
ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich
Star and Structure Formation:
From First Light to the Milky Way
Posters Abstract
Astrophysics Conference
August 18 - 22, 2003
ETH Zurich, Switzerland

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Session 1

When and where was First Light and how can we look for it?

H_2 Lines from the First Generation Star Formation Process

Hiromi Mizusawa, Niigata University

Abstract Molecular hydrogen line photons emitted owing to formation events of first-generation stars and their detectability by future observational facilities are explored. The H_2 luminosity evolution from the onset of prestellar collapse to the formation of about 100 M_sun protostar is followed by a simplified model for the dynamical evolution. In particular, the calculation is extended not only the early phase of the runaway collapse but also to the later phase of accretion, whose observational feature has not been studied before. Contrary to the runaway collapse phase, where the pure-rotational lines are always dominant, during the accretion phase prominent emission is owing to rovibrational lines. Also, the maximum luminosity is attained in the accretion phase for strong emission lines. The peak intensity of the strongest rovibrational line reaches about 10^{-27} (W/m^2), corresponding to the flux density of 10^{-5} (μJy), for a source at the typical redshift of the next-generation infrared satellite, SPICA, Space Infrared Telescope for Cosmology and Astrophysics, is ideal for observing the redshifted rovibrational line emission, to exceed the detection threshold, about 10^6 such forming stars must reach the maximum luminosity simultaneously in a pregalactic cloud. Unfortunately, this situation is excluded by the current theoretical understanding of early structure formation.

Revised primordial chemistry of the early Universe

Denis Puy, Observatory of Geneva
Daniel Pfenniger, Observatory of Geneva

Abstract The leading view in structure formation theories is that the first condensed structures occurred at small scales. Because of their rotational and vibrational levels, molecules such as H2, HD or LiH are important thermal agent determining the heating or cooling of the first structures. The knowledge of the molecular abundances given by solving the chemicalkinetic equations in the post nucleo-synthesis matter is a crucial step in order to determine the growth of the first condensed structures. In this work, we present calculations about primordial molecules formation revised with respect to previous works in several ways. In addition these equations are solved in over or underdense matter fluctuations in the linear approximation. We can thus quantify the differential chemical abundances following variations in the assumed initial conditions or in density fluctuations.

Session 2

When did Reionization occur and what did it?

First Results from a Multislit Windows Search for z=5.7 LyA

Crystal Martin, University of California, Santa Barbara, USA

Abstract not available yet

Ionization before Reionization?

James Taylor, University of Oxford

Abstract The large optical depth to the CMB recently measured by WMAP suggests that the reionization of the universe occurred at very high redshifts, cf. z = 15-20. While the overall efficiency of primordial ionization sources is highly uncertain, it seems hard to achieve this very early reionization by conventional means. We suggest that an exotic source of photons, from the annihilation of dark matter particles, may have contributed to the reionization of the universe before the first baryonic objects had even formed.

A Search for Distant Ly-alpha Galaxies with Multi-slit Windows

Kim-Vy Tran, ETH Zurich
S. Lilly, M. Brodwin, & D. Crampton

Abstract We present results from a search for Ly-alpha galaxies at z=6.5 in the 9150 A atmospheric window. Utilizing a novel technique that combines multiple long slit spectroscopy with a narrow band filter, we survey with the CFHT 3.6 m an effective area of 8 square arcmins to a 5 sigma flux limit of 2.5e-17 erg/s/cm^2. From this initial survey, we isolate 11 emission line objects that are all confirmed to be lower redshift interlopers with photometric redshifts from deep UBVRIZ imaging. We also describe the large program we have begun using this method at the VLT to survey Ly-alpha galaxies at 3<z<4 and z=6.5 over a cumulative area of 130 and 20 square arcmins respectively. Mapping the distribution of Ly-alpha galaxies at these redshifts will provide better estimates of the auto-correlation clustering of galaxies, the Ly-alpha luminosity function, the epoch of reionization, and the properties of the very first galaxies.

Session 3

How does Metallicity of the Universe develop?

Chemical enrichment of the ICM in a hierarchical merger model

Gabriella De Lucia, Max-Planck-Institute for Astrophysics

Abstract We use semi-analytic techniques to follow the formation, the evolution and chemical enrichment of cluster galaxies in a hierarchical dark matter model. The use of simple physical prescriptions for the transport of metals in the different phases considered, and the choice of few physically motivated parameters, allow us to reproduce the latest observational both in terms of luminosity and in terms of metallicity in the stellar population and in the intra-cluster medium (ICM). The behaviour of three different schemes is investigated in order to study the influence of different prescriptions on the feedback process. A simple scheme based on observational results (Heckman 2002) produces, at the same time, results that are in good agreement with observational data both for the cluster luminosity function and the Tully-Fisher relation.

We find that the chemical enrichment of the ICM occurs at high redshift: 65-85 per cent of the metals are ejected into the ICM at redshift larger than 1, 40-60 per cent at redshift larger than 2 and 20-45 per cent at redshift larger than 3. Massive galaxies constitute important contributors to such chemical pollution: 15-25 per cent of the metals today present in the ICM were ejected by galaxies with mass larger than 10^(11) solar masse/h.

Not available yet

Akimi Fujita, UCSB

Abstract not available yet

The Oxygen Abundance in star-forming Galaxies at half the Hubble Time

Simon Lilly and **Marcella Carollo**, ETH Zurich
Alan Stockton, University of Hawaii

Abstract We have estimated the emission line [O/H] metallicity in a complete sample of 66 CFRS galaxies between 0.47 < z < 0.92. The emission line spectra of these galaxies are much more similar to those of local galaxies than to the handful of z ~ 3 Lyman Break galaxies observed to date. Most galaxies have the [O/H] ~ 8.9 seen locally in galaxies of similar luminosities, but a significant fraction (< 25%) appear to have significantly lower metallicities [O/H] < 8.6. The lower metallicity galaxies are not distinguished from the remainder by H-beta luminosity, optical morphology, size or, for the few available, emission line kinematics. The metallicity does however correlate with the continuum colours, especially rest (B-J) in a way that can be explained by some combination of photospheric effects, lower reddening, younger stellar ages or the addition of a starburst in the lower [O/H] systems. It is unlikely that these lower [O/H] galaxies can fade sufficiently to be low metallicity dwarfs today, and these results support a "downsizing" picture of galaxy evolution. The overall change in [O/H] in star-forming galaxies over the last 50% of the age of the Universe is estimated to be Delta[O/H] ~ 0.08 ± 0.06, broadly consistent with the age-metallicity relation in the solar neighbourhood and with at least some models for the chemical evolution of the Universe.

The metallicity-luminosity relation at medium redshift based on faint CADIS emission line galaxies

Christian Maier, Max Planck-Institut fuer Astronomie Heidelberg

Abstract We derived oxygen abundances of FAINT CADIS emission line galaxies (-20.5 > M_B > -17) in two redshift bins, at 0.392 < z < 0.415, and at 0.625 < z < 0.648, using multi-object spectroscopy with FORS2 at the VLT, and with DOLORES at TNG. Combining our results with published metallicities of galaxies with BRIGHTER absolute magnitudes at medium redshift we can study the metallicity-luminosity relation at medium redshift (0.3 < z < 0.7) over a wider luminosity range.

Our results indicate that a correlation between galaxy metallicity and absolute magnitude M_B, known for galaxies in the local universe, apply also at medium redshift. However, the relation is slightly displaced to lower abundances. I will discuss possible explanations (luminosity evolution or metallicity evolution between z=0 and z=0.64?) for this finding.

Session 4

How do Galaxies Grow?

Substructures in Cold Dark Matter Halos

Gabriella De Lucia, Max-Planck-Institute for Astrophysics

Abstract We analyse the properties of substructures within dark matter halos (subhalos) using a set of high-resolution numerical simulations of the formation of structure in a Lambda--CDM Universe. Our simulation set includes 11 high-resolution simulations of massive clusters as well as a region of mean density, allowing us to study the spatial and mass distribution of substructures down to a mass resolution limit of 10^9 solar masses/h.

We also investigate how the properties of substructures vary as a function of the mass of the `parent' halo in which they are located. We find that the substructure mass function depends at most weakly on the mass of the parent halo and is well described by a power-law. The radial number density profiles of substructures are steeper in low mass halos than in high mass halos. More massive substructures tend to avoid the centres of halos and are preferentially located in the external regions of their parent halos. We also study the mass accretion and merging histories of substructures, which we find to be largely independent of environment. We find that a significant fraction of the substructures residing in clusters at the present day were accreted at redshifts $z < 1$. This implies that a significant fraction of present-day 'passive' cluster galaxies should have been still outside the cluster progenitor and more active at $z\sim1$.

Disk Secular Evolution and Bulge Formation

Victor Debattista, ETH Zurich

Abstract We present new results from high resolution simulations of disk galaxies experiencing various instabilities and secular evolution. These lead to mass redistribution and the generation of bulge-like central concentrations and kinematics. We find that, indeed, the secular evolution of pure disks (with various initial density profiles) produces systems which resemble the observed disk+bulge galaxies.

Thick boxy bulges caused by interaction?

Daniela Vergani, Ralf-Juergen Dettmar, and Uli Klein,
Ruhr-University Bochum

Abstract The close connection between bars and box/peanut-shaped bulges is observationally and theoretically supported. However, for the class of thick box/peanut-shaped bulges an environmental hypothesis instead of an internal mechanism is suggested to account for the prominence of the box/peanut component.

The main goal of this project is to present a multi-wavelength study of the kinematics and the morphology in a sample of thick box/peanut-shaped bulges in order to find out relics of interactions.

A new technique to derive the rotation curve from the HI observation will be presented.

All these new results suggest a scenario in which interactions play a significant role in the history of thick box/peanut-shaped bulge galaxies and they have likely experienced a recent infall of matter.

Gas content in galaxies: peculiar vs. normal

D. Bettoni, Osservatorio Astronomico di Padova, INAF
S. Garcia-Burillo, Observatorio Astronòmico Nacional, Madrid
G.Galletta, V. Casasola, Dipartimento di Astronomia, Università di Padova

Abstract We present a study of the interstellar medium in 275 galaxies showing several types of peculiarities (polar rings, counter rotation, faint outer shells and AGN) and of 1769 galaxies, considered to be a fair representation of `normality'. Masses for warm dust, atomic and molecular gas, as well as X-ray luminosities have been converted to a uniform distance scale taken from the Catalogue of Principal Galaxies (PGC).

Apart from X-ray luminosities, galaxies hosting AGN show no differences of ISM content with respect to normal ones. Polar ring galaxies on the contrary show a normalised content of cold gas one order of magnitude higher than the reference value derived for normal galaxies. The inferred gas masses are sufficient to stabilise polar rings through self-gravity. Shell galaxies and galaxies with counterrotation are similar to the normal galaxies and probably represent events that have been already evolved. Although counterrotators and polar rings probably share a common origin, the gas masses estimated here confirm that light gas rings accreted by future counterrotators may have evolved faster than the self-gravitating structures of polar rings.

The data for non interacting objects can be used in future studies to define a template ISM content for 'normal' galaxies along the Hubble sequence. They are in a catalogue (Bettoni et al. 2003) that can be accessed on-line at the Centre des Données Stellaires (CDS) or at: http://dipastro.pd.astro.it/galletta/ismcat/.

Mergers: Dry, mixed or classic?

Sadegh Khochfar, Max-Planck-Institute for Astronomy

Abstract We use semi-analytical modelling techniques to investigate the progenitor morphologies of present day ellipticals. We find that, independent of the environment, the fraction of mergers of bulge dominated galaxies (early-types) increases with time. The last major merger of bright present day ellipticals with B-band magnitude of less or similar -21 is preferentially between bulge dominated galaxies, while those with B-band magnitude around -20 have mainly experienced last major mergers between a bulge dominated and a disk dominated galaxy. Independent of specific model assumptions, more than 50% of present day ellipticals in clusters with B-band magnitude less than -18 had last major mergers, which are not between spirals as usually expected within the standard merger scenario.

Clustering of Lyman Alpha Galaxies at z = 4.5

Katarina Kovac, Kapteyn Institute Groningen,
Sangeeta Malhotra, Space Telescope Science Institute and
James E. Rhoads, Space Telescope Science Institute

Abstract The Large Area Lyman Alpha (LALA) survey has been designed and executed to detect a number of Lyman alpha (Ly alpha) emitting galaxies at high redshift to be statistically useful. Studies of clustering properties of those objects offer a probe for galaxy formation models.

We present the clustering properties of 167 Ly alpha galaxies around z=4.5 selected from the LALA survey. Our catalogue covers an area of 36' x 36' observed with five narrowband filters. We consider all galaxies as one sample.We assume that the angular correlation function is well represented by a power-law of slope beta equal 0.8 and we find for the amplitude of the angular correlation function to be 14.75 (for distances in arcsec). We then calculate the correlation length of the two-point spatial correlation function through the Limber transform. We estimate this value is 5.07/h Mpc in a Lambda-dominated universe. The strong clustering indicates that Ly alpha galaxies are associated with massive dark matter haloes.

NGC 6240 on trial

A. Pasquali, ESO/ST-ECF & **J.S. Gallagher,** University of Madison

Abstract We have used archived HST data to study, in detail and for the first time, the star-formation modes ongoing in the massive merger and ULIG NGC 6240. Here, we summarize and discuss the properties (i.e. age and mass) derived for compact star clusters in the galaxy main body and tails, and for three discrete sources located in the galaxy double nucleus. We also discuss the possible future evolution of the merger.

Evolution of Disk galaxies to Z=1.25: Based on the Goods CDF-S Observations

Sawa Ravindranath, Space Telescope Science Institute

Abstract Disk galaxies constitute about 60-80% of the galaxies in the nearby Universe and there is very little consensus about how they formed and evolved. In the recent years, high resolution images from the Hubble Space Telescope have made it possible to derive the structural parameters of galaxies out to high redshifts. We examine the evolution of the sizes and number densities of disk galaxies using the multiwavelength (B,V,i,z) images obtained by the Great Observatories Origins Deep Survey (GOODS) with the Advanced Camera for Surveys (ACS). We use two-dimensional modelling of the light profiles to classify galaxies based on their rest--frame B-band morphologies over the redshift range 0.25<z<1.25. Earlier studies of disk galaxies have shown that accounting for the selection biases of the survey is very crucial to interpreting the observed evolution in the properties of disks. We confine our analysis to the region of magnitude-size plane where the survey is almost complete at all redshifts for disk galaxies in the GOODS CDF-S field. We find that the size distribution function is consistent with a log-normal distribution as seen for the disk galaxies in the local Universe and does not show any significant evolution over the redshift range 0.25<z<1.25. The number densities of disk galaxies remains fairly constant over this redshift range, and only a modest evolution by a factor of four may be possible within the uncertainties.

Old massive Ly-alpha emitters at z=2.4

Claudia Scarlata, Padova University and STScI

Abstact We have carried out a search for Ly-alpha emission from galaxies at z=2.4 over a field of 1200 arcmin^2 using the CFH12K camera at the Canada-France-Hawaii Telescope. The red rest-frame ultraviolet and optical colors of these galaxies, combined with the Ly-alpha equivalent width, cannot be explained by a single stellar population and require two components: one is responsible for the Ly-alpha emission due to either a burst of star formation or AGN activity. The second component -dominating in mass- is either a heavily reddened starburst, or a relatively old stellar population (1 Gyr). The J-H and H-K colors favor the old stellar population interpretation. The volume density of the red Ly-alpha emitters (n = 2.6x10^(-5)h^3 Mpc^(-3)) is similar to that of local spheroids (about 30%). Given the large mass of the old stellar population (> 10^(11) solar masses) we suggest that the red Ly-alpha emitters might be the progenitors of present day spheroids, undergoing a secondary burst of star formation (~90 solar masses per yr).

Bar Dissolution by Central Mass Concentrations and Bulge Formation

Juntai Shen, J. A. Sellwood (Rutgers University)

Abstract We discuss the physical mechanism of bar weakening by Central Mass Concentrations (CMCs), based on an extensive simulation study on the bar dissolution by CMCs. We explain why bars should be weakened by a central mass and why it happens in two separate phases. Our findings clearly show that neither typical SMBHs in spirals nor typical central molecular gas concentrations can have any significant weakening effect on the bar within a Hubble time.

Our results suggest it is unlikely that large fractions of bulges are formed by bar dissolution, because the CMCs observed in galaxies today do not destroy bars. However, the bar weakening process does add some disk material to bulges, since those orbits which become chaotic because of the presence of the CMC fill a more nearly spherical volume near the center of the bar.

An Aligned Stream of the Most Metal-Poor Globular Clusters in the Halo of the Milky Way

Suk-Jin Yoon, Oxford University

Abstract Here, we have discovered that most of the lowest metallicity ([Fe/H] < -2.0) globular clusters, which are believed to represent the indigenous population of the Galaxy, display a striking planar alignment in the outer halo. This alignment, combined with evidence from kinematics and stellar population, indicates a captured origin from a Galactic satellite galaxy. We tentatively suggest that their former host galaxy is the Large Magellanic Cloud.

Session 5

When and how are Fundamental Scaling Relations set?

Estimation of the stellar masses in 30000 galaxies with redshifts below 1.0

Andrea Borch, Max-Planck-Institut Heidelberg

Abstract Contemporary models of galaxy evolution predict the stellar masses of galaxies. Since it is hard to derive the galaxy type and hence the M/L from these models, it is nontrivial to predict the luminosities. From the observational point of view, extragalactic surveys like COMBO-17 provide the luminosity function (Wolf et al 2003). In order to link this observable to the stellar mass, a reliable estimation of the stellar M/L ratios of the galaxies is needed.

In order to assign survey objects to different M/L ratios derived from stellar population synthesis models Kauffmann et al (2003) proposed to use the 400 nm break together with the H_delta index. They applied it to 10^5 SDSS galaxies and derived the local distribution of stellar masses.

The COMBO-17 survey covers an area of one square degree and contains about 30’000 galaxies down to R=24 mag. Armed with this dataset we follow a different approach of stellar mass estimation. Using 5 broadband filters together with 12 medium band filters we use a 16 dimensional color space in order to classify the objects. For the galaxy class a new template library based on PEGASE spectra is developed. It is appropriate for multi color classification and delivers redshift estimations as well as estimations of the spectral energy distribution (SED) types. The SED type corresponds to a certain stellar M/L ratio delivered by the PEGASE code. This allows us to estimate the stellar masses for the galaxies in our sample in the redshift regime $0.1 < z < 1.0$. The lowest redshift bin can be compared to the Kauffmann et al result and shows a good agreement.

The $<\mu>_e$ - log(R_e) plane, The Kormendy relation, and the Evolution of Elliptical Galaxies

Mauro D'Onofrio, Università di Padova
D. Bettoni, G. Fasano, M. Moles, P. Kjaergaard

Abstract The Kormendy (1977, KR) relation between the effective radius and the effective surface brightness of early-type galaxiesk, has been used several times to constrain the models of galaxy luminosity evolution without success. Unfortunately infact, the data samples required for this analysis must be homogeneus and complete both for high and low redshift clusters. We present today the analysis of the KR for a sample of 735 early-type galaxies members of 20 different nearby clusters. Up to now this is the largest and more complete CCD dataset suited for this study (but WINGS is coming!).

The results of this work indicate that the KR may be the product of a double selection effect due to the existence of the line of avoidance (LoA) and the cut-off in luminosity adopted for the galaxy selection. The ZP and the slope of the KR of the observed clusters have a scatter larger than the expected errors. This large variance is an obstacle to the determination of the galaxy luminosity evolution. A promising alternative method rely on the determination of the average distance of the cluster galaxies from the LoA. This average is approximately the same for all clusters (considering only the bright part of the LF: M_r < -20.0 mag). Unfortunately since the degree of completeness of the cluster LFs is still poorly known, it is not possible to derive any firm conclusions about the true scatter around this average. At present, therefore, the scatter still hampers the determination of the luminosity evolution of galaxies in clusters as a function of redshift.

Vertical Scaleheights of Stars and Gas in the Galactic Disk

Chaitra Narayan, Indian Institute of Science, Bangalore, India

Abstract The vertical scale height of atomic hydrogen gas is remarkably constant in the inner Galaxy (<8.5kpc). This has been a long-standing puzzle (Oort 1962) because the gas scale height is expected to increase with radius due to the exponentially decreasing surface density of the stellar disk. We present a realistic model to determine the scale height where the total gravitational force is due to the three disk components - stars, HI and H2, which are gravitationally coupled, and the dark matter halo. This approach naturally explains the observed scale height distribution of all the three components, including the constancy of HI scale height.

Nuclear Properties of Spiral Galaxies

Claudia Scarlata, Padova University and STScI

Abstract We present surface photometry for the central regions of a sample of 48 spiral galaxies (Sbc, Sc) observed with the Space Telescope Imaging Spectrograph on board the Hubble Space Telescope. Surface brightness profiles were derived and modeled with a Nuker law. We also analyzed archival Wide Field Planetary Camera 2 images with a larger field of view, available for 18 galaxies in our sample. We modeled the extracted bulge surface brightness profiles with an exponential, a De Vaucouleur, or a Sersic profile. In agreement with previous studies, we find that bulges of Sbc galaxies fall into two categories: bulges well described by an exponential profile and those well described by a De Vaucouleur profile. Only one galaxy requires the use of a more general Sersic profile to properly describe the bulge. Nuclear photometrically distinct components are found in 55% of the galaxies. For those that we classify as star clusters based on their resolved extent we find absolute magnitudes that are brighter on average than those previously identified in spiral galaxies. This might be due to a bias in our sample toward star forming galaxies, combined with a trend for star forming galaxies to host brighter central clusters.

Clustering of Lyman Alpha Galaxies at z = 4.5

Francesco Shankar, SISSA

Abstract After a detailed analysis and comparision of the most recent galactic luminosity function in various bands, we were able to estimate the local SMBH mass function and its error bars through the use of the L-σ and the M_{bh} – M_{bulge} relations. We find a total $\rho_{bh} = (4.5 \pm 1.5)\ 10^5\ M_{\odot}/Mpc^3$.

First Steps Toward Constraining Supermassive Black-Hole Growth: Mass Estimates of Black Holes in Distant Quasars

Marianne Vestergaard, Ohio State University

Abstract Supermassive black holes most likely reside ubiquitously in the centers of quiescent and active galaxies and may impact the evolution of their host galaxies. A fundamental property of a black hole is its mass. Statistical studies of large samples of supermassive black holes and their masses promise insights on how black holes grow and affect their environment, which comprise an important step toward our understanding structure formation and evolution in the Universe. Of particular interest is whether or not black-hole growth properties such as growth rate and process (e.g., mergers, accretion, or both) change with redshift. Measuring black-hole masses of nearby quiescent galaxies is a non-trivial task and proves increasingly difficult (or becomes impossible) for more distant galaxies. Fortunately, recent developments allow black-hole masses to be readily {\it estimated} in distant active galaxies. Although these estimates are only accurate to within a (statistical) uncertainty of a factor of a few, they are still very useful for statistical studies. I will summarize this mass estimation method and present the first results of applying this method to samples of active galaxies and quasars. Furthermore, I will outline ongoing efforts with collaborators in constraining the cosmic growth of supermassive black holes.

Session 6

What is the underlying Physics of Disk Formation?

A Search for Pure Disk Galaxies

Stefan J. Kautsch, Max-Planck-Institut fuer Astronomie
Eva K. Grebel, Max-Planck-Institut fuer Astronomie

Abstract Flat (or superthin) galaxies are late-type edge-on spiral galaxies that exhibit large axial ratios, small stellar disk scale heights and no distinct spheroidal bulge component. This type of galaxies appears to be a pure disk system with an extended blue stellar disk embedded in a red thick layer. Flat galaxies are very common objects with low star formation rates, low metallicities, low optical surface brightness but high neutral gas fractions. Their rotation curves resemble those of dwarf and irregular galaxies. These simple disk systems offer the unique opportunity to constrain galaxy disk evolution in underevolved galaxies in the nearby Universe. They are also an evolutionary puzzle since merger scenarios do not predict the formation of pure disks. We present first results from an extensive search for flat galaxies in the Sloan Digital Sky Survey (SDSS).

Session 7

How does a Dense Environment Affect Galaxies?

The mean flux and color of diffuse intracluster light in 10 clusters at 0.18 < z < 0.3

Rebecca Bernstein, University of Michigan

Abstract not available yet

The distribution of morphological types in nearby clusters from the WINGS survey

Daniela Bettoni, INAF-Osservatorio Astronomico di Padova

Abstract WINGS is a two-band (B and V), wide-field imaging survey of a complete, all-sky X-ray selected sample of nearby clusters. This sample comprises 78 clusters in the redshift range z=0.04-0.07. The aim of this survey is to provide the astronomical community with a complete set of homogeneous, CCD-based surface photometry and morphological data of nearby cluster galaxies located within 1.5 Mpc from the cluster center. The data collection has been completed in seven observing runs at the INT and ESO-2.2m telescopes. Here we present the analysis of the morphological distribution of about ~20.000 galaxies (down to V~21) in a subsample of ~40 clusters (See also http://web.pd.astro.it/wings/).

The influence of the cluster environment on the evolution of dwarf elliptical galaxies

Sven De Rijcke, Ghent University

Abstract We present results from an ESO/VLT Large Program. The aim of this program is to study the origin and evolution of dwarf elliptical galaxies (dEs) via observations of their present-day morphology and kinematics, from which we can infer their internal dynamics and mass-distribution (including dark matter). We show that dEs are not dark-matter dominated within the inner 2 half-light radii. Many observed features such as fast rotation, embedded stellar disks and kinematically decoupled cores can be explained quite naturally by the "harassment" scenario, according to which dEs stem from destabilised late-type galaxies.

Quantitative Study of Galaxy Morphology in Clusters

Dajana Dzanovic, University of Durham, UK

Abstract We present a quantitative study of the galaxy spheroid and disk luminosity ratios of a sample nearby (z~ 0.05) clusters taken from the Dressler 1980 catalogue. The luminosity functions of bulges as a function of local environment will be derived. We will implement the same quantitative methods to a sample of intermediate redshift clusters (z~0.3) to test for the evolution of the fraction of bulge/disk light and the overall implications for the formation and evolution of galaxies.

Dwarf galaxies in the cores and halos of compact groups

Elvira Krusch, Ruhr Universität Bochum

Abstract Compact groups are the most interesting places of galaxy evolution and transformation in the universe. They are excellent laboratories for the study of the influence of the environment on member galaxies, as their galaxy densities approach or even exceed those found in the centers of rich clusters. The outer regions of Hickson Compact Groups (HCGs) are scarcely studied. We observed a sample of HCGs (HCG, 16, 19, 30, 31, 42) with the WFI at the ESO/MPIA 2.2 m telescope at La Silla and extracted a significant number of new dwarf galaxy candidates from these very deep, wide field, broad band B and R CCD mosaic data. In order to determine dwarf elliptical (dE) galaxies belonging to the Compact groups we used the red sequence of the Color Magnitude Diagram and additionally morphology, radial profile, and the surface brightness of the candidate galaxies. Using this sample of dE galaxies we explore their structural and color properties as well as their distribution with regard to the center of the groups. The distribution of the identified high probability dE member galaxies shows an extended envelope structure in which the HCG core is embedded. Using velocity information of a subsample we calculated the radius of the zero velocity surface, beyond which galaxies participate in the Hubble expansion. We determine the approximate extension of the groups and the relation of the compact core to a possible extended halo and derive typical radii, which are of the order of 2 Mpc.

Dynamical stability of Disk Galaxies with Finite Thickness

Yi-Hui Lin, Qiu-He Peng, Chih-Kang Chou, NCU, TAIWAN

Abstract We have considered the dynamical properties of the unperturbed galactic disk with finite thickness on the basis of the exact solution of the three-dimensional Possion equation for the gravitational potential. The rigorous solution of the Possion equation for the perturbed gravitational potential is combined with the Lin-Shu hypothesis for the self-sustaining spiral density waves to obtain the dispersion relation for the propagation of spiral density waves in three-dimensional spiral galaxies with finite thickness. The dispersion relation is applied to discuss the local stability of the three-dimensional galactic disk against axi-symmetric perturbations in gravitationally coupled stars and gas. Detail analysis has been carried out to study the thickness effect, gas contained and local parameters relevant to the stability (Q-value) of the galactic disk in regimes of astrophysical interest. Our result indicates that the thickness of the galactic disk is a very important parameter in studying galactic dynamics and it has stabilizing effect on galactic disk. And the Q value of the mixed two-component system (stars and gas) in a galactic disk is shown to be always less than the Q values of the purely stellar disk and the purely gas disk cases. Hence, the two components have a mutual destabilizing effect on each other.

Not available yet

Dolf Michielsen, Universiteit Gent

Abstract not available yet

The puzzlingly large Ca II triplet absorption in dwarf elliptical galaxies

Dolf Michielsen, Universiteit Gent

Abstract We present central CaT, PaT, and CaT* indices for a sample of fifteen dwarf elliptical galaxies (dEs). Twelve of these have CaT* ~ 7 A and extend the negative correlation between the CaT* index and central velocity dispersion, which was derived for bright ellipticals (Es), down to the range of 20 - 55km/s. For five dEs we have independent age and metallicity estimates. Four of these have CaT* ~ 7A, much higher than expected from their low metallicities (-1.5 < [Z/H] < -0.5). Moreover, 3 dEs in our sample have CaT* 5 A, as would be expected for metal-poor stellar systems. Any theory for dE evolution will have to be able to explain the co-existence of low-CaT* and high-CaT* dEs at a given mean metallicity. This could be the first direct evidence that the dE population is not homogeneous, and that different evolutionary paths led to morphologically and kinematically similar but chemically distinct objects.

Probability of voids and the dependence of the galaxy formation on environmental density

Santiago Patiri, Instituto de Astrofisica de Canarias

Abstract not available yet

The Nature of E+A Galaxies in Intermediate Redshift Clusters

Kim-Vy Tran, ETH Zurich
M. Franx, G. Illingworth, D. Kelson, & P. van Dokkum

Abstract Combining HST/WFPC2 mosaics with extensive ground-based spectroscopy, we study the nature of E+A galaxies in three intermediate redshift clusters (z=0.33, 0.58, & 0.83). From a sample of ~500 confirmed cluster members, we isolate 47 E+A candidates to determine the E+A fraction and study their physical properties. We find E+A's comprise a non-negligible component (~7-13%) of the cluster population at these redshifts, and their diverse nature indicates a heterogeneous parent population. While cluster E+A's are predominantly disk-dominated systems, they span the range in Hubble type and bulge-to-total fraction to include even early-type members. Cluster E+A's also cover a wide range in luminosity (L_B< 2.5L_B*), internal velocity dispersion (<250kms), and half-light radius (<5h^(-1) kpc). From their velocity dispersions and half-light radii, we infer that the descendants of E+A's in our highest redshift cluster are massive early-type galaxies. In contrast to the wide range of luminosity and internal velocity dispersion spanned by E+A's at higher redshift, only low mass E+A's are found in nearby clusters, e.g. Coma. The observed decrease in the characteristic E+A mass is similar to the decrease in luminosity of rapidly star-forming field galaxies since z~1, i.e. galaxy “down-sizing." In addition, we argue our statistics imply that >30% of the E-S0 members have undergone an E+A phase; the true fraction could be 100% if the effects of E+A down-sizing, an increasing E+A fraction with redshift, and the conversion of spirals into early-types are also considered.

Detecting Poor Groups using strong lensing

Kurtis Williams, University of Arizona

Abstract Poor groups are common environments for galaxies and systems in which the mechanisms thought to drive galaxy evolution (primarily galaxy-galaxy interactions) are fewer than in hotter, denser clusters. Therefore, any successful galaxy evolution model must, at the very least, reproduce the properties of galaxies in groups over a wide range of redshifts. As distant groups cannot be detected with conventional methods used for finding rich clusters, few observational constraints on the evolution of galaxies in groups exist. We have undertaken a deep imaging and spectroscopic survey for galaxy groups of wide fields surrounding strong gravitational lenses, as careful modeling has suggested that groups identified in this manner are representative of the larger population of dynamically-evolved groups, and as the identified groups are crucial to appropriate modeling of the gravitational lenses. We present the first results from the survey, including statistics comparing the luminosities, colors, and structural parameters over several different epochs.

Session 8

How do Baryons and Dark Matter interact?

An Adaptive Particle Dynamical Model of the Milky Way Bulge: Application to Bulge Microlensing

Victor P. Debattista, ETH Zurich
Nicolai Bissantz and Ortwin Gerhard

Abstract We describe a dynamical model of the Milky Way built using an adaptive particle method constrained by the density distribution. The model matches the observed kinematics in several fields. We computed the model's distribution of microlensing event timescales and compared it to the observations of the MACHO group. We were able to match the observed timescale distribution with a reasonable stellar mass function. We examine the observational consequences of this mass function for parallax shifted events.

Not available yet

Kyoungsoo Lee, STScI

Abstract not available yet

Detecting gamma-photons by extragalactic Dark Matter annihilation with ground bases experiments

Lidia Pieri, Università di Roma Tre

Abstract Under the hypothesis of a Dark Matter composed by neutralinos, we investigate the possibility of detecting their annihilation products in the galaxies of the Local Group. Expected gamma-ray fluxs crucially depend on the structure of their host Dark Matter halos.

We find that, for all reasonable choices Dark Matter halos models, the intensity of the gamma-ray flux from some of the nearest galaxies is high enough to be detected by next-generation Cerenkov telescopes.

Probing outer halos with SDSS satellites

Francisco Prada, Instituto de Astrofisica de Canarias

Abstract not available yet

Mass Distribution in a Dark Matter Halo

Cathryn Trott, University of Melbourne
(Co-author: Prof. Rachel Webster)

Abstract There has been much contention in recent years regarding the discrepancy between N-body simulations of cold dark matter haloes and observed galaxy rotation curves. Observations do not provide sufficient information to uniquely define the mass distribution of galactic components, leaving a degeneracy between the relative contributions of the dark and luminous matter. Gravitational lensing can break this degeneracy. We have studied the lensing galaxy 2237+0305 and modelled the major mass components with a combination of observational and lensing constraints. This additional information can break the degeneracy. We are obtaining a rotation curve that will constrain the inner slope and ellipticity of the dark matter halo.

How round is your halo? The shape of dark matter haloes from gravitational lensing

Randall Wayth, University of Melbourne

Abstract The shape and inner density profile of dark matter haloes can be strongly constrained by the strong gravitational lensing of a resolved source. We can separate the lensing effects of the visible and dark components to probe the mass in the halo around the regions of the image.

We use software based on the LensMEM algorithm to analyze optical and radio images of ER0047-2808 and MG1549-3047. We find that we can strongly constrain the ellipticity and position angle of the dark matter with 5% or better accuracy. We find that the haloes of the lensing galaxies are remarkably round, despite the ellipticity of the visible matter.