We discuss on our results, indicating that they are consistent with a simple theoretical predictions for motions as induced by gravitational instability mechanism. Our results indicate that the Cosmic Web elements are coherent dynamical entities rather than just temporal geometrical associations. In addition it should be possible to observationally test various Cosmic Web finding algorithms by segmenting available peculiar velocity data and studying resulting velocity statistics.

Henriques Bruno Galaxy Formation in the PLANCK Cosmology: Matching the Observed Evolution of Star Formation Rates, Colours and Stellar Masses across Cosmic Time

I will present results from the recent major release of the Munich galaxy formation model. In addition to the new PLANCK cosmology, significant modifications to the physics were implemented in order to fix major problems identified in previous versions. These include the too early formation of low mass objects and their too passive populations at later times. I will show how the new physics result in a model that is consistent with the observed evolution of the stellar mass functions of all, red and blue galaxies from z=3 to z=0, while matching the evolution of the star formation rate densities and the main sequence of star formation across the entire observable mass range. I will connect the different evolution of low and high mass galaxies to the efficiency of the star formation quenching processes included in the model such as AGN radio mode feedback and environmental effects across cosmic time. Particular attention will be paid to the processes affecting the gas content and star formation rates of satellite galaxies

in different large scale environments and their impact on global trends of galaxy evolution. In addition I will analyse quenching in massive galaxies in terms of the connection between radio-mode accretion and host halo properties.

Hudson Michael Cosmological Parameters from the Comparison of Peculiar Velocities with Predictions from the Density Field in the Nearby Universe

Abstract: We have assembled the redshifts from SDSS, 6dFGRS and 2MRS into a new compilation, the 2M++. We use an iterative method to reconstruct the density field in real space and test this method with N-body simulations. The comparison of the linear theory predictions with peculiar velocity data sets yields the measurement of two parameter combinations: $f.\sigma_8$, where f is the growth factor, and V_ext, the contribution to bulk velocities due to structures beyond the survey limits. Our measurement of $f.\sigma_8$ is competitive with redshift-space distortions despite the much smaller data sets being used. Although the 2M++ density field accounts for 85% of the LG's motion, there is still 150 km/s unaccounted for, which presumably arises on much larger scales.

Hutsemékers Damien Alignments of Quasar Axes with Large-Scale Structures

Based on measurements of optical linear polarization of quasars belonging to large groups at redshift ~ 1.3, we found that quasar spin axes are likely parallel to their host large-scale structures. The observations and the statistical analysis will be reviewed, and interpretations discussed.

Iovino Angela The Wall in HD: a Case Study at z~0.73

We have performed deep spectroscopic observations at VIMOS@VLT of a large filamentary structure at z~0.73 in the field of the COSMOS survey, the so-called COSMOS-Wall, a remarkable structure encompasses a comprehensive range of environments: from a dense cluster and galaxy groups to filaments and lower density regions. We fully mapped this structure targeting a K-band selected, mass complete sample down to M_{lim} ~9.8 $M_{\odot}$ within the narrow redshift bin 0.69<z<0.79. The final sample in our hands totals ~1300 galaxies, for which we possess exquisite quality spectroscopic information, providing sharp environmental definition and important spectral diagnostics, and the wealth of ancillary photometric information available for the COSMOS field: HST-ACS data complemented by extensive multi-wavelength ground and space-based observations spanning the entire electromagnetic spectrum. We will discuss evidence for star formation quenching taking place within the groups environment. It is well known that at fixed galaxy mass the fraction of red/quenched galaxies - as defined from color-color diagrams - is higher in denser environments than in lower density regions. In addition we detected a lowering of typical sSFR of blue galaxies in denser environments, as witnessed by the presence of an excess of blue, low-mass and low sSFR galaxies, observed in the densest regions of our survey: a transition population, whose quenching is most probably accelerated by environmental effects.

Kang Xi The Accretion of Dark Matter Haloes within Cosmic Web: Primordial Anisotropy and its Universality

Observations in the past few years have found two interesting facts. One is that satellite galaxies are not randomly distributed around the central galaxies. The other is that galaxies spin are well correlated with the large scales structures, with dependence on galaxy type. Existed theoretical studies have difficult to explain the two observations. In fact they can be understood in the context of galaxy halo assembly with its relation to the cosmic web. Using N-body simulation, we investigate the assembly history of dark matter halo. It is found that satellite galaxy (or subhaloes) are accreted mostly along the cosmic filament, and the current anisotropy of satellites are already set at high-redshift universe at accretion. However, we find that for low-mass haloes (or spiral galaxy) at z=0, the accretion of their massive progenitors are preferentially be perpendicular to the filament, not like the progenitors of elliptical galaxies. This finding well explains the puzzle that the observed spins of spiral galaxies are aligned with cosmic filament, but that of elliptical galaxies (or their short axes) are perpendicular to filament.

Laigle Clotilde Swirling Around Filaments: Are Large-Scale Structure Vortices Spinning Up Dark Haloes?

The kinematic analysis of dark matter and hydrodynamical simulations suggests that the vorticity in large-scale structure is mostly confined to, and predominantly aligned with, their filaments. The cross-sections of these filaments are typically partitioned into four quadrants with opposite vorticity sign, arising from multiple flows, originating from neighbouring walls. The spins of haloes embedded within these filaments are consistently aligned with this vorticity for any halo mass, with a stronger alignment for the most massive structures. The global geometry of the flow within the cosmic web is therefore qualitatively consistent with a spin acquisition for smaller haloes induced by this large-scale coherence. In effect, secondary anisotropic infall (originating from the vortex-rich filament within which these lower-mass haloes form) dominates the angular momentum budget of these haloes. The transition mass from alignment to

orthogonality is related to the size of a given multi-flow region with a given polarity. This transition may be reconciled with the standard tidal torque theory if the latter is augmented so as to account for the larger scale anisotropic environment of walls and filaments.

Lee Jounghun The Radial Velocity Profile of the Filament Galaxies in the Vicinity of the Virgo Cluster as a Test of Gravity

The radial velocities of the galaxies in the vicinity of a massive cluster shows deviation from the pure Hubble flow due to their gravitational interaction with the cluster. According to a recent study of Falco et al. with a high-resolution N-body simulation based on General Relativity (GR), the radial velocity profile of the galaxies located at distances larger than three times the virial radius of a neighbour cluster has a universal shape and could be reconstructed from direct observables provided that the galaxies are distributed along one dimensional filament. Analyzing the narrow filamentary structure identified by Kim et al. in the vicinity of the Virgo cluster from the NASA-Sloan-Atlas catalog, we reconstruct the radial velocity profile of the Virgo filament galaxies and compare it with the universal formula derived by Falco et al. It is found that unless the virial mass of the Virgo cluster exceeds 10^{15} $M_{\odot}$ the universal formula fails to describe the reconstructed radial velocity profile whose peculiar velocity term turns out to decrease much less rapidly. Speculating that the disagreement between the GR prediction and the observed radial velocity profile of the Virgo filament galaxies may be due to the presence of unscreened fifth force, we suggest the radial velocity profile of the filament galaxies around the clusters as a powerful test of gravity on the cosmological scale.

L'Huillier Benjamin The Rates and Types of Halo Interactions

Interactions such as mergers and flybys play a fundamental role in shaping galaxy morphology. Using the Horizon Run 4 cosmological N-body simulation, we studied the frequency and type of halo interactions, and their redshift evolution as a function of the environment defined by the large-scale density, pair separation, mass ratio, and target halo mass. Most interactions happen at large-scale density contrast $\delta \sim 20$, regardless of the redshift corresponding to haloes in filaments . However, the fraction of interacting target is maximum at $\delta \sim 1000$. We provide a new empirical fitting form for the interaction rate as a function of the halo mass, large-scale density, and redshift. We also report the existence of two modes of interactions from the distributions of mass ratio and relative distance, probing two different stages of the interaction. Satellite targets lose their mass as they proceed deeper into the host halo. The relative importance of these two trends strongly depends on the large-scale density, target mass, and redshift.

Libeskind Noam How the Cosmic Web Shapes Planes of Dwarf Galaxies in the Local Universe

Dwarf galaxies are the smallest yet most most abundant cosmological objects in existence. Yet owing to their low luminosity, they can only be seen in the immediate neighborhood of the Milky Way, a region known as the Local Group. Most of these galaxies have only been recently found and since their discovery have presented the paradigm of structure/galaxy formation (known as the LCDM model) with a number of intriguing challenges. Specifically, many dwarf galaxies appear to cluster on vast thin planes, an as yet unresolved problem for the model. I will present some ideas to explain the origin of this peculiar set up within the LCDM model, focusing on using velocity field surveys to reconstruction the cosmic web in which the Local Group is embedded. Finally, I will report the first observations of a similar set-up around a galaxy exterior to the Local Group.

Lietzen Heidi Galaxies in Superclusters and in Voids

Most galaxies in the Universe reside in groups of a few massive galaxies, which can be found in all the different large-scale environments from superclusters to voids. Galaxies in different environments have typically different properties, such as luminosity, color, and star-formation rate. These differences can be detected on all scales from the position of the galaxy within its local neighborhood to its place in the cosmic web. In Lietzen et al. (2012) we found that galaxies in groups are more likely to be star-forming if they are in voids than if they are in superclusters, even when they belong to groups with the same richness. In this talk, I will present results on galaxies in groups in superclusters and in voids. The distribution of galaxies in different environments will shed light on the effects of the large-scale environment on galaxy evolution.

Martin Christopher Cosmic Web Imager Observations of Circum-Galactic and Circum-QSO Medium Emission at High Redshift

We describe recent results from the Palomar Cosmic Web Imager (PCWI). These include the discovery of filamentary Lyman alpha emission and a giant (>120 kpc) protogalactic disk around a QSO, filamentary emission and large gas disks near a second QSO, and filamentary emission around and kinematics in a Lyman Alpha Blob consistent with a large rotating gas disk. The discovery of filamentary and disk-like structures is evidence for cold accretion inflows with significant angular momentum. We also report observations of HeII 1640, NV 1240, and CIV 1549 which help diagnose

the physical conditions and origin of these circum-galactic gas structures. Finally, we describe future instrumentation exploring IGM emission on the ground and in space.

Martizzi Davide Modeling AGN Feedback in the Most Massive Galaxy Clusters

AGN feedback plays an extremely relevant role in galaxy clusters and it is one of the main mechanisms by which gas overcooling can be prevented in cluster. Recent results from numerical cosmological zoom-in simulations show that AGN feedback also influences the properties of the most massive galaxies in massive groups and clusters. Despite the successes achieved by cosmological hydrodynamical simulations including AGN feedback in massive groups and low mass cluster, I will show that reproducing the some of the properties of the most massive clusters of galaxies with simulations including state-of-the-art AGN feedback models is still an open and challenging problem.

Massara Elena Modelling the LSS in Massive Neutrino Cosmologies

Neutrino oscillation experiments have shown that at least two of the three neutrino species are massive and massive neutrinos impact on the evolution of structures in the Universe, at the linear and non-linear levels. Firstly, I will discuss how to model the non-linear matter power spectrum in a massive neutrino cosmology, using an extended version of the halo model. I will show a comparison between these theoretical predictions and the results of N-body simulations that incorporate massive neutrinos. I will also provide a simple application of the halo model: the computation of the clustering of galaxies, in massless and massive neutrinos cosmologies, using a simple Halo Occupation Distribution scheme and our halo model extension. Secondly, I will present a study of the properties of voids found in our simulations, focusing on how these properties are effected by the the presence of massive neutrinos. Finally, I will show a comparison between the matter profile in galaxy voids for a massive and a massless neutrino cosmology.

McCall Marshall A Search for Warm-Hot Intergalactic Matter in the Local Sheet

Cosmological simulations reveal that in the Local Sheet there should exist a warm-hot intergalactic medium (WHIM) concentrated in a thin layer. If the oxygen abundance is comparable to expectations, then OVI absorption should have been detected in spectra of background sources observed by the Far-Ultraviolet Spectroscopic Explorer (FUSE). FUSE spectra of targets spanning the entire sky have been examined to distinguish WHIM in the Sheet from other sources, particularly by looking for a correlation of the OVI absorption equivalent widths with latitude and for north-south asymmetries in line properties. The data yield a strong constraint on the oxygen abundance of the WHIM.

Moster Benjamin The Galaxy - Dark Matter Connection: Modelling Individual Galaxies

Semi-empirical galaxy formation models (such as abundance matching) provide a unique and direct link between galaxies and dark matter haloes, and do not depend on model assumptions on unresolved physics. I will present the next generation of semi-empirical galaxy formation models that take into account the assembly history of the dark matter haloes. To this end the SFR of a galaxy is computed from the growth rate of a simulated DM halo using a mass and redshift dependent conversion efficiency which is constrained by requiring several observations (SMFs, sSFRs, clustering, quenched fractions) be reproduced. While previous models determined galaxy quantities only as an average for a given halo mass, the new models can predict stellar mass, star formation rate, gas mass, and colour for individual systems based on their formation history. Using this new technique I will present star formation and accretion histories for quenched and star-forming galaxies, and the evolution of the star formation main sequence. I will also show how other high redshift quantities that will be probed in future surveys can be predicted, such as gas fractions and galaxy merger rates, and how mock observations based on the model look like. Furthermore I will demonstrate how modelled quantities depend on the environment and the galaxy's location within the cosmic web, and how this gives rise to galactic conformity, i.e. the observation that quenched galaxies typically reside in quenched neighbourhoods.

Nusser Adi Clustering at Low Redshifts: from Galaxy Motion to Radio Galaxies

Analysis of the clustering of matter in the low redshift Universe is particularly useful as it could constrain the underlying mechanism responsible for the observed cosmic accelerating. Implications from recent observations of galaxy motions will be discussed. A new analysis based on the coherent apparent variations of observed galaxy luminosities will also be presented. Additional considerations based on the clustering of radio galaxies will be discussed.

Péroux Céline The Baryon Cycle: Accretion, Outflow and the Circum-Galactic Medium

A picture arises where galaxy formation is fed by inflows of gas from the inter-galactic medium (IGM), counteracted by strong galactic winds, which in concert establish the growth rate of gas and stars within galaxies at all cosmic epochs.

These processes can be collectively described as a “baryon cycle". I will present results on the neutral gas reservoir for star formation and galaxies metal enrichment based on a large data set of VLT/UVES observations. In addition, I will describe the kinematics of gas around galaxies probed with the near-infrared Integral Field Unit VLT/SINFONI and the VLT/X-Shooter spectrograph.

Perret Valentin A Self-Gravity Star Formation Criterion in High Redshift Galaxy Simulations

For the last 20 years, the Schmidt law has been used as a proxy for star formation in most of the numerical simulations modelling galactic evolution, wether it is in a cosmological context or not. The implementation of this star formation law relies in the vast majority of these simulations on a density threshold ρ above which it is allowed to form stars and an efficiency parameter ε which scales the gas depletion time. The usual approach consist in tuning these parameters in order to obtain simulated galaxies following the empirical Kennicutt-Schmidt relation. While most of simulations have been successful in constraining the mass assembly and the structural evolution of galaxies, the numerical implementation of star formation remained the same for decades. These ρ/ε parameters depend on the achieved resolution and physics implemented: metal lines cooling, heating, stellar feedback, etc. For instance, simulating a high redshift galaxy and a low redshift counterpart at the same hydrodynamical and gravitational resolution requires very different fine tuning of the ρ/ε parameters in order to position both of these models on the Kennicutt-Schmidt relation. The parsec scale resolution reached nowadays by many idealised disk simulations allow to resolve the supersonic turbulent multi-phase interstellar medium. Therefore, it is possible to apply star formation criterion based on a local analysis of the turbulent support of the gas clouds. Following the work of Hopkins et al. 2013, we implemented a computation of the local Virial parameter for each hydrodynamical element in the RAMSES code (Teyssier et al. 2002). This computation therefore establish the stability of the each gas element and its ability to collapse and form stars. In this approach, a collapsing cloud is considered to convert gas into stars with an efficiency ε=100%, two orders of magnitude above the standard star formation criterion. Because star formation in the interstellar medium will happen less often and in specific locations, it has great implications for the global properties of the galaxies. This self-gravity criterion has been used for several years in molecular clouds simulations (e.g. Padoan & Nordlund 2011); it is therefore relevant to implement it on the galactic scales. In this work, we will present state of the art high resolution simulations of high redshift analogue galaxies with this new algorithm implemented. For our study, we designed idealised initial conditions for galactic disks typical of a z=2 universe. The very high initial gas fraction (>60%) and the low halo concentration parameter (c=5) allow to fragment the disk to produce clumps wandering in a very turbulent interstellar medium as it is displayed by a the large fraction of high redshift galaxies observed in deep field surveys. We used the adaptive mesh refinement code RAMSES which allows us to reach an effective resolution of 6 parsecs in the most refined cells. We compare two sets of simulations, one using the standard star formation criterion (using ρ=100 cm-3 ε=1%); another one using a local estimation of the Virial parameter with ε=100% and no density threshold. Each of these simulation sets encompass a run with and without stellar feedback. We will review through a comparative study of the star formation criteria the consequences for the star formation history, the gas and stellar morphology as well as the properties of the galactic fountain induced by stellar feedback. We will also compare the case of an idealised galaxy merger comparing these two star formation criterion and its implications for starburst activities.

Pichon Christophe Spin Alignments within the Cosmic Web: a Theory of Constrained Tidal Torques near Filaments

The geometry of the cosmic web drives in part the spin acquisition of galaxies. This can be explained in a Lagrangian framework, by identifying the specific long-wavelength correlations within the primordial Gaussian random field which are relevant to spin acquisition. Tidal Torque Theory is revisited in the context of such anisotropic environments, biased by the presence of a filament within a wall. The point process of filament-type saddles represents it most efficiently. The constrained misalignment between the tidal and the inertia tensors in the vicinity of filament-type saddles simply explains the distribution of spin directions.

Pieri Matthew Exploring Lyman-α Forest Circumgalactic Regions in Massive Spectroscopic Surveys

I will present the latest results from composite spectra of Lyman-alpha forest absorbers taken from the SDSS-III/BOSS survey of ~150k quasars. Comparison with a small sample of Lyman break galaxies in the foreground of background quasars allows ~50k high redshift circumgalactic regions to be identified and probed with high precision. For example, these composites show optically thin gas with near-solar metallicities and 30 parsec scale clumping. I will also explore the prospects for learning further galaxy properties in the cosmic web context with ever growing spectroscopic surveys (eBOSS, WEAVE and DESI).

Pisani Alice Precision Cosmology with Cosmic Voids

Modern surveys allow us to access to high quality measurements, by sampling the galaxy distribution in detail also in the emptier regions, voids. Cosmic voids present themselves as a new tool to constrain cosmology. While the treatment

of systematics might be simpler in these empty regions, with the aim of achieving the level of precision cosmology a careful modeling of such effects is necessary. In particular, peculiar velocities affect the way we observe cosmic voids, and thus their effect needs to be understood. Using mock catalogues, I analyze the effect of peculiar velocities on void properties. In this talk I thus present the results of the analysis of the systematic effects affecting voids and discuss it in the framework of current and future surveys. Additionally, I present a forecast for void abundances with the future Euclid and WFIRST missions and obtain, using the Fisher matrix formalism, a prediction for the constraints that voids will set on cosmological parameters.

Popesso Paola The Role of Massive Halos in the Cosmic Star Formation History

The main feature of the Cosmic Star Formation History (CSFH) is a dramatic drop of the star formation (SF) activity, since z~1. We analyze the evolution of the SF activity in massive halos to understand if the very same process of assembly and growth of structures is one of the major drivers of the observed decline. Our results show that low mass groups ($10^{\{12.5\text{-}13.5\}}$ $M_{\odot}$} provide a 60-80% contribution to the CSFH at z~1. Such contribution declines faster than the CSFH at z<0.3, where the overall SF activity is sustained by the lowest mass halos ($M_{halo} < 10^{12}$ $M_{\odot}$}). More massive systems provide only a marginal contribution at any epoch. The large contribution of low mass groups at z~1 is due to a large fraction of very massive, highly star forming Main Sequence galaxies. Below z~1 a quenching process must take place in massive halos to cause the observed faster suppression of their SF activity. Starvation or the transition from cold to hot accretion would provide a quenching timescale of 1 Gyrs more consistent with the observations.

Rahmani Hadi The Galaxy Population in Voids: Are all Voids the Same?

The influence of underdense environments on the formation and evolution of galaxies is studied by analyzing the photometric properties of ~200 galaxies residing in voids, taken from our Sloan Digital Sky Survey (SDSS) DR10 void catalog up to z ~ 0.055. We split void galaxies into two subsamples based on the luminosity density contrast of their host voids: “sparse void” delta < -0.95 and “populous void” delta > -0.87. We find that galaxies in sparse voids are less massive than galaxies in populous voids. The luminosity distribution of galaxies in populous voids follows the same distribution observed across the SDSS survey in the same redshift range. Galaxies in the sparse voids are also bluer, suggesting that they may be going through a relatively slow and continuous star formation. Additionally, we find that the luminosity function of galaxies in populous voids is represented with the Schechter function, whereas the same does not hold true for sparse voids. Our analysis suggests that the properties of a host void play a significant role in the formation and evolution of the void galaxies, and determining the large-scale evolution of voids is an important step to understand what processes regulate the evolution of galaxies.

Rahmati Alireza Distribution of Neutral Hydrogen and Metals in the Intergalactic Medium and its Connection with Galaxies

Modern state-of-the-art cosmological simulations of galaxy formation have become indispensable tools for probing the main processes that are shaping the formation and evolution of galaxies and they can be used to learn about the cycle of gas in galactic ecosystems. I will present an analysis of the distribution of neutral hydrogen and metals in the EAGLE cosmological simulation (Schaye et al. 2015). I will discuss the physical properties of the HI and metal absorbers, their evolution and their connection with galaxies. I compare the simulation results with observations at high and low redshifts and show how this comparison can help us to learn about the role of feedback in shaping the distribution of HI and metals around galaxies. Moreover, I will discuss the inferences we can obtain from cosmological simulations to better understand the relation between observed absorption systems and galaxies. The content of this talk is based on Rahmati et al. 13a, Rahmati & Schaye 14, Rahmati et al. 2015a,b (to-be-submitted) and Schaye et al. 2015.

Rauch Michael Observing Gas Flows between Galaxies and the Intergalactic Medium in Emission

Observations of the gaseous environment of high redshift galaxies in HI Lyman-α and other emission lines can shed light on several fundamental but so far poorly constrained aspects of high redshift galaxy formation: how does gas get from the IGM into galaxies? How does the IGM get enriched with metals? and how do galaxies ionize the universe? Based on a combination of ultra-deep spectroscopy and space-based imaging in the Hubble Deep Fields we report on a number of high redshift galaxies showing clear signs of such interactions between the gas and the stellar components in the galactic halos. These observations show the infall of matter into galactic halos to be quite messy, and point to the importance of stripping mechanisms and the role of satellite galaxies in the dispersal of metals in the IGM.

Rosdahl Joakim Galaxies That Shine: RHD Simulations of Radiation Feedback in Galactic Disks

Stellar radiation feedback is thought to be an important factor in regulating the evolution of galaxies. The radiation heats the galactic gas and pushes it via momentum transfer and as a result can play a role in stirring up the interstellar medium, suppressing star formation and perhaps even generating galactic winds. Radiation feedback is often included in numerical simulations of galaxy evolution. However, it is almost always modelled using pure hydrodynamics, with variously well motivated sub-grid recipes for the radiation, rather than from first principles with radiation-hydrodynamics (RHD), which are much more accurate, but complex and computationally expensive. The effects of those radiation feedback recipes are varied, and there is no consensus on how this feedback mechanism works in detail or whether it is actually important on the galactic scale. We have implemented RHD in the widely used cosmological simulations code RAMSES. In order to gain an understanding of the effect of stellar radiation on galaxies, we use our implementation to evolve 20 parsec resolved galaxy disks in three dimensions. We disentangle the effects of photoionisation heating, direct pressure from photoionisation and pressure on dust particles from reprocessed infra-red (IR) radiation. We find that thermal pressure in the photoionised gas has an impact on the galaxies, similar to the inclusion of supernova feedback, in suppressing the formation of stars. Radiation pressure, whether direct from the ionising photons, or from reprocessed IR radiation, has little effect in our simulations, but this is to some degree due to the lack of resolution. The inclusion of stellar radiation has the effect of slightly decreasing gas outflows in winds, owing to reduced star formation, while the ratio of outflow rate versus star formation rate is increased. We also present preliminary results of radiation feedback in cosmological simulations, focusing on the interaction of supernova and radiation feedback with gas accretion.

Rossi Graziano Massive Neutrinos and the Cosmic Web

The cosmic web is very sensitive to neutrino properties and their total mass, since the free-streaming of massive neutrinos imprints a specific redshift- and scale-dependent signature in the power spectrum of the matter and galaxy distribution. Hence, determining the absolute neutrino mass scale, the neutrino mass hierarchy, and the total number of effective neutrino species is not only relevant for a detailed understanding of the neutrino sector, but has also important implications for the large-scale organization of cosmic structures. To this end, I will describe a recent series of cosmological hydrodynamical simulations with massive neutrinos, present stringent joint constraints on the number of effective neutrino species and the sum of neutrino masses from state-of-the-art data, and finally make the connection with the cosmic web.

Safonova Evgeniya The Study of Galaxy Evolution in the Eridanus Void

The properties and evolution of void galaxies are not well established yet. The authors' recent study of galaxies residing in a nearby Lynx-Cancer void revealed the substantioal differences in their evolutionary parameters in respect to similar galaxies in denser environments. To extend this study, we compile the sample of 60 galaxies in the equatorial zone of the Eridanus void. With our new O/H measurements and estimates for 24 void galaxies, and incorporating data for 10 objects with O/H known from the literature, we analize the void sample of 34 galaxies. The «metallicity-luminosity» relation for our sample is compared with the «standard» one for a «reference» sample of similar galaxies in the Local Volume groups. We found that the most of void objects show O/H values below the «standard» relation that is have too low metallicity for their luminosity. This situation is similar to that found previously for the Lynx-Cancer void galaxies. This finding evidences for slower chemical evolution of the majority of void galaxies. The void sample is dominated by typical dwarf galaxies. However, a number of the intermediate luminosity late-type spirals are present as well. Part of them also reveal the reduced metallicity and the appearance of peculiar morphology with regions of intense star formation on their periphery. The latter might be caused by the so called cold accretion. The subsample of such unusual void spirals is compiled for further investigation and their general properties are presented.

Saito Tomoki The Environments of Ly-α Blobs

We exploit the wide-field Lya imaging with Subaru, together with the AzTEC/ASTE 1.1mm mapping, to probe the environments around known giant (>100kpc) Lya nebulae (Lya blobs, LABs) at z~3-4. We use samples of Lya emitters (LAEs) around four known LABs with and without radio galaxies. Our previous study revealed that one of our LABs associated with a radio galaxy at z=4.1 (TN J1338-1942, TNJ1338) resides in extreme overdensity on ~3-6 Mpc scales, wherein the Lya luminosity function (LF) is biased to bright LAEs. We speculate that the formation of bright galaxies in this field is enhanced via frequent galaxy mergers or high rates of gas accretion from the surroundings. We compare these results with other three LABs at z~3. Among these three, the environment of one LAB associated with a bright submillimetre source has the density distribution closest to that of the TNJ1338 field. This and another one LAB associated with a radio galaxy reside in overdensities up to delta~2-3, and the LFs show a hint of enhancement at the bright end. On the other hand, the environment of another LAB with a normal star-forming galaxy seems to be quite different from the remaining two, i.e., no significant overdensity, nor the bright-end enhancement of the LF. Although the four LABs are similarly extended in size, they have various environments. The peculiarity of the TNJ1338 field is also supported by detection of both the radio galaxy and a bright AzTEC 1.1mm source.

Scoville Nick Evolution of the Interstellar Matter Content of Galaxies

A major deficiency in our understanding of galaxy assembly and evolution in the early universe has been the lack of extensive samples of galaxies where the ISM masses and physical conditions are known. I will summarize the observational capabilities with ALMA and then present results for our very large survey with ALMA, using the long wavelength dust continuum to estimate ISM masses in 300 galaxies at z = 1 -5. Very Clear evolutionary trends are seen and strong variations relative to the galaxy main sequence. The next step will be to link the ISM masses of galaxies to their large scale structure environment.

Song Hyunmi Quasars as a Tracer of Large-Scale Structure at z~0.5

We present the correlation between quasar properties and background density with the largest spectroscopic dataset of quasars and galaxies to date. We construct a galaxy (number) density field on large-scale (~10-15Mpc) using the Sloan Digital Sky Survey (SDSS) Data Release 12 (DR12) Constant MASS (CMASS) galaxies following the 20 nearest-neighbors approach over the redshift range 0.46<z<0.59. Quasar sample is prepared from the DR7 of SDSS I/II. We examine a correlation of the incidence of quasars with the galaxy density and dependences of quasar properties such as black hole mass, bolometric luminosity and Eddington ratio on the galaxy density. We find a monotonic correlation between the quasar density and galaxy density, which doesn't change much with redshift. Dependences of the quasar properties on the galaxy density are very weak. Based on the results, we discuss the possibility of quasars as a tracer of Large-Scale Structure (LSS), which will be crucial in the near future to probe more deeply in the universe.

Sorce Jenny Cosmicflows Observations Give us CLUES to Matter Distribution

Reproducing the local large-scale structure (LSS), using dynamical information from observations, is a powerful tool to test gravitational theories and to better understand the formation and evolution of the LSS. The observational data - positions and peculiar velocities of more than 8,000 galaxies - come from the second catalog of the Cosmicflows project. Peculiar velocities constitute direct tracers of the underlying gravitational field and as such account for the total distribution of matter. Using a new technique - the reverse Zeldovich approximation and a bias correction developed to minimize the mismatch between observations and simulations, we are able to produce simulations constrained by measurements of galaxy gravitational motion which resemble the Local Universe. The scatter between observed and simulated positions and masses of the major attractors of the Local Universe is substantially reduced. The matter distribution is well recovered and therefore, it can be efficiently compared with observations down to a few megaparsecs (typically 3-4 Mpc/h).

Tejos Nicolas Towards the Statistical Characterization of the Intergalactic Medium in Intercluster Filaments

I will present results of our recent survey aimed to characterize the intergalactic medium (IGM) in intercluster filaments. We selected a single bright QSO whose sightline intersects 7 independent cluster-pairs (defined as being separated by < 2000 km/s along the line-of-sight, and < 25 Mpc transverse to the line-of-sight), at impact parameters < 3 Mpc, and observed it using the Cosmic Origins Spectrograph (COS) on HST. These observations allowed us to directly measure the redshift number density, dN/dz, of HI and OVI absorption systems associated to cluster-pairs. By comparing the relative dN/dz values as a function of distance to the cluster-pair axes, our results are consistent with a filamentary structure of the intercluster medium. We report a factor of ~2 excess of HI in intercluster filaments compared to the field expectation. Restricting the analysis to broad HI systems (i.e. having Doppler parameters > 50 km/s) and OVI, we report a factor of ~4 excess compared to their respective field values, although with a large uncertainty. Given that broad HI and OVI trace gas at temperatures $T > 10^5$ K, our results hint towards the presence of a warm-hot intergalactic medium (WHIM) in these intercluster filaments. Our novel experimental design provides a viable way to constrain the properties of the IGM in the densest filaments in the cosmic web, a fundamental observable to understand galaxy formation and the evolution of baryonic matter in the Universe.

Tempel Elmo The Alignment of Satellite Galaxies and Galaxy Pairs with Galactic Filaments

During last years several new and improved algorithms have been proposed for cosmic cartography. One of them is Bisous model (Tempel et al. 2014a) that uses the marked point process to detect the filamentary pattern in the cosmic web. This method have already used in several papers (Guo et al. 2015; Tempel et al. 2014b,c; Tempel & Libeskind 2013) to analyse the connection between cosmic web filaments and galaxies. In my talk I will present the recent results, where we analysed the alignment of satellite galaxies and galaxy pairs in filaments. Our study is based on the SDSS data. For satellite alignment we combine the spectroscopic and photometric redshift catalogues that increases the number of satellite galaxies considerably. To study the galaxy pair alignment in filaments, we use the friend-of-friend group catalogue constructed in Tempel et al. (2014d). Our results indicate that both, satellite galaxies and galaxy groups, are aligned with galactic filaments. The alignment is up to 6.5sigma for galaxy pairs. Our results give new insight into the

formation and evolution of galaxies and galaxy groups. Particularly, our results show that there is strong connection between the morphology of cosmic web and galaxy/group formation.

Trujillo-Gomez Sebastian Stellar Feedback and the Observational Signatures of Accretion and Winds

We investigate the cycle of gas accretion from the cosmic web, star formation, feedback, and outflows in high resolution simulations of galaxy formation. Irrespective of the modelling of feedback, the halo is a highly dynamic reservoir where gas is constantly accreting of outflowing. However, strong radiation feedback is essential in maintaining the abundance of dense gas observed around galaxies. When stellar feedback is strong enough to regulate galaxy growth, a "halo fountain" is responsible for a large fraction of the gas detected in absorption at z<1. Moreover, simulations are unable to reproduce the absorption properties of cold winds inferred from observations. This presents a challenge to our understanding of galaxy formation.

Tully Brent Large Scale Structure Velocity Fields

Coherent flows are a fundamental property of the development of large scale structure. In a universe with matter density well below closure density, local velocity dispersions are small and motions are coherent. Structures on intermediate scales are strongly affected by large scale tides. Current observations of motions that deviate from the cosmic expansion are providing an increasingly nuanced picture of structure on a wide range of scales.

Van de Weijgaert Rien The Cosmic Web in the Local Universe: the Adhesion Reconstruction

To study the dynamical evolution of the cosmic web, we have developed an updated adhesion model of cosmic structure formation. It involves Voronoi and Delaunay tessellations to efficiently compute the solution of the Burger's equation and to unequivocally identify the clusters, filaments, walls and voids in a cosmic volume. With this we can systematically follow the outline of the emerging cosmic web and its morphological components. It provides a systematic assessment of the sensitivity of the cosmic web to different cosmologies and/or as a function of power spectrum. In this presentation, we will describe the structure and evolution of the Cosmic Web in the Local Universe. The reconstruction is based on our adhesion formalism and the KIGEN reconstruction of the initial density field in the Local Universe inferred from the 2MRS survey. We will concentrate in particular on the structure of the Local Void, of the complex multiscale filamentary structure of the Pisces-Perseus supercluster and on the weblike morphology of the Coma Great Wall.

Vogelsberger Mark The Era of Large-Scale Cosmological Simulations

Progress in our understanding of galaxy formation, improved numerical algorithms, and increased computing power have recently lead to a number of impressive large-scale hydrodynamical simulations, which are able to reproduce key observables of the local and higher redshift Universe. These simulations allow us, for the first time, to study the interplay between large-scale structure and galaxy formation in detail. I will give an overview of these efforts and focus on the successes and failures of some of them.

Welker Charlotte The impact of mergers versus smooth accretion on the size and shape of galaxies

In this talk, I will explain how we can use cosmological hydrodynamical simulations to review the leading scenarios that aim to describe the evolution of galaxies across the peak of cosmic star formation history . In particular, I will show how we can estimate the competitive impact of mergers and smooth accretion on the size and shape of galaxies at high and low redshift in the Horizon-AGN simulation, and how those processes relate to the underlying cosmic web. I will then show how those results correlate to available observations. If time, I will discuss the impact of AGN activity on galactic evolution.

Wojtak Radoslaw Tracing Redshift Evolution of Voids in Cosmological Simulations

I will present a new technique for tracing redshift evolution of voids in cosmological simulations with dark matter. The method employs a new density estimator which is based on a rigorous procedure of projecting dark matter phase-space sheets onto configuration space. Hierarchical network of voids is traced in redshift space by applying the watershed algorithm to a density field computed on a regular grid in space of comoving coordinates and the scale factor. The main focus of my talk will be on showing some applications of the new method and demonstrating its robustness. I will also present redshift evolution of selected properties of voids such as size, shape and density profile.

Wu Po-Feng How much the Environment Matters for Disk Galaxies? View from Nearby Galaxies

It is widely accepted that the environment affects the evolution of galaxies. Nevertheless, environment is not the only factor. Other parameters such as mass and star formation also play crucial roles and there are likely interplay among each other. Therefore, in order to verify the environmental effect on galaxy properties observationally, one has to have good control over the galaxy sample in question. In this study, we focus on nearby galaxies where better measurements are available. We combine the density field estimated from the 2MASS Redshift Survey (2MRS), stellar mass and structure parameters estimated from Spitzer/WISE imaging, and HI observations from literature. By doing so, we are able to isolate the environmental effect from other parameters. We investigate that how the environment affects several properties of nearby disk galaxies, including size, rotation and star formation. We find that the environment plays a minor role comparing to the mass of galaxy, but the effect is observable on size, rotation and star formation. Galaxies in higher densities are more extended, rotate faster, and have turned more their gas into stars.

Zaroubi Saleem High Redshift Cosmic Structures with SKA and LOFAR

Within the coming decade the first phase of the Square Kilometre telescope is expected to be completed. This revolutionary telescope will provide us with exquisite data in the frequency range 50MHz up to the GHz regime. I will review the current status of the Cosmology project with SKA.The talk will review the first phase of the SKA project with regard to structure formation and cosmology researchand what it is expected to deliver in terms of Intensity mapping, HI and continuum studies.

Zhu Ming Detecting the Cosmic Web with the FAST Telescope

The Five hundred meter Aperture Spherical radio Telescope (FAST) is a Chinese mega-science project that is currently under construction, with the aim to build the largest single dish radio telescope in the world. It has an Arecibo-type dish located on an unique Karst depression. Unlike the Arecibo, FAST has an active main reflector which corrects spherical aberration on the ground to achieve full polarization and wide band without involving complex feed systems, and it is equipped with a light focus cabin driven by cables and servomechanism plus a parallel robot as the secondary adjustable system to carry the receivers. Such telescope will have much higher survey speed and can cover twice more sky area than the Arecibo 305m telescope. In this talk I will give an update of the latest status of FAST project, and discuss the possibility of detecting cosmic web features with FAST.