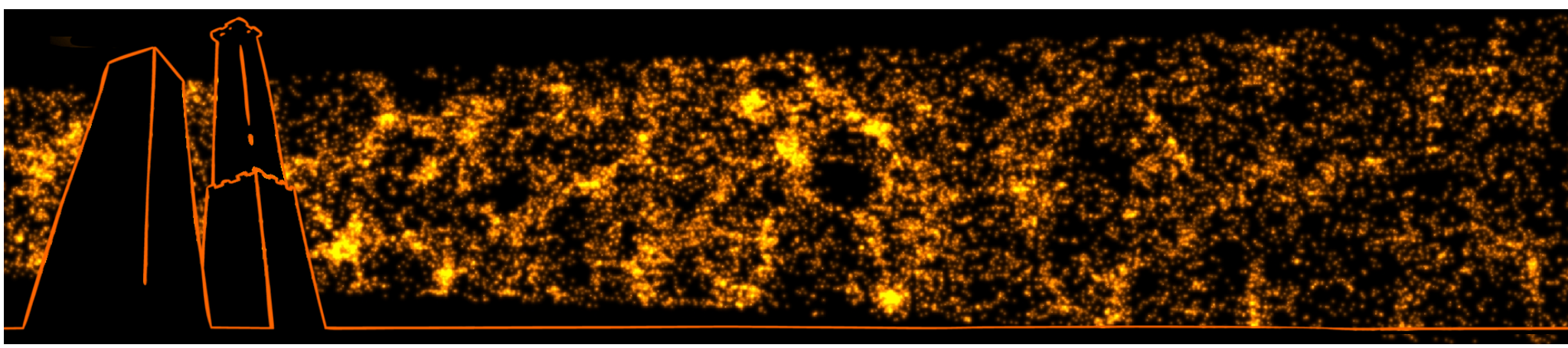
Bologna, 15-19 September 2014

Evolving Galaxies in Evolving Environments



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
DEPARTMENT OF PHYSICS AND ASTRONOMY

INAF-Osservatorio
Astronomico
di Bologna

INAF
ISTITUTO NAZIONALE
DI ASTROFISICA
NATIONAL INSTITUTE
FOR ASTROPHYSICS

PROGRAMME AND ABSTRACTS

Organising Committees

Scientific Organising Committee:

Micol Bolzonella *co-chair*	INAF-Astronomical Observatory of Bologna, Italy
Olga Cucciati *co-chair*	University of Bologna, Italy
Andrea Cimatti *co-chair*	University of Bologna, Italy
Stéphane Arnouts	Laboratoire d'Astrophysique de Marseille, France
Carlton Baugh	Durham University, UK
Gabriella De Lucia	INAF-Astronomical Observatory of Trieste, Italy
Angela Iovino	INAF-Astronomical Observatory of Brera, Italy
Tadayuki Kodama	National Astronomical Observatory of Japan, Japan
Ramin Skibba	University of California, San Diego, USA
Lourdes Verdes-Montenegro	Instituto de Astrofísica de Andalucía, Spain
David Wilman	MPE Garching, Germany

Local Organising Committee:

Samuel Boissier	Laboratoire d'Astrophysique de Marseille, France
Olga Cucciati	University of Bologna, Italy
Micol Bolzonella	INAF-Astronomical Observatory of Bologna, Italy
Iary Davidzon	INAF-OA Bologna, University of Bologna, Italy
Nicola Malavasi	University of Bologna, Italy
Olga Melnyk	Taras Schevchenko National University of Kyiv, Ukraine
Veronica Sommariva	University of Bologna, Italy
Margherita Talia	University of Bologna, Italy

Invited Speakers

Elena D'Onghia	University of Wisconsin-Madison, USA
Giuseppe Gavazzi	University of Milano Bicocca, Italy
Meghan Gray	University of Nottingham, UK
Katarina Kovač	ETH Zurich, Switzerland
Thorsten Naab	MPA Garching, Germany
Anna Pasquali	University of Heidelberg, Germany
Dave Patton	Trent University, Canada
Amélie Saintonge	UCL, UK
Debora Sijacki	University of Cambridge, UK
Christy Tremonti	University of Wisconsin-Madison, USA

Programme

Evolving Galaxies in Evolving Environments

Bologna, 15-19 September 2014

MONDAY, September 15th			
8:30-9:20	**Registration**		
9:20:9:30	**Welcome: University of Bologna and National Institute of Astrophysics**		
Session 1: Evolving Environments			
9:30-10:10	**Meghan Gray**	Univ. of Nottingham, UK	*Review talk*
10:10-10:30	**Rita Tojeiro**	Univ. of St. Andrews - UK	*The assembly history of galaxies and their environment*
10:30-10:50	**Álvaro Orsi**	CEFCA - Spain	*The evolution of massive structures revealed by star-forming galaxies around AGN*
10:50-11:10	**Iary Davidzon**	Univ. of Bologna - Italy	*Galaxy evolution in the VIPERS environments*
11:10-11:40	**Coffee Break**		
11:40-12:00	**ChangHoon Hahn**	NYU CCPP - USA	*PRIMUS: Galaxy Environment on the Quiescent Fraction Evolution at $z < 1$*
12:00-12:20	**Michaela Hirschmann**	IAP - France	*The influence of the environmental history on quenching star formation in a ΛCDM universe*
12:20-12:40	**Brian Lemaux**	LAM - France	*An Exploration of High Density at High Redshift: First Results from the VIMOS Ultra-Deep Survey*
12:40-13:00	**Bouquin, Delahaye, Dobrycheva, Falomo, Hatfield, Ishikawa, Kim, Krywult, Malavasi, Moutard, Zanichelli**		*Poster Session*
13:00-14:30	**Lunch**		

MONDAY, September 15th			
14:30-15:10	**Debora Sijacki**	Univ. of Cambridge - UK	*Review talk*
15:10-15:30	**Paola Popesso**	Excellence Cluster Universe Munich - Germany	*The role of massive halos in the Cosmic Star Formation History*
15:30-15:50	**Yusei Koyama**	ISAS/JAXA - Japan	*The environmental impacts on the star formation main sequence out to z~2*
15:50-16:10	**Matteo Fossati**	Univ. Sternwarte Munich & MPE - Germany	*The role of environment as traced by semi-analytic models and KMOS observations*
16:10-16:40	**Coffee break**		
16:40-17:00	**Yohan Dubois**	IAP - France	*Dancing in the dark: how galaxies swing in the cosmic web*
17:00-17:20	**Manuela Magliocchetti**	INAF-IAPS Rome - Italy	*Cosmic dichotomy in the hosts of star-forming galaxies at low and high redshifts*
17:20-17:40	**Sukyoung Yi** (from Session 5)	Yonsei Univ. - Korea	*Merger relics in galaxy clusters*
17:40-18:10	**Discussion - Tadayuki Kodama**		
18:30	**Welcome cocktail at *Chalet dei Giardini Margherita***		

canning

TUESDAY, September 16th			
Session 2: Central Galaxies			
9:30-10:10	**Christy Tremonti**	Univ. of Wisconsin-Madison - USA	*Review talk*
10:10-10:30	**José Sabater**	IfA, Univ. of Edinburgh - UK	*Triggering optical AGN: the need for cold dense gas, and the indirect roles of galaxy environment and interactions*
10:30-10:50	**Marcello Cacciato** (from Session 1)	Leiden Observatory - Netherlands	*Properties of GAMA galaxies (in different environments) from a lensing analysis of the KiDS survey*
10:50-11:10	**Viola Allevato**	Univ. of Helsinki - Finland	*Clustering properties of X-ray Type 1 and 2 AGNs in COSMOS at z~3*
11:10-11:40	**Coffee Break**		
11:40-12:00	**Yen-Ting Lin**	ASIAA - Taiwan	*The stellar mass growth of brightest cluster galaxies*
12:00-12:20	**Amelia Fraser-McKelvie**	Monash Univ. - Australia	*The Rarity of Star Formation in Brightest Cluster Galaxies as Measured by WISE*
12:20-12:40	**Gian Luigi Granato**	INAF-OA Trieste - Italy	*Brightest cluster galaxies in cosmological simulations: achievements and limitations of active galactic nuclei feedback models*
12:40-13:00	**Bonaventura, Gitti, Munari, Padilla-Torres, Piryia, Rawle, Rérat, Streblyanska, Talia, van der Burg,**		*Poster Session*
13:00-14:30	**Lunch**		

TUESDAY, September 16th			
14:30-14:50	**Carlo Nipoti** (from Session 4)	Univ. of Bologna - Italy	*Environmental dependence of the structural evolution of early-type galaxies*
14:50-15:10	**Rebecca Canning** (from Session 4)	Stanford University/KIPAC - USA	*Triggering X-ray AGN in the cluster environment*
15:10-15:30	**Michelle Furlong**	ICC, Univ. of Durham - UK	*Probing Galaxy Quenching Mechanisms using the Eagle Hydro-Simulations*
15:30-15:50	**Dongyao Zhao**	Univ. of Nottingham - UK	*The relationship between morphology and structure of Brightest Cluster Galaxies and their environment*
15:50-16:10	**William Hartley**	ETH Zurich - Switzerland	*Galactic conformity and central / satellite quenching at 0.4<z<1.9 in the UKIDSS UDS*
16:10-16:30	**Adams, Choi, Chung, De Propris, Kasparova, Lonoce, Pappalardo, Posti, Valentini, Venturi**		*Poster Session*
16:30-17:00	**Coffee break**		
16:40-17:00	**Francesco La Barbera**	INAF-OA Capodimonte - Italy	*The environmental fossil record of early-type galaxies*
17:00-17:20	**Philip Best**	IfA Edinburgh - UK	*The cosmic evolution of radio-AGN feedback to z=1*
17:20-18:10	**Discussion: Dave Wilman**		

WEDNESDAY, September 17th			
Session 3: Multiphase gas			
9:30-10:10	**Amélie Saintonge**	UCL - UK	*Review talk*
10:10-10:30	**Ryan Cybulski**	Univ. of Massachusetts - USA	*COOL BUDHIES: the interplay of gas, star-formation activity, and environment around two galaxy clusters at z~0.2*
10:30-10:50	**Bianca Poggianti**	INAF-OA Padova - Italy	*Gas stripping in clusters*
10:50-11:10	**Khee-Gan Lee**	MPIA - Germany	*Constraining z~2 Galaxy Environments with Ly-a Forest Tomography*
11:10-11:40	**Coffee Break**		
11:40-12:00	**Emily Freeland**	Stockholm Univ. - Sweden	*Tracing Outflows and Shocked Disk Gas in Supergroup Galaxies*
12:00-12:20	**Pierre Ocvirk**	Obs. Astr. de Strasbourg - France	*Internal and external regulation of star formation in dwarf galaxies by radiative feedback in coupled radiative-hydrodynamics simulations of the reionization*
12:20-12:40	**Paramita Barai**	INAF-OA Trieste - Italy	*Gas and Stellar Properties of Simulated Galaxies in Cosmological Volumes*
12:40-13:00	**Eva Busekool**	Univ. of Groningen - Netherlands	*HI properties of galaxies in the Ursa Major region and the Perseus-Pisces filament*
13:00-13:30	**Discussion: Peppo Gavazzi**		
13:30	**Lunch - Free afternoon**		

THURSDAY, September 18th			
Session 3: Satellite Galaxies			
9:30-10:10	**Peppo Gavazzi**	Univ. of Milano Bicocca - Italy	*Review talk*
10:10-10:30	**Allison Noble**	Univ. of Toronto - Canada	*The Phase Space of z=1.2 Clusters: Using Herschel to probe Dust Temperature as a Function of Environment and Accretion History*
10:30-10:50	**Christian Maier**	Univ. of Vienna - Austria	*The existence and universality of the fundamental metallicity relation of star-forming galaxies in CLASH clusters at z~0.4*
10:50-11:10	**Anna Gallazzi**	INAF-OA Arcetri - Italy	*Element abundance ratios and star formation quenching in central and satellite galaxies*
11:10-11:40	**Coffee Break**		
11:40-12:20	**Thorsten Naab** (from Session 2)	MPA Garching - Germany	*Review talk*
12:20-12:40	**Ewa Lokas**	Copernicus Center, Warsaw - Poland	*Formation of dwarf spheroidal galaxies by tidal stirring and mergers*
12:40-13:00	**Annunziatella, Bremer, Ciocca, Crossett, Eliche-Moral, Marino, Nehlig, Rosa, Salomé**		*Poster Session*
13:00-14:30	**Lunch**		

THURSDAY, September 18th			
14:30-15:10	**Anna Pasquali**	Univ. of Heidelberg - Germany	*Review talk*
15.10-15:30	**Gregory Rudnick**	Univ. of Kansas - USA	*Probing the End of Star Formation in Distant Cluster Galaxies*
15:30-15:50	**Oliver Steele**	ICG Univ. Portsmouth - UK	*The environmental dependence of emission lines in the GAMA survey*
15:50-16:10	**Yingjie Peng**	University of Cambridge - UK	*The dependence of the galaxy mass-metallicity relation on environment and the implied metallicity of the IGM*
16:10-16:30	**Gargiulo, González-Pérez, Jorgensen, Kelkar, Lee, Rey, Romano, Salomon, Saracco, Tortora, Valentino**		*Poster Session*
16:30-17:00	**Coffee break**		
17:00-17:20	**Ryan Quadri**	Texas A&M University - USA	*Using satellite galaxies to investigate the growth of galaxy groups and the quenching of star formation*
17:20-17:40	**Chris Haines**	Univ. de Chile - Chile	*LoCuSS: The slow quenching of star formation in cluster galaxies at z~0.2*
17:40-18:00	**Marc Huertas-Company**	GEPI - Obs. de Paris - France	*The growth of massive galaxies in dense environments*
18:00-18:40	**Discussion: Rita Tojeiro**		

FRIDAY, September 19th			
Session 3: Tight and no interactions			
9:30-10:10	**Elena D'Onghia**	Univ. of Wisconsin-Madison - USA	*Review talk*
10:10-10:30	**Carmen Eliche-Moral**	Univ. Complutense de Madrid - Spain	*The formation of a sequence of Soa–Sob–Soc galaxies through major mergers*
10:30-10:50	**Milena Pawlik**	Univ. of St. Andrews - UK	*Merger, starburst, post-merger, post-starburst... red-sequence?*
10:50-11:10	**Rosita Paladino**	Univ. of Bologna, INAF-IRA - Italy	*LOFAR observations of the Leo Triplet : searching for radio low frequency evidence of interaction*
11:10-11:40	**Coffee Break**		
11:40-12:00	**Gary Mamon**	IAP - France	*Optimal grouping algorithms and recent advances on compact groups*
12:00-12:20	**Jaime Perea**	Inst. de Astrofisíca de Andalucía CSIC - Spain	*The properties of the central galaxies formed through collisionless hierachical merging in small groups*
12:20-12:40	**Anna Cibinel**	CEA Saclay - France	*A Twofold Look on Environmental Effects: Satellite Quenching and Merger-Induced Star Formation in the ZENS Survey*
12:40-13:00	**Beghetto, Concas, Cordero, Dierickx, Domingue, Greggio, Kirihara, Morales, Solanes, Wu, Zarattini**		*Poster Session*
13:00-14:10	**Lunch**		

FRIDAY, September 19th			
14:10-14:50	**Dave Patton**	Univ. of Trent - Canada	*Review talk*
14:50-15:10	**Mirian Fernández Lorenzo**	Inst. de Astrofísica de Andalucía-CSIC - Spain	*Pseudobulges in isolated galaxies*
15:10-15:30	**Angela Sandrinelli**	Univ. of Insubria - Italy	*Relationship between QSO pairs and their galaxy environment*
15:30-15:50	**Allison Man**	Dark Cosmology Centre - Denmark	*Explaining the discrepancy in the observed galaxy merger fractions at z=0-2.5*
15:50-16:20	**Coffee break**		
16:20-16:40	**Carlos López-Sanjuan**	CEFCA Teruel - Spain	*The ALHAMBRA survey: Accurate photometric merger fractions from PDF analysis*
16:40-17:00	**Olga Melnyk**	Univ. of Kyiv - Ukraine	*Colours and star formation rates of isolated galaxies*
17:00-17:40	**Katarina Kovač**	ETH Zurich - Switzerland	*Concluding remarks and discussion*

Evolving environments

INVITED TALKS:

MEGHAN GRAY

(UNIV. OF NOTTINGHAM - UK)

DEBORA SIJACKI

(UNIV. OF CAMBRIDGE - UK)

Topics: clusters, groups, density field, clustering, dark matter environment, and how they depend globally on redshift)

- Marcello Cacciato
  Properties of GAMA galaxies (in different environments) from a lensing analysis of the KiDS survey
- Iary Davidzon
  Galaxy evolution in the VIPERS environments
- Yohan Dubois
  Dancing in the dark: how galaxies swing in the cosmic web
- Matteo Fossati
  The role of environment as traced by semi-analytic models and KMOS observations
- ChangHoon Hahn
  PRIMUS: Galaxy Environment on the Quiescent Fraction Evolution at z<1
- Michaela Hirschmann
  The influence of the environmental history on quenching star formation in a ΛCDM universe
- Yusei Koyama
  The environmental impacts on the star formation main sequence out to z~2
- Brian Lemaux
  An Exploration of High Density at High Redshift: First Results from the VIMOS Ultra-Deep Survey
- Manuela Magliocchetti
  Cosmic dichotomy in the hosts of star-forming galaxies at low and high redshifts
- Álvaro Orsi
  The evolution of massive structures revealed by star-forming galaxies around AGN
- Paola Popesso
  The role of massive halos in the Cosmic Star Formation History
- Rita Tojeiro
  The assembly history of galaxies and their environment

Marcello Cacciato
Leiden Observatory (Netherlands)

Properties of GAMA galaxies (in different environments) from a lensing analysis of the KiDS survey

Galaxy-galaxy lensing is a statistical probe of the mass distribution around galaxies. In turn, it allows for a detailed scrutiny of the galaxy-dark matter connection. We measure the tangential shear distortion around spectroscopically selected galaxies from the GAMA survey using background galaxy shapes extracted from the spatially overlapping regions of the deeper, higher imaging quality KiDS survey. We first establish satellite fractions of galaxies of various luminosity and at different redshifts. Exploiting the completeness of GAMA down to r=19.8 magnitude and the fidelity of the GAMA group catalogue, we then probe the amount of matter associated to satellite galaxies as a function of their stellar mass and distance from the centre of the group. We compare the lensing signal of satellite galaxies with that of equal stellar mass galaxies in the field, thus observationally probing mass stripping as galaxies approach denser environments. We emphasize that, apart for a few tentative cases, this is the first time that a robust galaxy-galaxy lensing analysis is performed to directly probe the matter associated to satellite galaxies in a statistical manner. As the statistical power of galaxy-galaxy lensing will drastically increase in the near future (see e.g. DES, full-KiDS, HSC, Euclid), we envision that these measurements will become a standard test for galaxy formation models.

Iary Davidzon
University of Bologna & INAF-OA Bologna (Italy)

Galaxy evolution in the VIPERS environments

With more than 57,000 (and counting) objects, the VIMOS Public Extragalactic Redshift Survey (VIPERS, Guzzo et al. 2014) is assembling the largest spectroscopic galaxy catalogue between redshift 0.5 and 1.2. Thanks to the accurate spectroscopic redshifts of VIPERS, we are able to trace the 3-dimensional structure of the galaxy density field. In addition, we recover the LSS skeleton and provide an alternative definition of environment, identifying filaments, walls and voids. We investigate the role of the density field in quenching the star formation of galaxies at intermediate redshifts. From a different point of view, we search for correlations between physical properties of galaxies and their distance from filaments. Over cosmic time, we observe how massive galaxies ($M_{\star}>10^{10.5}$ $M_{\odot}$) turn from active into passive in low- and high-density regions, using VIPERS data to test different mechanisms of environment quenching. We also obtain new constraints to galaxy merging, to be compared with estimates derived from galaxy pairs.

Yohan Dubois
Institut d'Astrophysique de Paris (France)

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.

Matteo Fossati
Universitaet Sternwarte München / MPE (Germany)

The role of environment as traced by semi-analytic models and KMOS observations

The role of the environment in the formation and assembly of stars in galaxies is hotly debated. With KMOS, the revolutionary multiplexing NIR integral field spectrograph on the VLT, we can investigate the influence of environment on the star formation activity of z~0.7- 2.5 galaxies via the Ha+NII emission complex.
A robust definition of environment requires accurate calibrations that I will present, using the most up to date semi-analytic models derived from the Millennium simulation. I will focus on the correlation between observables (e.g. galaxy density, stellar masses) and properties only available in the simulated Universe such as Halo masses and central/satellite status.
I will then present early results from our mass-selected KMOS^3D program, focusing on the dependence of the ionized gas properties derived from KMOS on the high redshift environment.

ChangHoon Hahn
NYU CCPP (USA)

PRIMUS: Galaxy Environment on the Quiescent Fraction Evolution at z < 1

We investigate the effects of galaxy environment on the evolution of the quiescent fraction (f_Q) from z =0.8 to 0.0 using spectroscopic redshifts and multi-wavelength imaging data from PRism MUlti-object Survey (PRIMUS) and the Sloan Digital Sky Survey (SDSS). Our stellar mass limited galaxy sample consists of ~40000 PRIMUS galaxies within z = 0.2-0.8 and ~130000 SDSS galaxies within z = 0.0375-0.145. We classify the galaxies as quiescent or star-forming, based on an evolving specific star formation cut, and as low or high density environments, based on fixed cylindrical aperture environment measurements on a volume-limited Environment Definition Population (from PRIMUS and SDSS). We examine the stellar mass function (SMF) evolution for each of our subsamples of quiescent and star-forming galaxies in low and high density environments. We find, from the f_Q(M*) computed from these SMFs, that in both low and high density environments the quiescent fraction increases with cosmic time over the probed redshift range. Moreover, the difference between the quiescent fraction in low and high density environments remains constant throughout the redshift range. These results suggest that the evolution of the quiescent fraction is independent of environment and provide constraints on quenching mechanisms in high density environments such as groups and clusters.

Michaela Hirschmann
Institut d'Astrophysique de Paris (France)

The influence of the environmental history on quenching star formation in a ΛCDM universe

We present a detailed analysis of the influence of the environment and of the environmental history on quenching star formation in satellite galaxies in the local Universe. We take advantage of publicly available galaxy catalogues obtained from applying a galaxy formation model to the Millennium simulation. In addition to halo mass, we consider the local density of galaxies within various fixed scales. Comparing our model predictions to observational data (SDSS), we demonstrate that the models are failing to reproduce the observed density dependence of the quiescent galaxy fraction as for a given stellar mass ($< 10^{11}$ $M_{\odot}$) and density, models significantly over-estimate that of satellites. The density dependence of quiescent fractions of satellites reflects a dependence on the time spent orbiting within a parent halo of a particular mass, correlating strongly with halo mass and distance from the halo centre. Comparisons with observational estimates suggest relatively long gas consumption time scales of roughly 5-7 Gyr in low mass satellite galaxies. The quenching time scales decrease with increasing satellite stellar mass. We demonstrate that a change in modeling both internal processes (e.g. stellar feedback) and environmental processes is required for predicting such long quenching time-scales and for improving currently used galaxy formation models in this respect.

Yusei Koyama
ISAS/JAXA (Japan)

The environmental impacts on the star formation main sequence out to z~2

Studying the environmental dependence of the star-formation (SF) main sequence in the distant universe is obviously an important step towards understanding the physics of environmental effects on galaxies in the peak epoch of galaxy formation. However, it is not an easy task - because it requires a large sample of distant SF galaxies across cosmic time and environment. We here present our recent efforts on tracking down the environmental impacts on the SF main sequence out to z~2. By compiling our large, purely H-alpha selected galaxy samples in distant clusters (from our MAHALO-Subaru campaign) and in general field environments (from HiZELS), we find that there is no detectable environmental variation in the location of the SF main sequence out to z~2, as far as we rely on the simple H-alpha based SFRs. However, in contrast to this apparently simple picture, we also find an interesting hint that SF galaxies in high-z cluster environments tend to be more massive, and perhaps more highly obscured by dust, implying a different mode of SF activity prevailing in galaxies at different environments. We argue that those massive/dusty galaxies surviving in distant cluster environments must be in a key transitional phase under environmental effects in the early universe.

Brian Lemaux
Laboratoire d'Astrophysique de Marseille (France)

An Exploration of High Density at High Redshift: First Results from the VIMOS Ultra-Deep Survey

The recently completed VIMOS Ultra-Deep Survey (VUDS) is a massive spectroscopic survey aimed at the high-redshift (z>2) universe targeting roughly 10,000 very faint objects across three well-known fields of the sky. Though originally designed as a â€œfieldâ€ survey, VUDS observations, in tandem with additional existing spectroscopy, deep multi-band optical/NIR imaging, and other multi-wavelength ancillary data, were used to perform a preliminary census of the effects of environment in the early universe. I will discuss the initial challenges and triumphs of this investigation, including the discovery of Cl J0227-0421, a massive proto-cluster of galaxies at z~3.3. I will then discuss prospects for future investigations of the role of environment with VUDS utilizing the ~40 spectroscopic overdensities found to date.

Manuela Magliocchetti
INAF-IAPS Roma (Italy)

Cosmic dichotomy in the hosts of star-forming galaxies at low and high redshifts

We use Herschel-PEP observations of GOODS, COSMOS and Extended Groth Strip to estimate the dependence of the clustering properties of star-forming galaxies on cosmic epoch between z=0 and z=2.5.

In order to remove any possible bias in the selection process, we only include galaxies observed at the same rest-frame wavelength, with comparable bolometric luminosities and therefore star-formation rates (SFRs >~ 100 $M_\odot$/yr).

Our analysis shows that the same amount of (intense) star forming activity takes place in extremely different environments at the different cosmological epochs. At relatively modest z<1 redshifts the hosts of star forming systems are small, Mhalo ~ 10^{11} $M_\odot$, isolated galaxies.

High (z~2) redshift star formation instead seems to uniquely take place in extremely massive/ cluster-like halos, M_{halo} ~ $10^{13.5}$ $M_\odot$, which are associated with the highest peaks of the density fluctuation field at those epochs.

We also show how this result is not specific to FIR galaxies but is a general characteristic of star-forming galaxies, which holds for all sources selected throughout most of the electromagnetic spectrum from the radio to the UV.

Álvaro Orsi
CEFCA Teruel (Spain)

The evolution of massive structures revealed by star-forming galaxies around AGN

We predict the properties of protoclusters traced by QSOs and radio galaxies surrounded by star-forming emission line galaxies in a semi-analytical galaxy formation model. Our strategy combines a robust treatment for the coupled evolution of the central super-massive black hole and its host galaxy, and a Lyman-alpha radiative transfer model to compute the abundance and properties of Ly-alpha emitters (LAEs). Our analysis spanning z~2-6 reveals that radio galaxies are predicted to be hosted by more massive haloes than QSOs. However, emission-line galaxies tend to avoid the centre of massive haloes, making the interpretation of counts of galaxies around AGNs non-trivial.

LAEs in protoclusters are found to be more massive and metal rich than field LAEs, a prediction that could be challenged by future observations with instruments such as MUSE and MOSFIRE, thus providing new constraints to the feedback mechanisms acting in high density environments.

Paola Popesso
Excellence Cluster Universe Munich (Germany)

The role of massive halos in the Cosmic Star Formation History

The most striking feature of the Cosmic Star Formation History (CSFH) of the Universe is a dramatic drop of the star formation activity since z~1. This period coincides with the formation of the cosmic web as we know it. Thus, it is mandatory to ask if the very same process of structure formation may be one of the main causes. For this purpose we study the contribution to the CSFH of galaxies in halos of different masses. Our results show that the contribution of low mass groups provides a 60-80% contribution at z~1. Such contribution declines faster than the CSFH to less than 1% at z<0.3. The most massive systems provide only a marginal contribution (< 1%) at any epoch. The large contribution of low mass groups at z~1 is due to a large fraction of very massive galaxies on the Main Sequence inhabiting such halos. Below z~1 a quenching process takes place in massive halos to suppress the SF activity. Such process must be a slow one though, as most of the models implementing a rapid SF quenching in accreting satellites significantly underpredicts the observed SF level in massive halos at any redshift. This favors long time-scale mechanisms such as starvation or the satellite transition from cold to hot accretion. Our results suggest a scenario in which due to the structure formation process, more and more galaxies experience the group environment and, thus, the associated quenching process since z~1, leading to the observed progressive decline of the CSFH.

Rita Tojeiro
University of St Andrews (UK)

The assembly history of galaxies and their environment

Halo distribution models are becoming an increasingly powerful tool to understand galaxy evolution. Whereas simple halo models predict that the present-day content of dark matter halos depends only on their total mass, others have suggested further dependencies - for example, on their assembly history or formation time (a so called “halo assembly bias”). In turn, the assembly of stellar mass in galaxies is intrinsically linked to the formation of structure and the growth of dark matter halos. I will show results from recent work on the GAMA survey, where we combine detailed star-formation histories of local galaxies with robust estimates of local environment to look for a detection of halo assembly bias, and test one of the most basic assumptions of currently widely used halo models. I will also characterise the assembly history of stellar mass in galaxies, show how it depends on present-day local environment, and discuss the implications for galaxy evolution models.

Central galaxies

Invited talks:

Christy Tremonti

(Univ. of Wisconsin-Madison - USA)

Thorsten Naab

(MPA Garching - Germany)

Topics: links between accretion, bulge growth, star formation & AGN feedback, including BCGs

- Viola Allevato
  Clustering properties of X-ray Type 1 and 2 AGNs in COSMOS at z~3
- Philip Best
  The cosmic evolution of radio-AGN feedback to z=1
- Amelia Fraser-McKelvie
  The Rarity of Star Formation in Brightest Cluster Galaxies as Measured by WISE
- Michelle Furlong
  Probing Galaxy Quenching Mechanisms using the Eagle Hydro-Simulations
- Gian Luigi Granato
  Brightest cluster galaxies in cosmological simulations: achievements and limitations of active galactic nuclei feedback models
- William Hartley
  Galactic conformity and central / satellite quenching at 0.4
- Francesco La Barbera
  The environmental fossil record of early-type galaxies
- Yen-Ting Lin
  The stellar mass growth of brightest cluster galaxies
- José Sabater
  Triggering optical AGN: the need for cold dense gas, and the indirect roles of galaxy environment and interactions
- Tracy Webb
  A Massive Galaxy Cluster at z = 1.7 and the In-Situ Formation of its Central Galaxy
- Dongyao Zhao
  The relationship between morphology and structure of Brightest Cluster Galaxies and their environment

Viola Allevato
University of Helsinki (Finland)

Clustering properties of X-ray Type 1 and 2 AGNs in COSMOS at z~3

Measurements of the spatial distribution of AGN in the Universe, provides a unique way to study the typical environment in which AGN preferentially reside, through the connection with their host dark matter halos and to address which physical processes are triggering AGN activity. In this presentation I will talk about the clustering properties and the halo occupation distribution of X-ray selected AGN, from XMM and Chandra data in the COSMOS survey at different redshifts. I'll show some recent results on the clustering of COSMOS AGN at z~3 and the implications in terms of AGN triggering mechanisms.

Philip Best
IfA Edinburgh (Uk)

The cosmic evolution of radio-AGN feedback to z=1

I present the first measurement of the radio luminosity function of 'jet-mode' (radiatively-inefficient) radio-AGN out to z=1, in order to investigate the cosmic evolution of radio-AGN feedback. Eight radio source samples are combined to produce a catalogue of 211 radio-loud AGN with 0.5<z<1.0, which are spectroscopically classified into jet-mode and radiative-mode (radiatively-efficient) AGN classes. Comparing with large samples of local radio-AGN from the Sloan Digital Sky Survey, the cosmic evolution of the radio luminosity function of each radio-AGN class is independently derived. I show that the space density of jet-mode radio-AGN decreases with increasing redshift at low radio luminosities ($L < 10^{24}$ W/Hz) but increases at higher radio luminosities. I present simple models that can explain the observed evolution. In the best-fitting models, the characteristic space density of jet-mode AGN declines with redshift in accordance with the declining space density of massive quiescent galaxies, which fuel them via cooling of gas in their hot haloes. The data favour a time delay of 1.5-2 Gyr between the quenching of star formation and the onset of jet-mode radio-AGN activity, presumably related to the timescale needed for hot gas cooling to become established. The behaviour at higher radio luminosities can be explained by an increasing characteristic luminosity of jet-mode radio-AGN activity with redshift, due to higher gas densities.

Amelia Fraser-McKelvie
Monash University (Australia)

The Rarity of Star Formation in Brightest Cluster Galaxies as Measured by WISE

Brightest cluster galaxies (BCGs) are the most massive galaxies in the local Universe, located in extreme environments. While it is well known that the bulk of BCGs are red, there is a well-studied portion with vigorous star formation, sometimes coupled with AGN activity. In the low redshift Universe, Perseus A is a prime example, displaying a SFR > 30 $M_\odot$/yr, whilst being the archetypal example of AGN feedback. The exact portion of star forming BCGs in the local Universe is unknown however, as is the significance of this star formation. The Wide-Field Infrared Survey Explorer (WISE) AllWISE Data Release provides the first measurement of the 12 micron star formation indicator for all BCGs in the nearby Universe. We assemble a sample of 245 BCGs that constitute a volume limited sample at z<0.1 from clusters with X-ray luminosity >10^{44} erg/s to measure BCG star formation rates. 93% of the sample possesses IR SFRs of < 1 solar mass per year, while just 1% display SFRs > 10 solar masses per year. Perseus A is in the tiny minority of vigorously star forming BCGs, an outlier in a mostly passive population (Fraser-McKelvie et al., submitted).

Michelle Furlong
ICC, University of Durham (UK)

Probing Galaxy Quenching Mechanisms using the Eagle Hydro-Simulations

Hydrodynamical simulations can be a very useful tool to study the quenching mechanisms in galaxies due to their implicit inclusion of satellite stripping processes and their ability to trace objects across time to understand how and why a galaxy is quenched. The $(100\ \mathrm{Mpc})^3$ Eagle simulation is particularly suited to studying galaxy quenching following the inclusion of an angular momentum dependent black hole accretion model that produces efficient AGN feedback and reproduces observed black hole scaling relations. This AGN feedback, along with stellar feedback, results in good agreement between the simulation and observations for the redshift zero colour magnitude diagram, galaxy passive fractions and the evolution of stellar mass, making Eagle an ideal test bed for understanding galaxy quenching in halos of up to a few times $10^{14}\ \mathrm{M}_\odot$.

I will present results showing the impact of efficient AGN feedback on central galaxies, looking at the global population and individual objects. I will also show how galaxies in different environments are quenched, and how this varies with distance from the BCG and time since infall.

Gian Luigi Granato
INAF-OA Trieste (Italy)

Brightest cluster galaxies in cosmological simulations: achievements and limitations of active galactic nuclei feedback models

We analyse the properties of brightest cluster galaxies (BCGs) produced by state of the art cosmological zoom-in hydrodynamical simulations. These simulations have been run with different subgrid physics included. Here we focus on the results obtained with and without the inclusion of the prescriptions for supermassive black hole growth and of the ensuing active galactic nuclei (AGN) feedback. The latter process goes in the direction of decreasing significantly the overall formation of stars. However, BCGs end up still containing too much stellar mass, a problem that increases with halo mass, and having an unsatisfactory structure. This is in the sense that their effective radii are too large, and that their density profiles feature a flattening on scales much larger than observed. We also find that our model of thermal AGN feedback has very little effect on the stellar velocity dispersions, which turn out to be very large. These problems, which to some extent can be recognized also in other numerical studies typically dealing with smaller halo masses, indicate that on one hand present day subresolution models of AGN feedback are not effective enough in diminishing the global formation of stars in the most massive galaxies, but on the other hand they are relatively too effective in their centres. It is likely that a form of feedback generating large-scale gas outflows from BCGs precursors, and a more widespread effect over the galaxy volume, can alleviate these difficulties.

William Hartley
ETH Zurich (Switzerland)

Galactic conformity and central / satellite quenching at 0.4<z<1.9 in the UKIDSS UDS

A curious correlation exists between the star-formation activities of central galaxies and their satellites. The tendency for passive central galaxies to have an enhanced fraction of passive satellites (and vice-versa) has been dubbed 'galactic conformity', and has been demonstrated at group and sub-group halo masses. Theoretical models that include only halo-mass dependent quenching mechanisms are unable to reproduce this behaviour. Understanding how conformity arises may therefore lead us to new discoveries regarding the physical processes that govern the termination of star-formation in satellite galaxies. A vital, but currently unknown, aspect of the conformity effect is how it evolves with redshift. Thus far the correlation has only been identified at low redshift (z~0.1). In this contribution I use the UKIDSS Ultra Deep Survey to investigate the properties and radial distribution of satellite galaxies around typical mass (M*) galaxies over 0.4<z<1.9. I show that galactic conformity is present to at least z~2 and is not a simple manifestation of halo-mass-driven effects. Finally, I discuss some of the possible implications of conformity for the quenching of central and satellite galaxies.

Francesco La Barbera
INAF-OA Capodimonte (Italy)

The environmental fossil record of early-type galaxies

I will present a detailed analysis of how environment affects the star formation history of early-type galaxies (ETGs), based on a large (N=20,977) sample of ETGs selected from the SDSS-based SPIDER survey. We analyze ETGs according to their central velocity dispersion (sigma), which relates to local drivers of star formation, and the mass of the parent halo (the "environment") where they reside. Splitting the sample into central (the most massive galaxy in a halo) and satellite galaxies, we find that age, metallicity, and alpha/Fe, increase with sigma. However, while no environmental dependence is detected for satellite ETGs, our study reveals that central ETGs in groups have younger ages, lower alpha/Fe, and higher internal reddening, than "isolated" systems. Moreover, central ETGs exhibit a significant environmental trend in the abundance ratios of several chemical species. These findings suggest that central ETGs in groups formed their stellar component over longer time scales than those in "isolation", mainly because of gas-rich interactions with their companion galaxies.

Yen-Ting Lin
ASIAA Taipei (Taiwan)

The stellar mass growth of brightest cluster galaxies

The details of the stellar mass assembly of brightest cluster galaxies (BCGs) remain a challenging problem in galaxy formation. We have developed a novel approach that allows us to construct cluster samples that form an evolutionary sequence (i.e., the clusters on the sequence are expected to evolve into each other in a statistical sense), and have applied it to the IRAC Shallow Cluster Survey to examine the stellar mass evolution of BCGs in progenitors of present-day clusters with mass of 3×10^{14} $M_{\odot}$. We follow the cluster mass growth history extracted from cosmological simulations, and then select high-z clusters of appropriate mass to be progenitors of the given set of z=0 clusters. We find that, between z=1.5 and 0.5, the BCGs have grown by a factor of 2.3, which is well-matched by the predictions from a state-of-the-art semi-analytic model. At z<0.5, while the model BCGs continue to grow at constant rate, the observed BCGs show <10% increase in stellar mass content down to z~0. Such a behavior is also found in a much more massive cluster sample detected by Planck satellite. Finally, we compare these results to a suite of high resolution cosmological hydrodynamical simulations of cluster formation, and comment on the importance of intracluster stars in bridging the discrepancy between observations and theory.

José Sabater
IfA, University of Edinburgh (UK)

Triggering optical AGN: the need for cold dense gas, and the indirect roles of galaxy environment and interactions

We present a study of the prevalence and luminosity of Active Galactic Nuclei (AGN; traced by optical spectra) as a function of both environment and galaxy interactions. For this study we used a sample of more than 250000 galaxies drawn from the Sloan Digital Sky Survey and, crucially, we controlled for the effect of both stellar mass and central star formation activity. Once these two factors are taken into account, the effect of the local density of galaxies and of one-on-one interactions is minimal in both the prevalence of AGN activity and AGN luminosity. This suggests that the level of nuclear activity depends primarily on the availability of cold gas in the nuclear regions of galaxies and that secular processes can drive the AGN activity in the majority of cases. Large scale environment and galaxy interactions only affect AGN activity in an indirect manner, by influencing the central gas supply.

Tracy Webb
McGill University (Canada)

A Massive Galaxy Cluster at z = 1.7 and the In-Situ Formation of its Central Galaxy

We announce the discovery of massive galaxy cluster at z=1.7 with a star-bursting central galaxy. The system was detected within the Spitzer Adaptation of the Red-Sequence Cluster Survey (SpARCS), and is confirmed through Keck-MOSFIRE spectroscopy. The total halo mass is currently unconstrained, however the rest-frame optical richness measurement of N_{gal} = 20 implies a substantial system, comparable to the handful of other clusters known at this redshift. The cluster is has a wealth of ancillary data available, particularly in the IR regime, through the SWIRE and HerMES Legacy surveys with Spitzer and Herschel, respectively. We add to this deep submm imaging with the new SCUBA2 bolometer array on the JCMT. These data reveal that the BCG is an Ultra-luminous Infrared Galaxy with an estimated LIR = 7×10^{12} $L_{\odot}$. Moreover, the detection of polycyclic aromatic hydrocarbons (PAHs) in the IR spectrum implies the infrared luminosity is dominated by star formation, with an estimated rate of ~1200 $M_{\odot}$/yr. The rest-frame optical imaging (though limited) shows no obvious evidence for a major galaxy merger within the core, and thus gas deposition through a cooling flow is a possible mechanism, similar to the z=0.6 Phoenix cluster, but seen at a much earlier epoch.

Dongyao Zhao
University of Nottingham (UK)

The relationship between morphology and structure of Brightest Cluster Galaxies and their environment

cD galaxies are a unique type of BCGs whose structure is physically different from that of normal elliptical BCGs. In this work, we use a large sample of 625 morphologically-classified BCGs to quantify the structural differences between cD and elliptical BCGs and explore the effect from environment on their properties. By fitting the galaxies 2D light profile using different model components we find that morphologically-classified cDs possess an unique extended envelope clearly distinct from their central bulge while morphologically-classified elliptical BCGs do not. The bulge of cD galaxies is structurally similar to elliptical BCGs, but it has typically a larger size. Based on this quantitative analysis, we propose an objective diagnostic to automatically separate cDs from non-cD BCGs using structural information only, and thus avoiding the need for visual classification. We also find that the most massive BCGs, which are usually cDs, tend to reside in the densest clusters. Although the stellar masses of BCGs does correlate with environment, there is a considerable scatter. The mass-radius relation for BCGs is, however, environment-independent. Interestingly, at similar densities cD galaxies are generally more massive and larger than elliptical BCGs. This suggests that cDs originated as elliptical BCGs and grew in mass and size by developing their unique stellar envelopes from minor mergers.

Multiphase gas

INVITED TALKS:

AMÉLIE SAINTONGE

(UCL - UK)

PEPPO GAVAZZI

(UNIV. OF MILANO BICOCCA - ITALY)

Topics: observations and simulations of gas budget vs halo mass, hot gas (detection, cooling, stripping), warm gas (absorption studies, abundance), cold gas (detection of flows, abundance)

- Paramita Barai
  Gas and Stellar Properties of Simulated Galaxies in Cosmological Volumes
- Eva Busekool
  HI properties of galaxies in the Ursa Major region and the Perseus-Pisces filament
- Ryan Cybulski
  COOL BUDHIES: the interplay of gas, star-formation activity, and environment around two galaxy clusters at z~0.2
- Emily Freeland
  Tracing Outflows and Shocked Disk Gas in Supergroup Galaxies
- Khee-Gan Lee
  Constraining z~2 Galaxy Environments with Ly-a Forest Tomography
- Pierre Ocvirk
  Internal and external regulation of star formation in dwarf galaxies by radiative feedback in coupled radiative-hydrodynamics simulations of the reionization
- Bianca Poggianti
  Gas stripping in clusters

Paramita Barai
INAF-OA Trieste (Italy)

Gas and Stellar Properties of Simulated Galaxies in Cosmological Volumes

I will report our ongoing development and performance of cosmological hydrodynamical simulations, and subsequent analysis of simulated galaxy properties. The incorporation of sub-pc scale baryonic physics, e.g. feedback from star formation (SF) and supernova (SN) explosions, in kpc's resolution galaxy simulations is computationally challenging because of the large dynamical range. Aiming to improve such sub-resolution numerical implementation, we consider novel baryonic feedback models in the 3D TreePM-SPH code GADGET-3 : energy feedback from SN-driven galactic outflows (Barai et al. 2013, MNRAS, 430, 3213), and the MUPPI model of SF in multiphase ISM (Murante et al. 2010, MNRAS, 405, 1491). We simulate cosmological volumes using these models, also including radiative cooling, SF, and chemical enrichment. The impact of different feedback mechanisms on the galaxy properties are analyzed, and confronted with observations, where available. Some of the properties relevant for this conference are: SF rate; gas fraction, stellar fraction, gas outflow velocity and mass loading in galaxies; density, temperature-phases (cold, warm, hot) and metal enrichment of the circumgalactic gas. Results from such studies will be presented.

Eva Busekool
University of Groningen, Kapteyn Astronomical Institute (Netherlands)

HI properties of galaxies in the Ursa Major region and the Perseus-Pisces filament

Blind HI imaging surveys have been carried out of the Ursa Major region and the Perseus-Pisces filament using the VLA. The goals of these surveys are to investigate the slope of the HI Mass Function (HIMF), the scatter in the Tully-Fisher relation, and HI morphologies and kinematics of the galaxies in these different environments. Here we report on the HIMF of the Ursa Major volume and the HI detected galaxies in the Perseus-Pisces filament. We measured the HIMF of the Ursa Major region down to HI masses of 2×10^7 $M_\odot$. The slope of the low-mass end of the HIMF ($\alpha = -0.88 \pm 0.04$) is quite different from the recent HIPASS and ALFALFA results, which are -1.37 and -1.33 respectively. The slope seems to change due to environmental effects. The slope of the HIMF of the Ursa Major region is similar to the slope of its R-band luminosity function. Currently all 44 individual VLA pointings of the Perseus-Pisces filament are reduced and galaxies are being extracted from the cubes. Among the detected galaxies are two early type galaxies with huge HI disks. In the future all pointings will be mosaiced to obtain more uniform sensitivity across the observed 8 squared degrees. This also serves as a test case for future AperTIF surveys.

Ryan Cybulski
University of Massachusetts, Amherst (USA)

COOL BUDHIES: the interplay of gas, star-formation activity, and environment around two galaxy clusters at z~0.2

One of the most pressing issues in galaxy evolution today is the interplay between gas content, star-formation activity, and environment. To address this issue, we have carried out a pilot study with the Redshift Search Receiver on the Large Millimeter Telescope to examine the molecular gas content of galaxies in two clusters at z~0.2, as part of the Blind Ultra-Deep HI Environment Survey (BUDHIES). These two fields have a rich multi-wavelength data set, including extremely deep observations in HI, UV, and Mid- to Far-IR, and so our addition of CO observations allows us to characterize the total cold gas content, and trace the effects of environment on the atomic and molecular gas components as well as on SFR. Our sample of 26 galaxies spans a wide range of environments in and around these two clusters, from within the cluster core to projected radii of 4-5 Mpc. We compare our results to other reference samples, like the COLD GASS survey, and show that although our sample of galaxies show molecular gas content consistent with other galaxies of similar mass, our sample is comparatively much more deficient in atomic gas. We characterize the environments of the galaxies in both our own sample and in the reference samples, using the Voronoi Tessellation and Minimal Spanning Tree techniques previously published in our study of the Coma Supercluster, and show the effect that environment plays in the stripping of gas and how this in turn affects star-formation activity.

Emily Freeland
University of Stockolm (Sweden)

Tracing Outflows and Shocked Disk Gas in Supergroup Galaxies

Environment is known to play a role in the evolution of galaxies. I will discuss a multi-wavelength study of four galaxy groups at z=0.37 which will merge to form a Coma-sized cluster. This system has an excess of AGN compared to field and cluster environments at similar redshift. We sparsely map possibly outflowing extraplanar gas in two edge-on galaxies and discuss the fate of this gas. We discover a set of galaxies whose disk gas is being heated by shocks and discuss star formation quenching in these galaxies and their misidentification as AGN.

Khee-Gan Lee
Max Planck Institute for Astronomy (Germany)

Constraining z~2 Galaxy Environments with Ly-α Forest Tomography

The Lyman-alpha forest spectrum is the pattern of neutral hydrogen seen in the spectrum of high-redshift quasars. Each individual background source probes the z>2 IGM along a 1D line-of-sight, but with a large set of closely separated skewers it becomes possible to interpolate in the transverse direction to create a full 3D tomographic map of the IGM absorption. This will require using LBGs as well as quasars as background sightlines to obtain sufficient area density of sources. I will describe CLAMATO, a survey aiming to target 2000 LBGs to depths of g=24.5 in 1 deg^2 of the COSMOS field, requiring 15 nights of 8-10 m telescope time. This will result in a large-scale structure map at z=2.3 covering a comoving volume of (100 Mpc/h)^3 with a spatial resolution of 5-6 Mpc/h. Since the Ly-a forest absorption is a tracer of the underlying dark matter distribution, this allows us to study z>2 COSMOS galaxies as a function of their large-scale environment. I will show how this can be used to shed light on the merger history of z=0 halos.

Pierre Ocvirk
Observatoire astronomique de Strasbourg (France)

Internal and external regulation of star formation in dwarf galaxies by radiative feedback in coupled radiative-hydrodynamics simulations of the reionization

The missing satellite problem is one of the most salient apparent failures of LCDM. The UV background pervading the Universe during the Epoch of Reionization (EoR) has been claimed to provide a solution. The radiation field is responsible for evaporating the gas of the lowest-mass galaxies as early as z=6, preventing, stopping or delaying their star formation. The apparent low efficiency of star formation in low mass satellites populations, in particular the faintest dwarfs of the Milky Way, can be interpreted as the result of this process. Therefore these are often regarded as fossils of the EoR. I will present the efforts or our group to model and understand the EoR with a focus on radiative feedback on satellite population progenitors in different environments using our new, coupled hydro-radiative, massive simulation (64 h^{-1} Mpc box CLUES initial conditions, 4096^3 grid, 8192 GPUs, 30 million core hours) performed with RAMSES-CUDATON on the Titan Cray-XK7 supercomputer at Oak Ridge National Laboratory.

Bianca Poggianti
INAF-OA Padova (Italy)

Gas stripping in clusters

I would like to present new results on gas stripping in cluster galaxies based on two ongoing surveys: WINGS and BUDHIES. New very large area optical imaging + spectroscopy of 40+ WINGS clusters (z=0.04-0.07) has allowed the first systematic search for ram pressure effects in low-z clusters. We have studied the star formation, location and phase-space characteristics of ~300 ram-pressure affected galaxies and the dependence on cluster properties. BUDHIES - a Westerbork large volume HI survey of large volumes centered on two clusters at z=0.2 - has detected ~160 HI galaxies in and around the clusters. The dependence of gas content and star formation on galaxy location (main clusters, substructuure, surrounding and infalling structures) have been studied and a phase-space study shows how nicely observations follow theoretical expectations for ram pressure stripping.

Satellite galaxies

INVITED TALK:

ANNA PASQUALI

(UNIV. OF HEIDELBERG - GERMANY)

Topics: direct evidence of interaction with environment, physical mechanisms, simulations, empirical trends

- Rebecca Canning
  Triggering X-ray AGN in the cluster environment
- Anna Gallazzi
  Element abundance ratios and star formation quenching in central and satellite galaxies
- Chris Haines
  LoCuSS: The slow quenching of star formation in cluster galaxies at z~0.2
- Marc Huertas-Company
  The growth of massive galaxies in dense environments
- Ewa Lokas
  Formation of dwarf spheroidal galaxies by tidal stirring and mergers
- Christian Maier
  The existence and universality of the fundamental metallicity relation of star-forming galaxies in CLASH clusters at z~0.4
- Carlo Nipoti
  Environmental dependence of the structural evolution of early-type galaxies
- Allison Noble
  The Phase Space of z=1.2 Clusters: Using Herschel to probe Dust Temperature as a Function of Environment and Accretion History
- Yingjie Peng
  The dependence of the galaxy mass-metallicity relation on environment and the implied metallicity of the IGM
- Ryan Quadri
  Using satellite galaxies to investigate the growth of galaxy groups and the quenching of star formation
- Gregory Rudnick
  Probing the End of Star Formation in Distant Cluster Galaxies
- Oliver Steele
  The environmental dependence of emission lines in the GAMA survey

Rebecca Canning
Stanford University/KIPAC (USA)

Triggering X-ray AGN in the cluster environment

Studies of the triggering of X-ray AGN in clusters have to date been hindered by small sample sizes. To address this we have undertaken a survey of 11,000 X-ray AGN in the fields of 135 of the most massive clusters known, where the high galaxy and gas densities offer a unique opportunity to examine the impact of environment. We find the number density of cluster AGN at a given radius, relative to the field, scales inversely with the cluster mass in a similar way to the predicted galaxy merger rate, suggesting that galaxy mergers and interactions are important for the triggering of cluster AGN. The redshift evolution of the cluster AGN is consistent with that of the field. Evan larger datasets extending to higher redshifts will be required to investigate this further.

Anna Gallazzi
INAF-OA Arcetri (Italy)

Element abundance ratios and star formation quenching in central and satellite galaxies

The environment in which galaxies reside has an impact on the galaxy star formation history and hence can leave an imprint on the properties of their stellar populations. Differences in the stellar populations of central galaxies (the most massive galaxy in a halo) and those of equally massive satellite galaxies have indeed been detected in our previous works (Pasquali et al 2010,2012). Below $10^{10.5}$ $M_{\odot}$, satellite galaxies are found to be older and more metal-rich than centrals, with the difference increasing with satellite's group halo mass. We investigate whether such differences are also reflected in the degree of alpha/Fe enhancement, associated to different star formation timescales. We perform a comparative analysis of the alpha/Fe abundance ratio (in addition to mean age and metallicity) of isolated centrals, centrals in groups/clusters and satellite galaxies as a function of the galaxy stellar mass and of the host halo mass. Extending our recent work (La Barbera et al, subm.) we include all galaxy types and characterise galaxies in terms of their star formation rate. The negligible differences between centrals and satellites in alpha/Fe abundance ratio at fixed mass pose constraints on the epoch and duration of star formation quenching associated to the accretion of a galaxy onto a group environment.

Chris Haines
Universidad de Chile, Santiago (Chile)

LoCuSS: The slow quenching of star formation in cluster galaxies at z~0.2

We present an analysis of star formation among galaxies in and around 30 massive clusters at z=0.15-0.30, combining Spitzer 24um and GALEX UV imaging from the Local Cluster Substructure Survey (LoCuSS) with extensive spectroscopy from the Arizona Cluster Redshift Survey, including >10,000 confirmed cluster members. We robustly show that the specific-SFRs of star-forming cluster galaxies are systematically lower than their counterparts in the field at fixed stellar mass and redshift, and demonstrate that this requires most (if not all) massive star-forming galaxies accreted into clusters to have their star formation slowly quenched on 1-2 Gyr time-scales. We present further independent support for this slow quenching model, by comparing the observed kinematics and radial distributions of the star-forming galaxies from our ensemble cluster to the predicted distributions of infalling and recently accreted galaxies in 75 massive clusters extracted from the Millennium simulation. This produces a best-fit quenching time-scale of 2 Gyr with rather robust constraints, which we suggest can be reconciled with either ram-pressure stripping or starvation mechanisms. We also present results demonstrating the need for pre-processing in groups, consistent with the an over-abundance of X-ray groups in the outskirts of our cluster sample.

Marc Huertas-Company
GEPI - Observatoire de Paris (France)

The growth of massive galaxies in dense environments

The emergence of the massive end of the Hubble sequence, is still an open issue. Little is known about their early evolution where most of their stars are expected to form and about the impact of in-situ (star formation)/external events (mergers) in their subsequent mass and size growth. Even though the massive end of the mass function is built continuously over time from z~4-5 to today, it is also well established that there exists at least a population of massive galaxies at very early epochs which formed the bulk of their stellar content in very short timescales. Whether this primordial population evolves to match the properties of today's massive ellipticals or simply remains as a marginal population of relics (progenitor bias) is an open debate in the literature. In my talk I will address these issues by comparing the structures of massive galaxies in different environments from z~2 to z~0 (clusters, field, groups). I will show that the growth observed in the population of ETGs is probably better explained by the accretion of new galaxies. Only the most massive galaxies (M*>10^11) seem to experience a significant individual growth (Huertas-Company13a,b, Delaye+14, Huertas-Company+14b, Mei+14, Kaviraj, Huertas-Company+14).

Ewa Lokas
Copernicus Center Warsaw (Poland)

Formation of dwarf spheroidal galaxies by tidal stirring and mergers

I will discuss two promising scenarios for the formation of dwarf spheroidal (dSph) galaxies in the Local Group: via tidal stirring of disky dwarfs orbiting a Milky Way-like host and via mergers of two disky dwarfs. I will present predictions of these models obtained using a series of N-body simulations and compare them to the observational parameters of the real dwarf galaxies in the Local Group. In both scenarios the stellar disks undergo morphological transformation into spheroids and the initial rotation of the stars changes into random motions. An important intermediate stage of this evolution may involve the formation of a tidally induced stellar bar. There are however subtle differences in the final properties of the dwarfs formed in both scenarios that may allow us to discriminate between them, such as the type of remnant rotation. I will focus on the particular example of Andromeda II, a dSph satellite of M31, showing an unusual prolate rotation. I will demonstrate that this type of rotation occurs much more naturally in the merger scenario and is more difficult to explain by tidal stirring.

Christian Maier
University of Vienna (Austria)

The existence and universality of the fundamental metallicity relation of star-forming galaxies in CLASH clusters at z~0.4

In the local universe, there is good evidence that, at a given stellar mass M, the gas-phase metallicity Z is anti-correlated with the SFR of the galaxies. It has also been claimed that the resulting Z(M,SFR) relation is invariant - the so-called “Fundamental Metallicity Relation” (FMR). Given a number of difficulties in determining metallicities, the form of the Z(M, SFR) relation and whether it is really independent of redshift and environment is still very controversial. To shed light on this, we used VLT-VIMOS MR spectra of 100 star-forming galaxies, which are spectroscopic confirmed members in the CLASH MACSJ1206 and MACSJ0416 clusters at z~0.45 and z~0.39. All 5 emission lines [OII]3727, Hbeta, [OIII]5007, Halpha and [NII]6584 of these galaxies could be measured at the same time with VIMOS ensuring a high reliability of the relative flux calibration of the 5 line fluxes. These 5 emission lines were used to measure reliable gas metallicities O/H, SFRs from extinction corrected Halpha, and to explore the (Type-2) AGN contribution from the BPT diagram. We compare the mass-metallicity relation (MZR) at these redshifts in clusters and field, and investigate if SFR is a second parameter in the MZR in clusters at z~0.4. We discuss the comparison of these observations with the predictions of the Z(M,SFR) of the physically motivated gas-regulation model of Lilly et al. (2013), which predicts the MZR and FMR evolution in the context of dark matter haloes of galaxies.

Carlo Nipoti
University of Bologna (Italy)

Environmental dependence of the structural evolution of early-type galaxies

Using cosmological and binary-merging N-body simulations, we construct theoretical models for the joint evolution of mass, size, velocity dispersion and dark-matter distribution of early-type galaxies (ETGs) in a Lambda Cold Dark Matter universe, accounting for the dependence on environment. The models are compared with recent observational data that suggest that the size and velocity dispersion evolution of ETGs is stronger for galaxies in groups than in clusters, with the exception of the brightest cluster galaxies, which grow most. At $z<1$ further observational constraints derive from the measurement, in lens ETGs, of the total mass density slope and dark-matter fraction within the Einstein radius. The observed trends are reproduced by the models if the evolution is driven by accretion of stars and dark matter in the galaxy outskirts, with only modest amounts of dissipation and nuclear star formation.

Allison Noble
University of Toronto (Canada)

The Phase Space of z=1.2 Clusters: Using Herschel to probe Dust Temperature as a Function of Environment and Accretion History

Understanding the influence of environment is a fundamental goal in studies of galaxy formation and evolution, and galaxy clusters offer ideal laboratories with which to examine environmental effects on their constituent members. Clusters continually evolve and build up mass through the accumulation of galaxies and groups, resulting in distinct galaxy populations based on their accretion history. In Noble et al. 2013, we presented a novel definition for environment using the phase space of line-of-sight velocity and clustercentric radius, which probes the time-averaged density to which a galaxy has been exposed and traces out accretion histories. Using this dynamical definition of environment reveals a decline in specific star formation towards the cluster core in the earliest accreted galaxies, and was further shown to isolate post-starburst galaxies within clusters (Muzzin et al. 2014). We have now extended this work to higher-redshift clusters at z=1.2 using Herschel data. We investigate various galaxy properties as a function of phase-space environment. Specifically, we have uncovered a drop in dust temperature in the intermediate phase-space bin, compared to both the recently accreted population and virialized galaxies (Noble et al. in prep). In this talk, I will discuss the various implications of a phase-space definition for environment, and present our most recent results, highlighting a plausible interpretation for quenching mechanisms within the cluster environment.

Yingjie Peng
University of Cambridge (UK)

The dependence of the galaxy mass-metallicity relation on environment and the implied metallicity of the IGM

We explore the dependence of the galaxy mass-metallicity relation on environment in SDSS, in terms of both over-density and central/satellite dichotomy. We find that at a given stellar mass, there is a strong dependence of metallicity on over-density for star-forming satellites. Instead, for star-forming centrals no correlation is found. Star-forming satellites at different stellar masses form a tight sequence in the average overdensity - metallicity plane, which covers the entire observed range of metallicities and stellar masses. This remarkable result appears to imply that there exists a universal evolutionary path for all star-forming satellites, regardless of their stellar masses. The strong correlation between over-density and metallicity for star-forming satellites indicates that the gas inflow of satellite galaxies is progressively metal-enriched in denser regions. We interpret our results by employing the gas regulator/bathtub-type model and find that the metallicity of the enriched inflow of star-forming satellite galaxies strongly increases with increasing over-density, largely independently of stellar mass. If the metallicity of the inflow of star-forming satellites can represent the metallicity of the IGM, then the implied metallicity of the IGM rises from ~ 0.01 solar metallicity in void-like environments to ~ 0.3 solar metallicity in cluster-like environments, in broad agreement with observations.

Ryan Quadri
Texas A&M University (USA)

Using satellite galaxies to investigate the growth of galaxy groups and the quenching of star formation

As photometric galaxy surveys push to deeper limits over large areas, we are obtaining an increasingly comprehensive view of how the population of low-mass galaxies builds up with time. Such low-mass objects are not generally spectroscopically accessible, complicating environmental studies – and in particular the classification of centrals and satellites. However statistical background subtraction of faint companions surrounding brighter objects provides a useful means to study satellite galaxies, including their masses, colors, and spatial distribution. I will present new results on the evolution of the stellar mass function of satellites, which shows directly how the stellar mass content of galaxy groups evolves with time. I will also show how studying satellite galaxies provides insight into the processes that quench of star formation -- for both the satellites themselves, and for the central galaxies.

Gregory Rudnick
University of Kansas (USA)

Probing the End of Star Formation in Distant Cluster Galaxies

I will present results that probe the buildup of passive galaxies in clusters over the last 10 Billion years of cosmic time. Our observations probe well down the faint red sequence luminosity function in clusters at z<1.6 and therefore allow us to constrain the physical processes regulating the cluster red sequence growth. Our main observational results are that 1) the z=1.62 cluster has a large deficit of faint passive galaxies compared to its likely descendant clusters at z<0.6, 2) that this deficit of galaxies exists down to at least z=0.7, 3) that the cluster red sequence has grown by a factor of ~4 in stellar mass over the past 10 billion years, and 4) that the group and cluster environment are effective at cutting off gas accretion in infalling galaxies. We explain this in the context of a simple, but physically motivated, model that describes the relative importance of quenching and merging in building the cluster red sequence. I will also present new results from a large JVLA program with which we measure the molecular gas contents in cluster galaxies at z=1.62 using extremely deep CO(1-0) data. These data allow us to understand the supply side of star formation in massive cluster galaxies by providing us with robust measures of the gas that directly fuels star formation itself. We can thus directly look for effects of the environment on the gas contents of massive galaxies at a time when their star formation was ceasing.

Oliver Steele
ICG, University of Portsmouth (UK)

The environmental dependence of emission lines in the GAMA survey

We extract emission line statistics from GAMA survey galaxies, and use these to ascertain their ionisation source via the BPT diagnostic diagram. We then investigate the dependence of these ionising sources on mass and environment. When we look at mass, we control for local density, and vice versa; this is in order to negate the dependence of the mass function on local environment. We find that there is a significant mass sequence for emission line classes from star forming objects at the low end, through composites and Seyferts, to LINERs, in agreement with the findings of other works. We extend this picture by investigating the effects of local and global environment, and find that there is no significant difference in local density distribution between different emission line classes when we have controlled for mass. This tells us that local environment has minimal impact on the progression previously observed. If this progression is due to AGN feedback then this would imply that AGN feedback is a primarily mass-driven process. We further find that this independence of emission line class from local density is not affected by group membership. In summary, we see a scale-based trend in the importance of a property on ionisation source, with the most important parameter being mass, followed by the much less significant influence of local density, and then the negligible influence of global environment.

Tight/no interactions

INVITED TALKS:

ELENA D'ONGHIA

(UNIV. OF WISCONSIN-MADISON - USA)

DAVE PATTON

(TRENT UNIVERSITY - CANADA)

Topics: merging, close pairs, compact groups, fossils/isolated galaxies, etc.

- Anna Cibinel
  A Twofold Look on Environmental Effects: Satellite Quenching and Merger-Induced Star Formation in the ZENS Survey
- Carmen Eliche-Moral
  The formation of a sequence of Soa-Sob-Soc galaxies through major mergers
- Mirian Fernández Lorenzo
  Pseudobulges in isolated galaxies
- Carlos López-Sanjuan
  The ALHAMBRA survey: Accurate photometric merger fractions from PDF analysis
- Gary Mamon
  Optimal grouping algorithms and recent advances on compact groups
- Allison Man
  Explaining the discrepancy in the observed galaxy merger fractions at z=0-2.5
- Olga Melnyk
  Colours and star formation rates of isolated galaxies
- Rosita Paladino
  LOFAR observations of the Leo Triplet : searching for radio low frequency evidence of interaction
- Milena Pawlik
  Merger, starburst, post-merger, post-starburst... red-sequence?
- Jaime Perea
  The properties of the central galaxies formed through collisionless hierachical merging in small groups
- Angela Sandrinelli
  Relationship between QSO pairs and their galaxy environment
- Sukyoug Yi
  Merger relics in galaxy clusters

Anna Cibinel
CEA Saclay (France)

A Twofold Look on Environmental Effects: Satellite Quenching and Merger-Induced Star Formation in the ZENS Survey

We present recent results on environmental quenching and the properties of merging galaxies in z~0 satellite from the Zurich Environmental Study. By analyzing the star formation (SF) vs. environment relation using three different environment definitions – the DM halo mass, the distance from the group center and the location within the large scale density (LSS) field – we investigate on which scale environment is most affecting SF in galaxies. We find evidence that the quenched fraction in satellite galaxies is largely independent of halo mass and LSS density, while it is clearly enhanced towards the groups centers. However, the radial dependence of the quenched fraction is not accompanied by an equal variation in the morphological mix of early type galaxies, which remains largely constant with group-centric distance. We interpret this constancy as an indication that physical process leading to quenching may not cause significant morphological transformation and we find that the structural parameters of the quenched population are consistent with a simple passive fading of the disk component with no structural change. We furthermore discuss properties of merging satellites and merger-induced star formation across the environmental bins. Close pairs in groups have enhanced (specific) star formation than similar mass, non-merging satellites but the level of enhancement varies with group dynamical state as well as LSS overdensities and the radial position in the halo.

Carmen Eliche-Moral
Universidad Complutense de Madrid (Spain)

The formation of a sequence of Soa–Sob–Soc galaxies through major mergers

Lenticular galaxies (So's) exhibit morphological and structural properties which are difficult to reconcile with a major-merger origin. However, hierarchical models of galaxy formation predict that merging has been very relevant in their buildup. We have investigated whether major mergers can result into realistic So galaxies by performing a detailed morphological and structural analysis to the relaxed So remnants that result from a set of dissipative N-body simulations of major and minor mergers. We have found that major mergers can assemble So remnants with morphological and structural properties consistent with those observed in massive So's, spanning the whole sequence of So Hubble types. The So remnants present a bulge-disc coupling similar to real So's, reproduce their strong photometric scaling relations, tend to host pseudobulges (as observed in real ones), and obey their global parameter correlations. They also host lenses and realistic antitruncated discs, as it is also frequent in real So's. Contrary to the popular view, mergers (and in particular, major events) can result in So remnants with realistic morphological and structural properties in less than 3 Gyr. These properties cannot thus be used as an argument against the possible major-merger origin of these galaxies.

Mirian Fernández Lorenzo
Instituto de Astrofísica de Andalucía-CSIC (Spain)

Pseudobulges in isolated galaxies

Important clues about spiral galaxy formation lie in the nature of their central bulges. In this sense, properties of bulges in isolated galaxies best reflect their origin because of their minimized environmental evolutionary effects. We report here the structural parameters and (g-i) bulge/disk colors for a sample of 189 isolated AMIGA (Analysis of the interstellar Medium of Isolated GAlaxies; http://www.amiga.iaa.es) galaxies. A 2D bulge/disk/bar decomposition of SDSS i-band images was performed in order to identify the pseudobulges in our sample. We derived (g-i) bulge colors using aperture photometry. Pseudobulges in our sample show median colors (g-i)~1.06, while their associated disks are much bluer, (g-i)~0.77. Moreover, 64% (113/177) of pseudobulges follow the red sequence of early-type galaxies. The bluer pseudobulges in our sample tend to be located in those galaxies more affected by the tidal interactions. The red bulge colors and low B/T values for AMIGA isolated galaxies are consistent with an early formation epoch. The results found here suggest that environment could be playing a role in rejuvenating the pseudobulges.

Carlos López-Sanjuan
CEFCA Teruel (Spain)

The ALHAMBRA survey: Accurate photometric merger fractions from PDF analysis

The estimation of the merger fraction in photometric surveys is limited by the large uncertainty in the photometric redshifts compared with the velocity difference in kinematical close pairs (less than 500 km/s). Several efforts have conducted to deal with this limitation and we present the latest improvements. Our new method (i) provides a robust estimation of the merger fraction by using full probability distribution functions (PDFs) instead of Gaussian distributions, as in previous work; (ii) takes into account the dependence of the luminosity and the stellar mass on redshift in both the selection of the samples and the definition of major/minor mergers; and (iii) deals with partial PDFs to define "red" (E/S0 templates) and “blue” (spiral/starburst templates) samples without apply any colour selection. We highlight our new method with the estimation of the merger fraction at 1 < z in the ALHAMBRA photometric survey. We find that our merger fractions and rates nicely agree with those from previous spectroscopic work. Our PDF approach will be capital for environmental studies in current and future large photometric surveys such as DES, J-PAS, or LSST.

Gary Mamon
Institut d'Astrophysique de Paris (France)

Optimal grouping algorithms and recent advances on compact groups

Previous studies find that massive galaxies feel little the effect of their group/cluster environment. However, since it is notoriously difficult to extract real space groups from redshift space galaxy catalogs, one may wonder whether the imperfectly extracted group environment information blurs the correlations of galaxy properties with the global (group mass) and local (galaxy position within group) environment. I will show which linking parameters of the Friends-of-Friends algorithm are optimal against group fragmentation and merging, and for galaxy completeness and reliability (for primary fragments) relative to the real group virial sphere, and for mass accuracy. I will then introduce a new Bayesian algorithm that performs even better than the optimal Friends-of-Friends. I will also discuss recent advances on compact groups: 1) the first catalog displaying strong evidence for galaxy mergers at the bright end and luminosity segregation, and 2) the nature (fraction caused by chance alignments) and mass assembly history, both probed with semi-analytical galaxy formation simulations.

Allison Man
Dark Cosmology Centre, Univ. of Copenhagen (Denmark)

Explaining the discrepancy in the observed galaxy merger fractions at z=0-2.5

I will present a comprehensive study of galaxy merger fractions at z=0-2.5 using the COSMOS/UltraVISTA survey. Complemented by the CANDELS fields, we are able to explain the discrepancies in previous merger fraction measurements with selection effects. Namely using the flux ratio to select mergers will include lower M/L ratio satellites at z>1.5, leading to an increasing trend of merger fraction in contrast to a non-evolution for mass ratio selected mergers. We also demonstrate that pencil beam surveys are inadequate for merger fractions due to cosmic variance. Large area surveys and/or sampling different areas of the skies are required for meaningful merger fraction measurements. We present the implications of the merger rates in the context of the overall galaxy evolution of sizes, stellar mass and number densities.

Olga Melnyk
Taras Schevchenko National University of Kyiv (Ukraine)

Colours and star formation rates of isolated galaxies

The isolated galaxies evolved mainly due to secular processes at least last few Gyr. Therefore a comparison of the physical properties of isolated galaxies with galaxies located in denser environments is a useful way to study the influence of environment on galaxy evolution. 2MASS Extended Source Catalog (2MASX) selected sample of isolated galaxies (2MIG) contains galaxies from the Local Universe (V<25000 km/s) and consists of 6% of total 2MASX sources brighter than Ks= 12 mag with angular diameters a>30″. In our work we considered the morphology, colors, HI and stellar masses, FUV and IR star formation rates of galaxies from 2MIG sample and compared these properties with corresponding properties of galaxies from different environments: having small companions, randomly taken from the field, in groups, triplets and compact pairs. We found that early type galaxies show similar J-H and g-r colors practically in all types of environments, however massive early type galaxies from the compact pairs located in clusters show significantly redder colors. In general, galaxies in groups and pairs of spiral and late morphological types have also redder colors than 2MIGs. On the contrary, the members of the most compact pairs tend to be bluer than isolated galaxies and have higher star formation and specific star formation rates at given mass interval. In summary, our results show that the properties of galaxies are strongly depend on the environmental influence.

Rosita Paladino
Univ. of Bologna, INAF-IRA (Italy)

LOFAR observations of the Leo Triplet: searching for radio low frequency evidence of interaction

Galaxies perturbed by their environment exhibit various anomalies in the structure of their magnetic field, and on their gas dynamics, including intense, possibly magnetized, outflows into the intergalactic space. For tidally interacting galaxies, bright polarized ridges or peculiar magnetic arms crossing the optical ones are observed, and in some cases the tidal tails have been found to be sources of surprisingly strong intergalactic magnetic fields. Low frequency observations, being able to trace cosmic-rays with low energy and weak magnetic fields in the intergalactic medium, provide a sensitive diagnostic tool in interacting objects. We observed the nearby group Leo Triplet with LOFAR in its first observing cycle: in this talk I will show preliminary results and highlight the perspectives of this kind of studies.

Milena Pawlik
University of St Andrews (UK)

Merger, starburst, post-merger, post-starburst... red-sequence?

Galaxies that show evidence of a historical rapid increase and subsequent quenching in star formation could be a result of gas-rich major merger processes. Studying the properties of galaxies with post-starburst stellar populations will lead to a better understanding of the role of mergers in galaxy evolution: did they originate from mergers, and will they evolve into red-sequence galaxies? The aim of this work is to quantify morphological changes in local galaxies that are passing through a post-starburst phase. Using visual classification we find a clear excess of post-merger features, and the excess declines steadily with increasing starburst age. However, we find that traditional methods of morphology measurement do not reliably identify post-merger features that are visible by eye. I will introduce a new, robust and physically meaningful automated method for the quantitative measurement of morphology of post-mergers. I will use this to show how the evolution of the morphology of starburst galaxies through the post-starburst phase resembles that of galaxy mergers modelled using hydrodynamic simulations.

Jaime Perea
Instituto de Astrofísica de Andalucía CSIC (Spain)

The properties of the central galaxies formed through collisionless hierachical merging in small groups

Observational evidence suggests that multiple dry merging contributes significantly to the growth of massive elliptical galaxies. Both simulations and observations show that at different redshift galaxies are predominantly found in poor group-like aggregations, where proximity to other galaxies and low relative velocities lead to enhanced merging rates. Hierarchical group merging therefore appears to be not just an alternate avenue for the formation of bright ETGs, but a very plausible one. We present a series of forty high-resolution collisionless numerical experiments that investigate the formation of luminous ellipticals in the group environment towards the end of the epoch that precedes the virialization of the entire galaxy system, when the rate and strength of galactic encounters are expected to peak. We use the simulations to study the scaling relations involving the main optical properties of the brightest group galaxies that form during the end of the pre-virialization epoch and its possible connection with the properties of the parent group. Examination of the role of multiple mergers in the long-term evolution of the global group Luminosity function indicates that our dynamically young simulated groups could be a fair representation of present-day systems which show a lack of late-type galaxies in their central regions, a marked concentration of optical luminosity towards the center and that are X-ray dim.

Angela Sandrinelli
University of Insubria (Italy)

Relationship between QSO pairs and their galaxy environment

We present preliminary results of an ongoing program aimed to investigate the environment of low redshift ($z < 0.9$) quasar associations derived from SDSS datasets. Spectroscopy and imaging are derived from SDSS and dedicated observations with NOT and GTC. We compare our results with those of isolated quasars of similar redshift and nuclear luminosity. We find that quasar pairs reside in environments on average indistinguishable from that of isolated quasars with similar redshift and host galaxy luminosity. This suggests that the rare activation of two quasars does not require any extraordinary environment.

Sukyoug Yi
Yonsei University (Korea)

Merger relics in galaxy clusters

According to the classical dynamics, galaxy mergers are expected to be extremely rare in clusters due to high speeds of motion. We performed a deep (r-band surface brightness limit of 28 mag/arcsec^2) imaging survey on rich clusters of galaxies using and found that an unexpectedly large fraction (40%) of bright member galaxies show strong post-merger features. We performed theoretical calculations on galaxy mergers in cluster environments using semi-analytic approaches and hydrodynamic zoom-in simulations to understand this. Our calculations confirm that in-situ galaxy mergers are indeed rare in clusters and suggest that many of these post-merger galaxies are instead relics of mergers that happened before they fell into the current cluster. It has turned out to be critical to consider realistic halo merger histories in the first place to understand galaxy evolution accurately.

Posters

Posters

Betsey Adams
ASTRON (Netherlands)

Searching for Local Group dwarfs via their HI content: Ultra-compact high velocity clouds in the ALFALFA HI survey

A long standing problem in cosmology is the mismatch between the number of low mass dark matter halos predicted by simulations and the number of low mass galaxies observed in the Local Group. We recently presented a set of isolated ultra-compact high velocity clouds (UCHVCs) identified within the dataset of the Arecibo Legacy Fast ALFA (ALFALFA) HI line survey that are consistent with representing low mass gas-bearing dark matter halos within the Local Group (Adams+ 2013). At distances of ~1 Mpc, the UCHVCs have HI masses of ~10^5 $M_\odot$ and indicative dynamical masses of ~10^7 $M_\odot$. The HI diameters of the UCHVCs range from 4' to 20', or 1 to 6 kpc at a distance of 1 Mpc. We have selected the most compact and isolated UCHVCs with the highest average column densities as representing the best galaxy candidates. These systems have been observed with the Westerbork Synthesis Radio Telescope (WSRT) to enable higher spatial resolution (~60") studies of the HI distribution. The HI morphology revealed by the WSRT data offers clues to the environment of the UCHVCs, and velocity fields allow the underlying mass distribution to be constrained. One UCHVC, AGC198606, is of particular interest as it is located 13 km/s and 1.2 degrees from Leo T and has similar HI properties within the ALFALFA dataset. I will present WSRT observations of this object and compare the observed HI to theoretical models for gas in low mass dark matter halos.

Sinan Alis
OCA (France), Istanbul University (Turkey)

Evolution of galaxy populations in galaxy clusters from z~1 to z~0 in the CFHT Legacy Survey

We present our preliminary results on the evolution of galaxy populations in galaxy clusters in the CFTHLS W1. Fundamental properties of galaxies, like luminosity, color, type, and structural parameters, and correlation of these parameters with cluster richnesses are presented. Furthermore, we compare galaxy populations from optically selected clusters (Benoist et al. 2014) and X-ray selected clusters (Pierre et al. 2014). Member selection for the clusters made based on photometric redshifts.

Posters

Marianna Annunziatella
University of Trieste (Italy)

CLASH-VLT: The stellar mass function and stellar mass density profile of the z=0.44 cluster of galaxies MACS J1206.2-0847

We determine the stellar mass function (SMF) of a z=0.44 cluster of galaxies separately for passive and Star-forming galaxies, in different regions of the clusters, from the center to ~2 virial radii. We base our determination on the data-set from the CLASH and CLASH-VLT surveys. For star-forming galaxies we find no environmental dependence of the SMF, while for passive galaxies we do observe a significantly different slope in the innermost, highest density cluster region. The number ratio of giant/subgiant passive galaxies is maximum in this innermost regions, minimum in the adjacent region, and then gently increases again towards the cluster outskirts. The lacking subgiant galaxies in the innermost regions would provide a mass similar to the intra-cluster diffuse mass. This suggests that a substantial fraction of subgiant galaxies are tidally disrupted when they cross the cluster center.

Dino Beghetto Junior
Universidade do Vale do Paraiba (Brasil)

Formation of Polar Ring Galaxies - a database of N-body simulations

The Polar Ring Galaxies (PRGs) are ringed galaxies, in which a ring is in a plan approximately perpendicular to the main plane of the host galaxy, so its formation cannot be due to intrinsic secular processes of isolated galaxies. Thus, the PRGs are the result (a) of the interaction between galaxies or (b) the accretion of cold gas from cosmic filaments by a galaxy. It is believed that the most common mechanism is the case (a), which is the interest of this work. The formation of PRGs by interaction of two galaxies requires orbits with specific geometries, so the addition of matter can occur, forming a polar ring. We are developing a set of N-body simulations aiming to investigate the parameter space needed to the formation of PRGs, exploring different mass ratios, orbital energies and inclinations. We present the current status of this work in progress, and some initial results.

Posters

Nina Bonaventura
McGill University (Canada)

The Infrared Spectral Energy Distribution of Brightest Cluster Galaxies

Brightest Cluster Galaxies (BCGs), the most massive and optically luminous galaxies located in the cores of galaxy clusters, ought to be ideal laboratories for measuring the complex interplay between galaxy mergers, AGN, and star formation and their respective roles in galaxy evolution, owing to their unique habitat in the Universe. With this in mind we present the results of an unprecedented Spitzer infrared (IR) study of the largest sample (several hundreds) of optically selected BCGs from the SpARCS cluster survey, from similarly massive clusters (~10^{14} $M_{\odot}$) out to z=1.95. We find the majority of the sample is undetected in the 24-um band, with a stacked IRAC-MIPS Spitzer broadband SED dominated by emission from an old stellar population and consistent with that of a quiescent giant elliptical galaxy. The SED of the 24um-bright population appears as a hybrid of IR galaxy types, a supposed 'red and dead' elliptical with a mid-infrared excess indicative of moderate-to-extreme levels of star formation and a weak AGN contribution, with the 24um-inferred star formation rate markedly increasing beyond z~0.8. These results lead us to suppose that while the majority of our statistically significant sample of BCGs is quiescent, a subpopulation is actively forming stars throughout a relatively large portion of its lifetime, in-line with observations of BCGs in X-ray-selected clusters, and presenting tension with models which predict only a passive evolution of BCGs since z~5.

Alexandre Bouquin
Universidad Complutense de Madrid (Spain)

Morphological and environmental segregation of nearby galaxies from their UV and IR colors

We obtained GALEX FUV, NUV, and Spitzer/IRAC 3.6μm photometry for a sample of over 2000 galaxies which corresponds to 90% of the Spitzer Survey of Stellar Structure in Galaxies sample (S^4G), in order to highlight the global color properties of the sample. We find a very tight (rms=0.20mag) "blue sequence (BlS)" in the (FUV-NUV) versus (NUV-[3.6]) color-color diagram, which is caused by the similar color changes, or degeneracy, between star-formation timescale (τ) and dust reddening. This BlS consists mostly of star forming irregular galaxies and late-type spirals. It is then followed, at its red end, by a wider "red sequence (RS)" that is populated mostly by elliptical and S0 galaxies that show different levels of UV upturn and residual star formation. We find no BlS galaxies with colors redder than (NUV-[3.6])>5, value beyond which most RS galaxies are located. A large fraction of S0 through Sa galaxies are found between the BlS and RS, suggesting that these are transitional galaxies. Similarly, a large fraction of early-type spirals in the optical "green valley" are also found in our RS. These results point to a quick (t~10^8yr) color evolution from the BlS to the RS once a minimum sSFR (as measured by the (NUV-[3.6]) color) is reached, beyond which star formation is effectively suppressed. This quenching process must be driven by other factors besides mass, and is enhanced in high-density environments.

Posters

Malcolm Bremer
University of Bristol (UK)

The evolution of the red sequence galaxy population in clusters

It is well-known that the galaxies in the red sequence of clusters appear to have undergone little or no star formation in the past ~9 Gyr. This, and the lack of evolution in their luminosity function indicates little or no active evolution over this time. However this appears not to be the case! Using deep multi-band HST imaging of multiple clusters out to z~1.3 we show that the morphological mix of the red sequence galaxies evolves significantly during this time, all without appreciable star formation. All apart from the most massive red sequence galaxies at high redshift are disky with significant colour gradients, the most massive are classical ellipticals. As cosmic time increases, the stellar mass at which the ellipticals dominate decreases until at low redshift the true elliptical fraction is high at all but the lowest masses:- Red disky galaxies slowly transform into classical ellipticals over this time. By exploring the morphological properties, sizes, shapes, Sersic indices, colour gradients etc of galaxies on the red sequences of multiple clusters as a function of stellar mass and time we can watch this secular evolution progress. We can estimate timescales for the process and explore the relative importance of disk fading and bulge growth in the transformation of this population over cosmic time. Clearly, identifying this transformation process is crucial to understanding the evolution of all early-type galaxies, not just those in clusters.

Lucio Buson
INAF-OA Padova (Italy)

UGC 7639 a Late-type Dwarf Galaxy in the Canes Venatici I Cloud

We made use of archive UV, optical and IR data together with specifically constructed SPH simulations to get insight into the nature and formation of the late-type dwarf UGC 7639, a nearby, dwarf galaxy hosting a large fraction of ongoing star forming stellar population. Both the above classification and such observed features assure quite a high interest for this galaxy, owing to its possible analogies with the high-redshift so-called clumpy galaxies (cf. Elmegreen et al. ApJ 701, 306 2009). Moreover we find that its modeled global properties, namely its total absolute B-band magnitude, whole SED, and morphology are well-matched by a past close encounter with a more massive object, likely the CvC member NGC 4346.

Posters

Hoseung Choi
Yonsei University (Korea)

Hydrodynamic zoom-in simulations on the galaxy evolution in cluster environments

Galaxy clusters provide a unique test for environmental effects for galaxy evolution. Some recent observations have reported evidence of gravitational interactions of cluster galaxies shedding some light on the role of halo mergers on galaxy evolution. Motivated by these observations, we perform a set of high resolution hydrodynamic zoom-in simulations of galaxy clusters to investigate the evolution history of galaxies in clusters with particular focus on gravitational interactions and their effects on the appearances of galaxies. We found that considerable fraction of galaxies have been gravitationally interacting since well before they fall into the cluster environment. This implies that only the final snapshot of evolution is not enough, and often more than 4Gyrs of past interaction history must be taken into account, to understand the properties of galaxies found today in cluster environments.

Jiwon Chung
Chungnam National University (Korea)

Enhanced nitrogen in morphologically disturbed blue compact galaxies at 0.20 < z < 0.35: probing galaxy merging features

We present a study of correlations between the elemental abundances and galaxy morphologies of 91 blue compact galaxies (BCGs) at z=0.2-0.35 with SDSS DR7 data. We classify the morphologies of the galaxies as either disturbed or undisturbed by visual inspection of the SDSS images, and using the Gini coefficient and M20. We derive oxygen and nitrogen abundances using the Te method. We find that a substantial fraction of BCGs with disturbed morphologies, indicative of merger remnants, show relatively high N/O and low O/H abundance ratios. The majority of the disturbed BCGs exhibit higher N/O values at a given O/H value compared to the morphologically undisturbed galaxies, implying more efficient nitrogen enrichment in disturbed BCGs. We detect Wolf-Rayet features in only a handful of the disturbed BCGs, which appears to contradict the idea that WR stars are responsible for high nitrogen abundance. Combining these results with GALEX UV data, we find that the majority of the disturbed BCGs show systematically lower values of the H alpha to near-UV star formation rate ratio. The equivalent width of the H beta emission line is also systematically lower in the disturbed BCGs. Based on these results, we infer that disturbed BCGs have undergone star formation (SF) over relatively longer timescales, resulting in a more continuous enrichment of nitrogen. We suggest that this correlation between morphology and chemical abundances in BCGs is due to a difference in their recent SF history.

Posters

Federica Ciocca

University of Insubria, INAF-OA Brera (Italy)

Colour gradients in cluster elliptical galaxies at z=1.39

We studied the ~$(U-R)_{rest}$ and ~$(UV-U)_{rest}$ colour gradients of a sample of 17 elliptical cluster galaxies at z = 1.39 in order to constrain the mechanisms by which elliptical galaxies aggregate their stellar mass. We found that all galaxies of the sample present a ~$(UV-U)_{rest}$ positive gradient, while they present a ~$(U-R)_{rest}$ negative gradient, with a few exceptions showing a null gradient. We investigated the origin of the radial variation of the internal colour of these galaxies on the basis of the predictions of synthetic stellar population models. The results obtained cannot be explained considering the radial variation of a single parameter (age or metallicity). On the contrary, the analysis shows evidence of a double stellar component: a young (<1 Gyr) and more metallic stellar population dominating in the center of the galaxies and a older and less metallic stellar population dominating the outskirts. The presence of a age gradient shows that the stellar populations did not form in a single burst; in particular, the young internal stellar population indicates that part of the stellar content formed “later”. We will discuss the implications of these findings on the basis of the mechanisms by which spheroidal galaxies can have accreted their stellar mass.

Alice Concas

Excellence Cluster Universe (Germany)

A new way to the galactic archeology

Achieving an observational determination and a theoretical understanding of the star formation history of the Universe is one of the biggest challenges in the study of galaxy formation and evolution. In this respect, the use of the galaxy full spectrum to recover its fossil record (galactic archeology) has become an extremely powerful method. However, this method acknowledges a strong limitation: noise in the data and in the models introduces degeneracies into the problem which can lead to unphysical results. The simultaneous fit of the spectral information and of the galaxy SED can help in breaking the degeneracies. For this purpose we develop a method for fitting simultaneously the spectrum and the SED from the UV to the far-IR of a sample of SDSS galaxies based on GRASIL, a code to compute the spectral evolution of stellar systems taking into account the effects of dust, which absorbs and scatters optical and UV photons and emits in the IR-submm region. I will show preliminary results and discuss future developments.

Posters

Juan Pablo Cordero
Universidad de Chile, Santiago (Chile)

The dry merger rate of galaxies in the Coma Cluster: implications for estimates in high-z clusters

We use highly complete photometry and spectroscopy for galaxies in the Coma cluster, together with high resolution HST images, to measure the dry merger rate and relate this to the observations of massive clusters at high redshift. Our evaluation of the number of interacting pairs is made with increasingly complex criteria: a) apparent physical separation; b) apparent physical separation and radial velocity difference; and c) apparent physical separation, radial velocity difference, and signature of perturbed morphology. By selecting galaxies on the Coma Red-Sequence with 13.4 < I < 17.6 mag, we find that 11% of the galaxies fulfill the definition of a close pair (r_p < 51.86 kpc, in projection). However, when we consider the available spectroscopic information and require also that Δ_V < 550 km/s we find that none of the close pairs satisfy this condition, excepting one, and thus they are unlikely to represent physical associations. For the single remaining pair, we use HST imaging to search for low surface brightness structures such as tidal tails indicative of an on-going interaction. No evidence of an on-going merger, at surface brightness level of 26.5 mag/arcsec^2, is found for this pair. Therefore to the I limit considered (corresponding to about H* + 4.4 mag) and using a volume limited sample, we get the result that no merging events are currently taking place in the central region of Coma. [...]

Jacob Crossett
Monash University (Australia)

Properties of UV Bright Red Sequence Cluster Galaxies

While it is commonly accepted that most elliptical galaxies on the red sequence contain largely older stellar populations, it has been suggested that a small amount of recent star formation may have occurred within the last billion years (Yi et al. 2005; Schawinski et al. 2007; Rawle et al. 2008). We detect this signature of this recent star formation using GALEX NUV observations of clusters at z~0.1 from the LARCS sample. We find that ~10% of red sequence galaxies in these clusters have such residual star formation. I will show that despite residing on the red sequence, many of these galaxies are not found to resemble traditional red sequence galaxies, but reside in low density (~100 Gal/Mpc^2) at predominantly high (<2 Mpc) radii from their host cluster centre. In addition to this, their morphology suggests these galaxies to be of spiral morphology, rather than the elliptical shape seen in their quiescent counterparts. This suggests that a population of “red spirals” (Masters et al. 2010) may be the cause of this residual star formation.

Posters

Anna Delahaye
McGill University (Canada)

A snapshot of a Coma-like progenitor at z=0.9: Characterizing the galaxy populations within different environments in the RCS2319 supercluster

RCS2319+00 is a massive high redshift supercluster providing an excellent laboratory in which to study the effects of environment on galaxy properties.We present the results of a multiwavelength photometric study of the z = 0.9 supercluster, comprising three massive X-ray detected cores, a high star-forming filament, and several infalling groups. Using 10 band photometry, we determine photometric redshifts using Spectral Energy Distribution (SED) fitting and select members using a cut in photometric redshift. Using a friends-of-friends algorithm we identify the three isolated cores, three large infalling groups including the filamentary structure, as well as several smaller associations. We find that the densest regions and cores are dominated by massive, red galaxies and the low density field environments are predominantly populated by low mass blue galaxies. The large groups show intermediate populations suggesting that preprocessing is occurring as they are coalescing onto the cluster halos. We find that colour and the fraction of red galaxies is strongly correlated with stellar mass; however, for intermediate masses ($9.6 < \mathrm{Log}(M/M_{\odot}) < 10.0$) we find a weak correlation with local density at the 3 sigma level for colour and 2 sigma level for red fraction.

Roberto De Propris
FINCA, Univ. of Turku (Finland)

A panoramic view of galaxy evolution in z=1.25 clusters

We explore the luminosity, colour, size and shape evolution of galaxies in four z=1.25 clusters with deep archival HST data. The luminosity function in z and H is consistent with pure passive evolution and early galaxy assembly to at least 10% of the mass of the Milky Way. Colour-magnitude relations consistent with local objects can be traced to at least H=24 or z=26 (about 3 mag. below the L* point); the red sequence luminosity function shows no weakening. We show that this is due to low surface brightness selection effects. The sizes of galaxies are also similar to those of objects of the same luminosity in the Virgo cluster. However, we find that galaxies in the z=1.25 clusters have lower Sersic indices and are more disk dominated. They also show significant colour gradients in the sense of being bluer (and younger) outwards. Our data suggest that most red sequence galaxies are born as ‘S0’ and undergo disk fading or secular evolution to become predominantly bulge-dominated at $z < 0.6$.

Posters

Marion Dierickx

Harvard-Smithsonian Center for Astrophysics (USA)

Signatures of the M31-M32 Galactic Collision

The unusual morphologies of the Andromeda spiral galaxy (M31) and its dwarf companion M32 have been characterized observationally in great detail. The two galaxies' apparent proximity suggests that Andromeda's prominent star-forming ring as well as M32's compact elliptical (cE) structure may result from a recent collision. We present the first self-consistent model of the M31-M32 interaction that simultaneously reproduces observed positions, velocities, and morphologies for both galaxies. Andromeda's spiral structure is resolved in unprecedented detail, showing that a rare head-on orbit is not necessary to match Andromeda's ring-like morphology. The passage of M32 through Andromeda's disk perturbs the disk velocity structure. We find tidal stripping of M32's stars to be inefficient during the interaction, suggesting that some cEs are intrinsically compact. Additionally, the orbital solution implies that M32 is currently closer to the Milky Way than models have typically assumed, a prediction that may be testable with upcoming observations.

Work published as Dierickx, Blecha & Loeb 2014, ApJL, 788, L38

Daria Dobrycheva

Main Astronomical Observatory of NAS of Ukraine (Ukraine)

Color indexes of galaxies in different environments defined by the Voronoi tessellation

We quantified the environmental density of SDSS DR9 galaxies using 3D Voronoi tessellation approach. We constructed Voronoi tessellation for the volume-limited sample $0.02<z<0.1$ with $Mi<-20.4$ of about 120,000 galaxies. We used inverse volume of the Voronoi cell as the indicator of galaxy local density. As it was expected we found that galaxies with redder colors are located in denser environment in comparison with blue population. In terms of the Voronoi cell properties we also discuss Large Scale Structure of the sample.

Posters

Donovan Domingue
Georgia College & State University (USA)

Does the star formation rate of a paired spiral depend on its companion's morphology?

The Herschel study of local major-merger candidate galaxy pairs (KPAIR) sample consists of 88 galaxy pairs chosen on the basis of physical separation and controlled for mass and observation limits. These pairs which contain at least one spiral galaxy, represent an unbiased look into the many stages of the merger processes of nearby spiral-spiral (S+S) and spiral-elliptical (S+E) pairs. The Herschel view of these pairs presents the Far-Infrared colors and luminosities which are keys to understanding their star formation properties and dust content. We carefully examine sub-sample differences (S+S vs.S+E) in these properties as a probe of star formation dependence on “pair type”. This study is an expansion of previous research which indicates that spiral galaxy star formation rates (SFR) in merging pairs depend on the "pair type" in addition to the previously assumed dependence on galaxy morphology. Since it is not expected based on pure dynamical models, such a pair morphology dependence may indicate the alteration of gas flow from the pair's shared halo environment caused by the presence of early type galaxies.

M. Carmen Eliche-Moral
Universidad Complutense de Madrid (Spain)

Evolution of the average properties of the stellar populations of massive dead galaxies up to z=2

Samples of ‘red&dead’ galaxies selected through colour-based criteria usually suffer from contamination by dust-obscured sources, making difficult to disentangle the evolution experienced by each galaxy population. We have selected a sample of red massive galaxies in GOODS-N field up to z=2 on the basis of the UVJ diagram. We have obtained stacked spectral energy distributions (SEDs) from rest-frame NUV to NIR for four basic galaxy spectral types (quiescent, post-starbursts, dust-reddened starbursts, starforming). The SEDs include the deep data obtained with GTC/OSIRIS in the 25 medium-band filters of the SHARDS project (Survey for High-z Absorption Red and Dead Sources), covering the wavelength range between 500 and 950 nm with contiguous passbands. We discuss the redshift evolution of the characteristic ages of each galaxy type, as derived from the Mg(UV) absorption, D(4000), Balmer break, and Hδ indices obtained from the stacked spectra.

Posters

James Etherington
Institute of Cosmology and Gravitation, Portsmouth (UK)

Measuring galaxy environment in large scale photometric surveys

The properties of galaxies in the local universe have been shown to depend upon their environment. The next generation of large scale photometric surveys (e.g. DES, Euclid) are vital to gain insight into the evolution of galaxy properties and the role of galaxy environment as a function of redshift. Huge photometric datasets come at the cost of redshift precision and this impacts the measurement of galaxy environment. We study this by measuring environments using spectroscopic and photometric redshifts from the SDSS. Environments are also computed for samples with simulated photometric redshifts with a range of redshift uncertainties: 0.0025-0.06. We examine the galaxy red fraction dependence on mass and environment and find that the trends found with spectroscopic redshifts are also present with photometric redshifts. We compare the environments of the galaxies that are in both the photometric and spectroscopic datasets and calculate best fit lines and Pearson's product moment correlations. The radial environment signal decays rapidly. However at an uncertainty of ~0.1 we find a significant correlation of ~0.3. An environment signal can still be extracted from the angular measurements. We show that the weaker environment signal per galaxy will be easily compensated for by the large samples that will become available in the next generation of photometric surveys and so it will be possible to measure environment trends in a statistical way.

Renato Falomo
INAF-OA Padova (Italy)

Multi color imaging of low redshift QSO hosts and their environments

We present a photometrical and morphological study of the properties of low redshift (z<0.3) quasar hosts based on a large and homogeneous dataset of objects derived from the Sloan Digital Sky Survey (DR7). We used quasars that were imaged in the SDSS Stripe82 that is up to 2 mag deeper than standard Sloan images. For these quasars we undertake a study of the host galaxies and of their environments in u,g,r,i and z bands. For each resolved quasar we are able to characterize the morphology of the host galaxy that turn out to be more complex than what found in previous studies. QSO are hosted in a variety of galaxies from pure ellipticals to complex/composite morphologies that combine spheroids, disk, lens and halo. The properties of the host galaxies and galaxy environment have been reported by: Falomo et al 2014 (MNRAS 440, 476) , and Karhunen et al 2014 (MNRAS 441, 1802). Here we present a preliminary analysis of the color properties of the host galaxies and of the close environment.

Posters

Adriana Gargiulo
INAF-OA Brera (Italy)

Constraining the stellar mass accretion in early-type galaxies in the last 9 Gyr

We have investigated the mass accretion of spheroidal galaxies (ETGs) in field and cluster over the last 9 Gyr. As far as the field ellipticals we have compared the structural (effective radius Re and stellar mass M*) and dynamical (velocity dispersion sigma) parameters of a sample of field ETGs at z=1.4 with those of local ones, taking into account the progenitor bias. For 5 out of the 20 ETGs at high redshift, we present previously unpublished VLT-FORS2 spectra. The comparison shows that at fixed velocity dispersion, each ETG of our high-z sample has a local counterpart with old age (luminosity weighted age >9 Gyr) and comparable M*, Re, sigma. However, the viceversa is not true: at fixed velocity dispersion, the local old ETGs with the largest radii and stellar masses, despite their old ages, are not present at z~1.4. Concurrently, we have studied a sample of ~ 20 cluster elliptical galaxies at similar redshift for which the kinematics parameters are not available. We have investigated their stellar mass assembly through the analysis of their size-mass and Kormendy relation. We have found that both high-z relations are consistent with their local counterparts. We will discuss the implications of these results in the contest of the most supported scenarios for the mass accretion in spheroidal galaxies.

Myriam Gitti
University of Bologna, INAF-IRA (Italy)

Twin SMBH candidates in RBS797's BCG and in A2626's dumbbell cD galaxy

The radio-loud BCG at the center of the cool core cluster RBS 797 is known to exhibit a misalignment of its 5 GHz radio emission observed at different VLA resolutions, with the innermost kpc-scale jets being almost orthogonal to the radio lobes which extends for tens of kpc filling the X-ray cavities seen by Chandra. The different radio directions may be caused by rapid jet reorientation due to interaction with a secondary supermassive black hole (SMBH), or to merger of two jet-emitting AGNs. I will show the results of new 5 GHz observations performed with the European VLBI Network (EVN). In particular, we detected two compact radio components, with a projected separation of ~77 pc. I will discuss two possible scenarios for the origin and nature of the EVN double source, showing that both interpretations are consistent with the presence of an SMBH binary system in the BCG of RBS 797. Time permitting, I will also present new, high-resolution VLA observations of the cool core cluster A2626, which is known to possess a radio mini-halo at its center. The most unusual features of A2626 are three symmetric radio arcs, having morphologies not common to the typical jet-lobe structures in cool cores. I will briefly discuss the different possibilities for their origin, including the presence of two pairs of precessing radio jets.

Posters

Violeta González-Pérez
University of Durham (UK)

The predicted colours of satellite galaxies

In this work we explore the predicted colours of nearby satellite galaxies using a state of the art semi-analytical model of galaxy formation and evolution, which exploits a N-body simulation set on a Lambda Cold Dark Matter universe. The optical colours of model galaxies are tightly correlated with their available cold gas. Therefore, the modeling of both the gas cooling and the ram-pressure stripping are fundamental for understanding what shapes the predicted distributions of satellite galaxies colours.

Laura Greggio
INAF-OA Padova (Italy)

The stellar halo of NGC 253

Outskirts of large galaxies contain important information about galaxy formation and assembly, and resolved star count studies efficiently probe the extremely low surface brightness of the outer halos. NGC 253 is a nearly edge-on disk galaxy in the Sculptor group where we resolved the halo stars on the very wide field VISTA images in Z and J bands. The very deep photometry and the wide area covered allows us to trace the red giant branch (RGB) and asymptotic giant branch (AGB) stars that belong to the halo of NGC 253 out to 50 kpc along the galaxy minor axis. In this talk I will illustrate the results of this study, which, among others, include (i) the existence of an inner flattened halo, embedded in a more circular structure; (ii) the detection of a substructure in the north-west part of the halo, 28 kpc distant from the plane and extending over 20 kpc parallel with the disk of the galaxy; (iii) the presence of a widespread population of intermediate age AGB stars, extending up to about 30 Kpc from the galactic plane.

Posters

Peter Hatfield
University of Oxford (UK)

Evolution of Galaxy Interactions and Clustering in the VIDEO Survey

The VISTA Deep Extragalactic Observations (VIDEO) Survey is a key survey in probing the epoch of activity where galaxies virialised within their dark matter halos and the majority of star-formation and AGN behaviour occurred. Observing in Z, Y, J, H,K over 12 sq degrees (with fields chosen for the availability of multiband data) and up to z~4, VIDEOs depth and breadth allows both large-scale structure as well as evolution inside individual dark matter halos to be probed up to very early times. We have developed a probabilistic approach to calculating the two-point correlation function and have applied it to the survey, extracting key galaxy evolution parameters - for example galaxy bias - as a function of redshift and galaxy mass, giving a good measure of global clustering structure. We have also studied how the cross correlation of low-mass galaxies to high mass galaxies changes as a function of central galaxy mass and redshift, giving an indication of how the interaction between satellite galaxies and central galaxies changes over cosmic time. We compare these results to hydrodynamic simulations and highlight where the current theoretical work agrees and differs with the observations.

Antonio Hernán-Caballero
Instituto de Física de Cantabria, Santander (Spain)

The maturing stellar populations of X-ray selected AGN host galaxies

Recent works show that once stellar mass selection effects are taken into account, quiescent galaxies are underrepresented among AGN hosts, which show average star formation rates comparable or higher than those of inactive star-forming galaxies. However, the distributions of restframe colours show no clear differences between the hosts of moderate luminosity AGN and inactive galaxies. This could be a consequence of higher extinction compensating for the younger stellar populations of AGN hosts in observed colours. Using a novel technique that combines the U-V colour with measurements of the Dn(4000) index to correct for extinction, we show that the distributions of the extinction-corrected U-V and Dn(4000) of X-ray selected AGN hosts are significantly different compared to inactive galaxies with the same mass and redshift. We find bluer extinction-corrected U-V and younger average stellar ages in AGN hosts, as well as a deficit of AGN in quiescent galaxies. We also find a highly significant excess of AGN hosts with Dn(4000)~1.4 and light weighted average stellar ages of 300–500 Myr, as well as a deficit of AGN in intrinsic red galaxies. We interpret failure in recognising these trends in previous studies as a consequence of the balancing effect in observed colours of the age-extinction degeneracy.

Posters

Shogo Ishikawa
NAOJ (Japan)

The clustering properties of star-forming galaxies at z~2 by extremely wide field galaxy survey

We present the clustering properties of star-forming galaxy at z~2 and discuss the dark halo mass and its evolution derived from accurate clustering analysis. By applying the gzk selection method over 5 deg^2 based on the Subaru and CFHT/UKIRT public archive data, we obtained a large sample of 41,112 star-forming galaxies(sgzKs) at z~2 down to K<23.0. We obtained high quality two-point angular correlation functions(ACFs) and found that clustering strength depends upon galaxy luminosity, which is consistent with previous studies. Our ACFs show apparent excess from power-law in small angular scales, enabling more detailed estimate of dark halo mass by HOD analysis, which is formulated by 1-halo term and 2-halo term. We derived the stellar mass and halo mass (SMHM) ratio, which indicates that star-formation efficiency at z~2 drops in massive dark halo compared with that of local universe. We discuss the relation between sgzKs and local SDSS galaxies and Lyman break galaxies at z~4 by tracing the evolution of the dark halo.

Inger Jorgensen
Gemini Observatory (USA)

Evolution of Galaxy Sizes and Stellar Populations in Dense Cluster Environments

Our project to investigate galaxy evolution in dense cluster environments from z=1.6 to the present is based on high S/N spectroscopy obtained with Gemini and imaging from HST. Our recent results for the 4 massive clusters MS0451-0305, RXJ0152.7-1357, RXJ1226.9+3332, and RXJ0848.6+4453 are as follows: (1) The galaxies in the z=0.5-0.9 clusters show no size evolution compared to z=0 cluster galaxies. Galaxies in RXJ0848.6+4453 at z=1.3 are marginally smaller than those at z=0. The result supports that the size evolution depends on the cluster environment and is accelerated in massive clusters compared to poorer clusters and the field. (2) The bulge-dominated galaxies in the 4 clusters populate the Fundamental Plane similarly to the FP at z=0. However, the slope is "steeper" at z=0.5-1.3 than at z=0. This indicates a mass dependent epoch of the last major star formation episode in the galaxies, occurring at z=1.5-2. (3) The bulge-dominated galaxies in RXJ0848.6+4453 at z=1.3 have very strong Balmer absorption lines and in many cases also show [OII] emission. Both facts can be explained by a major cluster-wide star formation episode 1-2 Gyr prior to the epoch equivalent to the cluster redshift. The project is ongoing. The full sample covers 20 massive clusters at z=0.15-1.6 and five z<0.1 clusters. Imaging is available for all the clusters, spectroscopy for the z<1 clusters is also completed, while spectroscopy of the highest redshift clusters is ongoing.

Posters

Anastasia Kasparova
Sternberg Astronomical Institute, Moscow Lomonosov State University (Russia)

A portrait of Malin 2

The low surface brightness (LSB) disc galaxy Malin 2 challenges the standard theory of galaxy evolution because of its enormous total mass ~2×10^{12} $M_\odot$, which must have been formed without recent major merger events. The aim of our work is to create a coherent picture of this exotic object by using new optical multicolour photometric and spectroscopic observations at the Apache Point Observatory as well as archival data sets from Gemini and wide-field surveys. We have performed Malin 2 mass modelling, we have estimated the contribution of the host dark halo and we have found that it acquired its low central density and huge isothermal sphere core radius before the disc subsystem was formed. One of the unique properties of Malin 2 turned out to be the apparent imbalance of the interstellar media: the molecular gas is in excess with respect to the atomic gas for given values of the gas equilibrium turbulent pressure. We explain this imbalance by the presence of a significant portion of the dark gas not observable in CO and the HI 21-cm lines. We also made conclusions about the features and the history of star formation for this galaxy. We argue that the massive and rarefied dark halo which formed before the disc component describes all the observed properties of Malin 2 well and we find that there is no need to assume additional catastrophic scenarios (such as major merging) proposed previously in order to explain the origin of giant LSB galaxies.

Kshitija Kelkar
University of Nottingham (UK)

Galaxy sizes as a function of environment at intermediate redshift from the ESO Distant Cluster Survey

The remarkable growth in galaxy size observed from z~2.5 to the present has been reported to be depend on the environment at higher redshifts, with the early-type/passive galaxies in higher density environments growing earlier. This talk will focus on comparing the mass-size relations of cluster and field galaxies in the $0.4 < z < 0.8$ redshift range from the ESO Distant Cluster Survey (EDisCS). Using a spectroscopic and a photometric sample, we compare galaxies in the widest possible range of available environments to assess whether the environment has any effect on the sizes of galaxies with similar morphologies or colours. We find no significant difference in the size distributions of cluster and field galaxies of a given morphology (E, S0 and Spiral). Similarly, we find no significant difference in the size distributions of cluster and field galaxies of similar colours (red sequence and blue cloud). These results have important consequences for the physical proces(ses) responsible for the size evolution of galaxies, and in particular the effect of the environment on such evolution. Such dependence disappears at lower redshifts, implying that, if the reported difference at higher-z is real, the growth of field galaxies has caught up with that of cluster galaxies by z~1.

Posters

Suk Kim
Chungnam National University (Korea)

The Extended Virgo Cluster Catalog

We present a new catalog of galaxies in the wider region of the Virgo cluster, based on the SDSS Data Release 7. The Extended Virgo Cluster Catalog covers an area of 750 deg² or 62.2 Mpc². It is 5.4 times larger than the footprint of the classical Virgo Cluster Catalog and reaches out to 3.5 times the virial radius of the Virgo cluster. We selected 1324 spectroscopically targeted galaxies with radial velocities less than 3000 km/s. In addition, 265 galaxies that have been missed in the SDSS spectroscopic survey but have available redshifts in the NED are also included. Our selection process secured a total of 1589 galaxies of which 676 galaxies are not included in the VCC. The certain and possible cluster members are defined by means of redshift comparison with a cluster infall model. We employed two independent and complementary galaxy classification schemes: the traditional morphological classification based on the visual inspection of optical images and a characterisation of galaxies from their spectroscopic features. We compare the EVCC galaxies with the VCC in terms of morphology, spatial distribution, and luminosity function. The EVCC defines a comprehensive galaxy sample covering a wider range in galaxy density that is significantly different from the inner region of the Virgo cluster. It will be the foundation for forthcoming galaxy evolution studies in the extended Virgo cluster region, complementing ongoing and planned Virgo cluster surveys at various wavelengths.

Takanobu Kirihara
University of Tsukuba (Japan)

A new puzzle of the Cold Dark Matter Prediction in the Outer Density Profile of the Andromeda Galaxy

Recent theory of the structure formation in the universe using cosmological N-body simulations predicts that cold dark matter (CDM) halos have a universal mass-density profile. These simulations predict that the density profile of CDM outer halos decreases with the cube of the distance from the galactic center. However, so far not much effort has examined this hypothesis because it is extremely difficult to measure the mass distribution of the outer region of a galaxy. The stellar and/or gas density is too low to detect even with the latest instruments. On the other hand, a recent observation discovered a giant stellar stream (GSS) and stellar shells in the halo of the Andromeda galaxy (M31). The GSS extends about 120 kpc further away along the line of sight from M31, and its spatial and velocity structure have been observed in detail. So far, N-body simulations of a galaxy merger between a satellite dwarf galaxy and M31 nicely reproduced these structures. Here we show the result of the N-body simulation of the galaxy to investigate the mass distribution of the DM halo in M31. We change the power-law index x of the outer-density profile and the total mass of the CDM halo of M31. To reproduce the observational structures, we find the sufficient condition for x. The best-fit parameter is x=-3.7, which is steeper than the CDM prediction. In addition, we also focus on the internal structure of the disrupted satellite galaxy. If time permits, we will discuss its morphology.

Posters

Janusz Krywult
Jan Kochanowski University (Poland)

Morphological properties of VIPERS galaxies at z~0.8

We investigate the morphological properties of galaxies in the redshift range 0.5<z<1.0 from VIMOS Public Extragalactic Redshift Survey (VIPERS). Luminosity profiles of ~50,000 objects were approximated with the single Sersic function using the CCD galaxy images taken from CFHTLS. We divided galaxies into early, intermediate and late-type class using (U-B) vs. (B-V) rest-frame colour and the Sersic index. We compare the Sersic index, luminosity, stellar mass and size of galaxies and discuss correlations of this parameters with galaxy morphological type.

Youngdae Lee
Chungnam National University (Korea)

Galaxy luminosity function and mass assembly of the Abell 119 cluster

We present the galaxy luminosity function (LF) of the Abell 119 cluster. Deep images in u, g, and r bands were taken using MOSAIC II CCD on a Blanco 4-m telescope at CTIO. Based on radial velocities at bright magnitudes and scaling relations at faint magnitudes, accurate membership of galaxies was determined. The LF of A119 is well fitted with a two-component (i.e., Gauss and Schechter function) rather than a single Schechter function. The LF varies with the environmental parameters in which the LFs in the inner and high density regions have a steep slope, while outer and low density regions show shallow one. This trend is also supported by L/F ratio which decreases with increasing clustercentric radius or decreasing local density. By dividing sample galaxies into red (R) and blue (B) ones, the B/(B + R) increases with increasing clustercentric radius and decreasing local density. We discovered that A119 is embedded in the large scale filamentary structure around the cluster and, furthermore, substructures of Abell 119 are aligned with direction of this filament. With these results, we discuss the mass assembly history of the Abell 119.

Posters

Ilaria Lonoce
University of Insubria, INAF-OA Brera (Italy)

Spectral evidences of multiple stellar populations in z~1 early-type galaxies

I present the first spectral evidence of multiple stellar components which differ for their age in a sample of ETGs at 0.7<z<1.1. The sample is composed by 15 galaxies selected from the GOODS-S field on the basis of their morphology and of the availability of high S/N spectra in the restframe range 3700-4300Å. The new proposed spectral analysis is based on the measure of the blue indices H+K(CaII) and D(4000). The combination of the two indices revealed detailed information about the not homogeneous age of the stellar populations of the galaxies, in a redshift range critical for their evolution. From the comparison of the obtained measures with a wide range of synthetic stellar population models, we found that some of the galaxies present composite stellar populations, where the most of their stellar mass belongs to old stellar populations and the remaining small fraction is less than 1 Gyr old; in some cases the younger component presents evidences of ongoing star formation, detected by means of the high sensitivity of the H+K(CaII) index to young stars. Finally we have compared these results with the analysis of a sample of ETGs belonging to two clusters at z~0.8, by Jorgensen et al. 2013. This comparison suggests that the stellar populations of cluster ETGs are more homogeneous with respect to their field counterparts in the same redshift range.

Nicola Malavasi
University of Bologna (Italy)

The environment of radio sources in the VLA-COSMOS Survey field

With this work the role of the environment and its correlation with Active Galactic Nucleus (AGN) phenomena is investigated. Using data from the Cosmic Evolution Survey (COSMOS) both in optical and radio wavelengths (VLA-COSMOS) the environment is determined on a scale of 0.5 Mpc between redshift 0 and 2. In order to bring new insights on the processes of galaxy formation and evolution, environmental properties are studied for galaxies presenting radio emission and in particular for subsamples of AGN-hosting and quiescent galaxies. The exploration of environmental properties is done via overdensity richness distributions, comparisons with various sets of control samples, matching with known catalogues of groups and clusters from the literature and the construction of mass functions. The results lead us to conclude that environment has a role in galaxy formation processes and that a correlation with the presence of AGN phenomena can be traced, with denser environments leading to an enhanced presence of galaxies showing radio emission. The evolution of these features with redshift is also investigated.

Posters

Raffaella Anna Marino
Universidad Complutense de Madrid (Spain)

Combing PPAk Integral Field Spectroscopy and PACS-SPIRE Herschel data: a multi-wavelength study of dust properties in spiral disks

The main goal of this study is to combine the analysis of the optical bidimensional spectroscopy data obtained using the Calar Alto (CAHA, Spain) observatory 3.5m telescope in the PPak Integral Field Unit mode with the infrared imaging data from the PACS instruments of a subset of galaxies from the Herschel Reference Survey (HRS hereafter; Boselli et al. 2010) observed with the ESA/Herschel observatory. We investigate the distribution and physical properties of interstellar dust and its relation with the chemical composition of the gas combining data from the UV to the submillimeter. We have also compared our photometric data with the results obtained from the code CIGALE (Code Investigating GALaxy Emission, Noll et al. 2012) to understand why and how the normal spiral galaxies are forming stars (among other properties). This unprecedented set of multi-wavelength data allow us to determine the attenuation of the gas from the PPAk spectroscopic optical data-cubes and compare it with the dust-attenuation of the stellar continuum from the ESA/Herschel total infrared emission that we can derive using its PACS bands combined with the UV data obtained with GALEX satellite. We are studing for the first time with an high spatial and unique spectral resolution, the results obtained so far for the attenuation derived with two different technique to understand which are the drivers for the present star formation and for the star formation history in a spiral galaxy.

Gustavo Morales
ARI, University of Heidelberg (Germany)

Stellar Tidal Streams as Cosmological Diagnostics

Within the hierarchical framework for galaxy formation, merging and tidal interactions are expected to shape large galaxies up to the present day. State-of-the art cosmological simulations built within the LCDM paradigm predicts that the fossils records of tidal disrupted satellites that lead to stellar tidal streams in their halos- may be still present in the outskirts of all the nearby galaxies. These faint tidal remnants have not yet been fully exploited as constraints on galaxy formation, mainly because they are challenging to observe. Our team has been working in an ultra-deep, wide-field imaging exploration of several nearby spiral galaxies based on data taken with amateur robotic telescopes, revealing for the first time striking stellar tidal streams of different morphologies at unprecedented sensitivity and detail. Encouraged by these results, we have embarked on the first systematic and comprehensive imaging survey of stellar tidal streams for a volume complete sample of 80 nearby Milky Way-like spiral galaxies, reaching a SB limit 2.5 magnitudes deeper that any available optical survey. The data produced will for first time give the extensive statistical basis necessary to undertake a direct and stringent comparison of the observed level of stellar halo sub-structure with theoretical predictions of high resolution LCDM models. Such a quantifiable comparison will allow to test these LCDM simulations at small scales, which are the most sensitive to the nature of DM.

Posters

Thibaud Moutard
Laboratoire d'Astrophysique de Marseille (France)

22 square degrees of the sky to probe the evolution of the stellar mass function since z = 1.5, and its link to the different galaxy star-formation quenching processes

The stellar mass function (SMF) has become a common tool to study the stellar mass assembly of galaxies and even their formation, through the constraint that they put on semi-analytic models and N-body simulations. We present here the evolution of the SMF since redshift z =1.5 to z = 0.2 and computed on more than 22 square degrees of the sky, allowing to become almost insensitive to the cosmic variance. We find a very high constancy of the star-forming galaxy SMF high-mass-end across cosmic time, which seems to confirm the scenario of "mass-quenching" introduced by Peng et al. in 2010. In parallel the SMF of passive galaxies at low redshift shows a clear double Schechter function that Peng et al. explains by an "environmental quenching" affecting low-mass galaxies in the high density regions of the Universe.

Emiliano Munari
University of Trieste (Italy)

Understanding galaxies for generating mock galaxy catalogues

I present a new software for creating mock catalogues of galaxies. It makes use of empirical relations taken from both observations and simulations to obtain a reliable reproduction of observable properties of galaxies and galaxy clusters, like 2pt correlation function, luminosity functions, colour distribution. The use of an HOD approach guarantees that the statistical properties of galaxy distribution are well reproduced, allowing these mocks to be a useful tool for testing algorithms and pipelines specifically built for future surveys, with particular attention to Euclid. For the spatial distribution of galaxies within DM halos, a dynamical model is being developed. Making use of relations calibrated against numerical simulations, we compute the orbits of galaxies taking into account the dynamical processes taking place in DM halos, like dynamical friction, tidal stripping and merging with the central galaxy. This model allows to compute the radial distribution of satellites in order to reproduce a reliable spatial distribution.

Posters

Brenda Namumba
University of Kwazulu-Natal (South Africa)

HI absorption study in active galaxies

Cold gas in galaxies has been related to the formation and evolution of galaxies in the recent past as it is a precessor of star formation. However, still very little is known about the evolution of cold gas present in galaxies. One of the main goals of this project is to use HI absortpion line to study the evolution of cold gas in three active galaxies using the KAT-7 data. This will enable us study the statistical properties of the atomic hydrogen across wide redshift and provide important input on the enviroment where the cold atomic gas is detected via 21 cm absorption line.

François Nehlig
Observatoire Astronomique de Strasbourg (France)

Environmental effects on Virgo spirals galaxies. Molecular fraction and star formation

The cluster environment can affect galaxy evolution in different ways: (1) via ram pressure stripping or (2) by gravitational perturbation caused by galactic encounters. Both kinds of interactions lead to the compression of the ISM and its associated magnetic field, causing an increase of the gas surface density as well as the appearance of asymmetric ridges of polarized radio continuum emission. We aim to disentangle the effects of ram pressure and tidal compression of the ISM to show how the compression of the ISM can influence the molecular fraction and the star formation rate. With new deep IRAM 30m HERA CO(2-1) data of NGC 4501, a Virgo spiral galaxy currently experiencing ram pressure stripping, and NGC 4567/68 an interacting pair of galaxies, we investigated the star formation efficiency with respect to the molecular gas and the dependency of the molecular fraction on pressure. Both systems show deviations from the relations observed for field spirals galaxies. A dynamical model of both systems allows us to investigate the physical reasons of these deviations.

Posters

Carmen P. Padilla-Torres

TNG FGG (Spain)

Searching Barionic Matter at Corona Borealis Supercluster

One of the most important parameters in the description of the universe is the mean baryonic density. The fraction of baryons missing can be distributed in large structures of the actual Universe, in the form of “hot diffuse gas warm” temperature 10^5 K<T<10^7 K. One possible way to identify this type of baryons is through the Sunyaev-Zel'dovich (SZ) effect. The VSA interferometer has been involved in the search of this matter. It has produced maps ~33 GHz with a beam of 11' and a sensitivity of ~ 20 mJy for the Corona Borealis supercluster (CrB-SC). We observed a region ~36 square degrees area within the supercluster that could be associated with SZ effect produced by the diffuse gas larger than galaxy clusters scales (Genova-Santos et al., 2005, 2008). We have studied the galactic population of that area, called CrB-H, and verified the existence of a difference compared to other intercluster regions. We used photometric and spectroscopic SDSS data and a deeper spectroscopic study using AF2-WYFFOS from WHT. An attempt was made to find out if the characteristics of galaxies that populate CrB-H are related to those of the galaxies that inhabit the CrB-SC clusters or are similar to those of galaxies that populate the intracluster medium. Has also performed a morphological study of galaxies that populate the area of CrB-SC. Finally, it has been sought to characterize the structures in CrB-H, and have assigned each contribution they contribute to the SZ effect maps found in VSA.

Ciro Pappalardo

CAAUL, OAL Lisbon (Portugal)

Environmental Effects on interstellar medium of Virgo spiral galaxies

The evolution of galaxies is set by a complex mechanism of recycling between the stellar and the gaseous components, but the picture is even more complicated, because galaxies are preferentially found in cluster. For that cases the environment through hydrodynamical and gravitational effects, can drastically modify the gas distribution within galaxies. To quantify this effects we considered a sample of spiral galaxies in the Virgo cluster and we investigate the dust-to-gas as a function of gas deficiency. Both the molecular gas and the dust distributions show steeper radial profiles for HI-deficient galaxies and the average dust-to-gas ratio for these galaxies increases or stays radially constant. On scales of ~3 kpc, we find a strong correlation between the molecular gas and the 250 micron surface brightness that is tighter than average for non-deficient galaxies. The correlation becomes linear if we consider the total gas surface mass density. However, the inclusion of atomic hydrogen does not improve the statistical significance of the correlation. The environment can modify the distributions of molecules and dust within a galaxy, although these components are more tightly bound than the atomic gas.

Posters

Akash Pirya
CRyA (Mexico)

SDSS study of the environments of giant radio galaxies

A sample of all known giant radio sources (GRGs) has been compiled, from which a subset of sources has been selected for a detailed study of their evolution in the nearby optical environments of these sources by examining the distributions of galaxies in their vicinity using Sloan Digital Sky Survey (SDSS) III (DR9). We found that generally the giant radio sources do not evolve in rich environments. Very few sources are in the richer environments but there is no significant signature for the asymmetric behaviour in these sources except in three giant radio sources J1021+1217, J1032+5644 and J1552+2005 (3C 326), the shorter arm is found to interact with a group of galaxies which forms part of a filamentary structure. In the case with strong and variable core, J0313+4120, the large flux density asymmetry is possibly also caused by the effects of relativistic motion.

Lorenzo Posti
University of Bologna (Italy)

The imprint of dark matter haloes on the size and velocity dispersion evolution of central and satellite galaxies

Early-type galaxies (ETGs) are observed to be more compact, on average, at $z > 2$ than at $z \sim 0$, at fixed stellar mass. Recent observational works suggest that such size evolution could reflect the similar evolution of the host dark matter halo density as a function of the time of galaxy quenching. We explore this hypothesis by studying a cosmological Lambda-CDM N-body simulation from which we extract halo and subhalo catalogs, measuring for each object mass, half-mass radius and a central velocity-dispersion. Haloes and subhaloes are linked, respectively, to central and satellite galaxies by assigning them a stellar component under simple but justified assumptions. The resulting galaxies evolve consistently with the observed ETGs up to $z \sim 2$, but the model has difficulty reproducing the fast evolution observed at $z > 2$. Our approach naturally takes into account the dilution of compact ETGs in a population of newly quenched galaxies. We conclude that a substantial fraction of the size evolution of ETGs can be ascribed to a systematic dependence on redshift of the structural properties of the dark matter haloes.

Posters

Tim Rawle
ESAC, ESA (Spain)

The Influence of Cluster Mergers on Galaxy Formation

Cluster mergers are the most massive dynamic environments in the Universe, yet their influence on the evolution of individual galaxies remains poorly understood. I present detailed analysis of star formation rates (dusty and unobscured, from Herschel, Spitzer, WISE, GALEX) and morphologies (HST) of galaxies within two spectacular cluster mergers at z~0.3: the archetypal Bullet cluster (1E0657-558; Rawle et al. 2012, ApJ 756 106), and the HST Frontier Field, Pandora's cluster (Abell 2744; Rawle et al. 2014, MNRAS 442 196). Examination of individual cluster galaxies in A2744 reveals striking evidence for morphological transformation and enhanced star formation, triggered by the merger-induced shock front. I also discuss the bulk properties of these two cluster mergers in the context of the general population at intermediate redshift (z~0.2-0.8), including both relaxed and merging systems from the LoCUSS and CLASH surveys.

Alvio Renzini
INAF-OA Padova (Italy)

Metal Production in the Environment of Clusters of Galaxies

The metal content of clusters of galaxies and its relation to their stellar content is revisited making use of a cluster sample for which all four basic parameters are homogeneously measured within consistent radii, namely core-excised mass-weighted metallicity plus total, stellar and ICM masses. For clusters of total mass M_500 ~ 10^14 Msun nice agreement is found between their iron content and what expected from empirical supernova yields. For the same clusters, there also appears to be at least as much iron in the intracluster medium (ICM) as there is still locked into stars (i.e., the ICM/stars metal share is about unity). However, for more massive clusters the stellar mass fraction appears to drop substantially without being accompanied by a drop in the ICM metallicity, thus generating a major tension with the nucleosynthesis expectation and inflating the metal share to extremely high values (up to ~ 4). Various possible solutions of this conundrum are discussed, but are all considered implausible given the lack of any independent observational support. For this reason we still entertain the possibility that even some of the best cluster data may be faulty, though we are not able to identify any obvious bias. Finally, based on the stellar mass-metallicity relation for local galaxies we estimate the contribution of galaxies to the ICM enrichment as a function of their mass, which sets constraints on their loss of metals over their evolutionary history.

Posters

François Rérat
LASTRO, EPFL (Switzerland)

The Fate of Galaxy Groups Falling on Intermediate Mass Clusters

Galaxies are distributed in a complex network of filamentary structures. Their properties such as morphology, star formation rate, and gas fraction strongly depend on their place in this cosmic web; dense regions contain a higher fraction of red, early-type galaxies and a lower fraction of galaxies with ongoing star-formation. We initiated the first systematic study of the galaxy properties along the structures feeding medium-low mass clusters, a domain not yet investigated at intermediate redshift. It by-passes most of the previous works in radial extent (up to 10 virial radii), and very crucially gather homogeneous data. I will discuss our methods to identify those large scale structures, and then present their contents and properties: masses, stellar population, star formation rates, and morphologies as a function of local density and distance to the cluster center, drawing comparisons with nearby and more massive clusters.

Soo-Chang Rey
Chungnam National University (Korea)

The properties of early-type dwarf galaxies in the Ursa Major cluster

Using SDSS DR7 and NED spectroscopic data, we identify 166 galaxies as members of the Ursa Major cluster with Mr < -13.5 mag. We perform morphological classification for all galaxies by means of carefully inspecting g, r, i band color and monochromatic images. We show that the Ursa Major cluster is dominated by late-type galaxies, but also contains a significant number of early-type galaxies, particularly in the dwarf regime. We present evidence for the existence of several subgroups of the cluster, and the early-type fraction is found to increase with group mass. We also investigate the role played by environment by comparing the properties of the Ursa Major early-type dwarf galaxies to those of the Virgo cluster. In contrast to Virgo, the red sequence of the Ursa Major cluster is only sparsely populated in the optical and ultraviolet color-magnitude relations. We discover that the majority of early-type dwarf galaxies in the Ursa Major cluster show star formation in their centers, which is a larger fraction than in the Virgo cluster. It is interesting, however, that the colors of these galaxies outside of their blue cores are as red as those of the Virgo cluster analogues. We suggest that gravitational tidal interactions can trigger central blue star forming regions in early-type dwarfs. After that, star formation would only fade completely when the galaxies experience harsh cluster environmental effects which are nearly absent in the Ursa Major cluster.

Donatella Romano
INAF-OA Bologna (Italy)

The chemical evolution of the smallest Milky Way satellites: Bootes I

We present the results of chemical evolution models for Bootes I, one of the ultra-faint dwarf galaxies found lurking around the Milky Way. We compare the model predictions with high-resolution spectroscopic observations of giant stars in Bootes I, and conclude that the interaction with the environment must have played a major role in shaping the chemical properties of Bootes I stars.

Deise Aparecida Rosa
Universidade do Vale do Paraiba (Brasil)

Interaction effects on galaxy pairs with Gemini/GMOS II: Oxygen abundance gradients

In this paper we derived oxygen abundance gradients from HII regions located in eleven galaxies in eight systems of close pairs. Long-slit spectra in the range 4400-7300Å were obtained with the Gemini Multi-Object Spectrograph at Gemini South (GMOS). Spatial profiles of oxygen abundance in the gaseous phase along galaxy disks were obtained using calibration of strong emission-lines (N2 and O3N2). We found oxygen gradients significantly flatter for all the studied galaxies than those in typical isolated spiral galaxies. For one object of our sample, AM 1256B, we found a clear break in the oxygen abundance for the inner part of this galaxy. This break is located in the region of disk with the minimum value of the star formation rate. We also found that HII regions located in interacting galaxies present lower values of the ionization parameter (U) when comparing to the ones in isolated galaxies. This result was interpreted as being due to the gas flow along the disk of interacting galaxies yields high values of electron density and consequently low values of the ionization parameter. These HII regions complete the low ionization and high metallicity zone of the sequence shown by the regions belonging to isolated galaxies in the U-metallicity plane.

Posters

Quentin Salomé
LERMA/Observatoire de Paris (France)

3C 285: a nearby galaxy with jet-induced star formation

How efficiently star formation proceed in galaxies is still an open question. Recent studies suggest that AGN can regulate the gas accretion and thus slow down star formation (negative feedback). However, evidence of AGN positive feedback has also been observed in a few radio galaxies (eg. Centaurus A, Minkowski's Object, 3C 285, ...). Here we present CO observations of one of them (3C 285), which is an example of jet-induced star formation: a spot (named 09.6) aligned with the jet, at a projected distance of 70 kpc from the galaxy, shows star formation, detected in optical emission. To know the distribution of molecular gas along the jets is a way to study the physical processes at play in the AGN interaction with the intergalactic medium. We observed CO lines in the central galaxy with the IRAM-30m telescope. The spectra present a double-horn profile, typical of a rotation pattern, from which we will be able to estimate the density profile of the galaxy. Interestingly, the 09.6 spot is not detected in CO, that shows the lack of large amount of molecular gas in this region. The cold gas mass upper limit is consistent with a star formation induced by the compression of dense ambient material by the jet. The molecular gas surface density follows a Schmidt-Kennicutt law if the emitting region is very compact and follows the Ha emission. Higher spatial resolution observations are thus required in order to detect and map the CO in this jet-induced star forming region.

Jean-Baptiste Salomon
Observatoire Astronomique de Strasbourg (France)

The intrinsic ellipticity of dwarf spheroidal galaxies

The shape and the orientation of dwarf spheroidal (dSph) galaxies in the Local Group place constraints on their dynamics, the external gravitational field and the evolutionary history of their environment. Generally, only the projected shape and orientation of these dwarfs are known. Using the measured distances orientations and projected distances of the dSph observed around the Andromeda galaxy, we have derived the intrinsic ellipticity distribution (under the assumption that they are prolate structures). We will also discuss various interesting correlations between the morphology and other properties of these satellites.

Posters

Paolo Saracco
INAF-OA Brera (Italy)

Scaling relations of cluster and field elliptical galaxies at z~1.4

We studied the size-surface brightness (Kormendy) relation and the size-mass relation for two samples of elliptical galaxies at z~1.4: the first one composed of about 30 cluster ellipticals selected in two clusters at redshift z=1.27 and z=1.39 respectively, and the second one composed of about 30 field ellipticals selected in the GOODS-South field in the redshift range 1.2<z<1.45. Elliptical galaxies both in the field and in the cluster, have been selected according to their morphology determined by visual analysis of their HST-ACS images in the F850LP band. Analogously, their structural parameters have been derived homogeneously through the fit of the observed surface brightness profile in the F850LP images. We present a comparison of the scaling relations we derived at z~1.4 and a comparison with those in the local universe in order to constrain the evolution of cluster and field ellipticals and the role played by the environment.

José M. Solanes
University of Barcelona (Spain)

Investigating the observed dependence of the dual-AGN fraction on the orbital and halo spins of galaxy mergers

A massive set of nearly 400 high-resolution collisionless major-merger simulations is being analyzed in order to investigate the possible impact that the total amount of angular momentum involved in the interaction may have on the dynamical evolution of these systems and the properties of their remnants. Our simulations follow the evolution of binary galaxy mergers in bound orbits by using self-consistent N-body models of late- and early-type galaxies, composed of dark matter and stars, with mass ratios of 1:1 and 3:1, different initial orientations, and with values of the orbital and spin parameters consistent with the predictions of the currently favored cosmological model. Here we present results concerning the merger times and the triggering of dual AGN activity by the dynamics of mergers. By including constraints that mimic observational limitations in the simultaneous detection of two AGNs, we have determined when dual AGN activity is expected to occur in merging galaxies. Preliminary results indicate that while the duration of the mergers in general depends largely on the moduli and relative orientations of the initial orbital and internal angular momenta of the interacting galaxies, as well as on their stellar structure, the fraction of the merger-time in which strong dual AGN activity can be detected through imaging and spectroscopy is relatively insensitive to these factors, always being limited to a few percent in agreement with observations.

Posters

Alina Streblyanska
Instituto de Astrofisica de Canarias (Spain)

Optical follow-up of Planck’s Sunyaev-Zel'dovich cluster sample

The Planck mission between 2009 and 2013 measured the Cosmic Microwave Background (CMB) over a broad range of far-infrared wavelengths, and to an unprecedented accuracy. Planck's CMB maps provide answers to many fundamental questions about the early history and evolution of our universe, revealing new information about its age, contents and origins. One of the important results of the mission is the new all-sky cluster survey and the most extensive catalogue of the galaxy clusters candidates detected by means of the Sunyaev-Zeldovich effect. I will present results of our optical follow-up campaign of SZ clusters conducted using telescopes located on the Canary Islands and discuss it in the context of previous measurements and findings.

Margherita Talia
University of Bologna (Italy)

The star-formation rate cookbook: recipes at 1 < z < 3

Many observational properties of galaxies are related to the star formation activity, but there are uncertainties in the exact quantitative interpretation of these observables, especially at high redshifts. Particularly important is to understand the processes that govern the star formation, and the relation between the instantaneous star-formation rate (SFR) and stellar mass, in galaxies at 1<z<3, which is the epoch when a substantial fraction of galaxy mass assembly took place, and when there is a peak in the evolution of the starÂ-formation rate density and AGN activity through cosmic time. Thanks to deep optical spectroscopy, the richness of public multi-wavelength photometry in the Chandra Deep Field, and the availability of HERSCHEL-PACS data, we studied the relation between various SFR indicators in a sample of z>1 galaxies drawn from the GMASS ultra-deep optical spectroscopic survey (UV flux, emission lines, SED fitting, IR luminosity), and how the different estimates may be crossÂ calibrated. We also addressed the fundamental topic of correcting indicators in the UV and optical regimes for dust extinction, by using the infra-red luminosity to test the relations on which the most commonly used local extinction laws are based.

Posters

Saeed Tavasoli
IPM Tehran (Iran)

The challenge of large and empty voids in the SDSS DR7 redshift survey

We present catalogs of voids for the SDSS DR7 redshift survey and for Millennium I simulation mock data. We use the void statistics as a test for Lambda_CDM model and semi-analytic galaxy formation model. We find that in the observation and the simulation, voids tend to be equally spherical. The total volume occupied by the voids and their total number are slightly larger in the simulation than in the observation. We find that large voids are less abundant in the simulation and the total luminosity of the galaxies contained in a void with a given radius is higher on average than observed by SDSS DR7 survey. We expect these discrepancies to be even more significant in reality than found here since the present value of sigma_8 given by WMAP7 is lower than the value of 0.9 used in the Millennium I simulation. The reason why the simulation fails to produce enough large and dark voids might be the failure of certain semi-analytic galaxy formation models to reduce the small-scale power of CDM and to produce sufficient power on large scales.

Crescenzo Tortora
INAF-OA Capodimonte (Italy)

Evolution of central dark matter of ETGs up to z = 1

I will discuss the evolution of dark and luminous matter in the central regions of early-type galaxies (ETGs) up to z about 1, adopting a spectroscopically selected sample of 154 cluster and field galaxies from the EDisCS survey. This datasample covers a wide range in redshifts, stellar masses and velocity dispersions. Dark matter (DM) fractions is obtained determining the dynamical masses from Jeans modelling of aperture velocity dispersions and the stellar mass from galaxy colours, and the results are compared with local samples. I discuss how the correlations of central DM with galaxy size (i.e. the effective radius), stellar mass and velocity dispersion evolve as a function of redshift, finding clear indications that local ETGs are, on average, more DM dominated than their counterparts at larger redshift. I discuss our results within galaxy formation scenarios, and conclude that the growth in size and DM content which we measure within the last 8 Gyr is incompatible with passive evolution, while it is well reproduced in the multiple minor merger scenario. I also show the impact of the galaxy model and IMF on our DM inferences. In particular, Salpeter IMF can be better accommodated by low redshift systems, while producing stellar masses at high-z which are unphysically larger than the estimated dynamical masses (particularly for systems with lower velocity dispersions).

Posters

Milena Valentini
University of Bologna (Italy)

Origin of cold gas in massive elliptical galaxies

The availability of multi-λ data revealed the presence of more than 10^7 $M_\odot$ of warm and cold gas in the innermost regions of ~80% of massive elliptical galaxies.One of the most important observed features in the core of these ellipticals is the spatial correspondence between the cold molecular, warm ionized and soft X-ray emitting gas. This picture can be explained by multiphase structures. The presence of a strongly disturbed morphology of the hot ISM of these ellipticals provides evidence that such systems have been perturbed by the AGN feedback. Both an internal and an external origin of these warm and cold phases are actually debated. An internal origin of the warm phase from stellar mass loss and subsequent cooling aided by interstellar dust is proposed here; several kinematic studies of ionized filamentary structures agree with it. The investigation (carried out through numerical hydrodynamical simulations) of the spatially distributed cooling process which occurs because of non-linear density perturbations and subsequent thermal instabilities proves that an internal origin of the warm phase from the once hot gas is possible. Computed velocity dispersions of ionized and hot gas are similar, thus validating the hypothesis that warm gas has cooled from a hot phase with turbulent motion. Cold gas originates from the cooling process, too: indeed, the surrounding stellar radiation does not manage to keep ionized all the cooled gas, which does undergo a further cooling.

Francesco Valentino
CEA Saclay (France)

The remarkable environment of the z=2 cluster CL J1449+0856: an evidence for a phase transition at the onset of cluster formation?

We have the unique opportunity to study the role of a cluster environment in the history of metal enrichment in galaxies through Subaru and HST observations of a significant set of typical SFGs emission lines (Hb, [OIII], Ha and [NII]) in the most distant spectroscopically confirmed cluster known to date, CL J1449+0856 at z=2. The stacking of representative samples of SFGs in the cluster over the mass range $10 < \log(M_*/M_\odot) < 11$ shows a significantly lower [NII]/Hα ratio (>3σ significance) compared to the field matched sample. This somewhat unexpected behaviour can be interpreted both as a metallicity deficiency in the cluster SFGs or as the result of a higher ionization parameter and a softer ionization field in the cluster SFGs or as a combination of the two effects. The metal deficiency in the cluster could be a special transitionary phase, as it is not observed in local clusters, nor in “proto-cluster” environments. It could be possibly due to an enhanced accretion of pristine gas from the environment and/or facilitated by recent or ongoing merging activity, something probably linked to the recent assembly of its dark matter halo. Our further surprising discovery of a giant Lyα halo residing in the cluster core from Keck narrow band imaging, and the presence of very strong diffuse light in the near-IR, support the idea that we are witnessing here for the first time a crucial formation phase of a cluster and its galaxies.

Posters

Remco van der Burg
CEA Saclay (France)

The distribution of stellar mass in galaxy clusters: Evidence for the inside-out growth of galaxy clusters since z = 1

Measurements on the distribution of galaxies in clusters show how well galaxies trace the underlying dark matter distribution, and provide constraints on galaxy evolution models. I will present measurements of the spatial distribution of stellar mass in 10 rich clusters from the Gemini Cluster Astrophysics Spectroscopic Survey (GCLASS) around redshift z~1 (vdBurg+14), and compare this to a similar measurement of their descendant population of 60 clusters at redshift z~0.15. By comparing the spatial stellar mass distributions in the same physical units, we can learn how the stellar mass content assembles in these massive haloes. We find that the stellar mass distributions are very concentrated at z~1, and that these clusters have to primarily accrete stellar mass onto the outskirts when they evolve towards redshift z~0.15. The stellar mass distribution of galaxy clusters therefore grows inside-out, in a way that is in stark contrast to what models predict.

Tiziana Venturi
INAF-IRA Bologna (Italy)

Radio luminosity function of BGC in the Extended GMRT Cluster Sample

We derived the radio luminosity function (RLF) for the brightest cluster galaxies in the Extended GMRT Cluster Sample, originally selected to address the question of the origin of diffuse cluster radio sources. The cluster sample includes 66 clusters with $L_x > 5\times10^{44}$ erg/s, redshift in the range 0.2-0.4 and declination > -30 deg. The total number of BCGs in the sample is 64. For 61 BGCs the information on the dynamical state of the hosting cluster is available, and we performed the study of the radio luminosity function dividing our sample between merging and non merging clusters. We found a significant dependance of the RLF on the dynamical state of the cluster: the BCGs in relaxed clusters have a higher probability of radio loudness at a given radio power compared to BCGs in merging environments. We will show our results and the follow-up studies.

Posters

Yu-Ting Wu
ASIAA (Taiwan)

The Eccentricities and Nucleus Off-Center Displacements of Collisional Ring Galaxies

Ring galaxies present very unusual shapes in that the main disk of individual spiral galaxies are dominated by a ring centered on a nucleus. Head-on collisions were first proposed by Lynds & Toomre (1976) as a mechanism for producing ring galaxies. Motivated by the existence of observational asymmetric ring galaxies, we investigated the effects of relative inclinations and impact parameters of the galaxy pair in collisional events on the morphology of ring galaxies using N-body simulations. This is the first study to quantify the association between the different parameters, including the initial inclination angle and the impact parameter on the shapes of ring galaxies. We conclude that the eccentricity of rings is proportional to the relative inclinations and the nucleus off-center displacement is proportional to the impact parameter, suggesting that some observed ring galaxies could be explained by our simulations.

Alessandra Zanichelli
INAF-IRA Bologna (Italy)

Galaxy populations in the VIPERS Survey: radio emission properties and evolution

Radio and optical properties of faint radio sources are investigated by means of the VIPERS and FIRST surveys. Type classification and redshifts of VIPERS galaxies allow the use of the stacking method in order to push the analysis of the radio properties well below the FIRST radio flux limit and to follow their evolution at different cosmic epochs.

Posters

Stefano Zarattini
Instituto de Astrofísica de Canarias (Spain)

The evolution of the luminosity function with the magnitude gap: from "regular" to "fossil" systems

Fossil galaxy groups were discovered three decades ago by Ponman et al. (1994).They are thought to be very old and relaxed systems in which all M* galaxies had merged in a single, massive, central galaxy. Their key parameter is the gap in magnitude between the two brightest member galaxies (Δm_{12}). Thus, their luminosity functions (LF) are expected to present a deficit of bright galaxies (smaller M* values). However, studies of the LF in fossil systems lead to different result concerning the faint-end slope (α). Some of them have steep slopes ($\alpha < -1.5$), others present flatter slopes ($\alpha > -1$). Those results were biased by the small number of fossil systems known; for this reason, we used an homogeneous dataset of ~100 clusters and groups taken from the SDSS, including 17 spectroscopically confirmed fossil systems. With this dataset, we are now able to present the first homogeneous study of the evolution of the LF with Δm_{12}. We stacked all LF in three bins of Δm_{12}, finding that both M* and α seem to evolve with Δm_{12}, in the sense that the bigger the gap, the lower the M* and α parameters. In this talk, we will discuss the impact of this result on the most-accepted formation scenario for fossil systems, together with possible biases and alternative explanations.

List of Participants

name	affiliation	contribution
Betsey Adams	ASTRON - Netherlands	poster
Sinan Alis	OCA - France	poster
Viola Allevato	Univ. of Helsinki - Finland	talk S2
Marianna Annunziatella	Univ. of Trieste - Italy	poster
Paramita Barai	INAF-OA Trieste - Italy	talk S3
Sandro Bardelli	INAF-OA Bologna - Italy	-
Dino Beghetto Junior	Univ. do Vale do Paraíba-UNIVAP - Brasil	poster
Philip Best	IfA Edinburgh - UK	talk S2
Samuel Boissier	LAM - France	LOC
Micol Bolzonella	INAF-OA Bologna - Italy	SOC/LOC
Nina Bonaventura	McGill Univ. - Canada	poster
Alexandre Bouquin	Univ. Complutense de Madrid - Spain	poster
Malcolm Bremer	Univ. of Bristol - UK	poster
Eva Busekool	Univ. of Groningen - Netherlands	talk S3
Lucio Buson	INAF-OA Padova - Italy	poster
Marcello Cacciato	Leiden Observatory - Netherlands	talk S1
Rebecca Canning	Stanford University/KIPAC - USA	talk S4
Alberto Cappi	INAF-OA Bologna - Italy	-
Hoseung Choi	Yonsei University - Korea	poster
Norbert Christlieb	Univ. of Heidelberg - Germany	-

Jiwon Chung	Chungnam National Univ. - Korea	poster
Anna Cibinel	CEA Saclay - France	talk S5
Andrea Cimatti	Univ. of Bologna - Italy	SOC
Federica Ciocca	Univ. of Insubria - Italy	poster
Alice Concas	Excellence Cluster Universe Munich - Germany	poster
Juan Pablo Cordero	Univ. de Chile - Chile	poster
Jacob Crossett	Monash University - Australia	poster
Olga Cucciati	Univ. of Bologna - Italy	SOC/LOC
Ryan Cybulski	Univ. of Massachusetts - USA	talk S3
Iary Davidzon	Univ. of Bologna - Italy	LOC/talk S1
Sabrina De Grandi	INAF-OA Brera - Italy	-
Anna Delahaye	McGill University - Canada	poster
Roberto De Propris	FINCA, Univ. of Turku - Finland	poster
Marion Dierickx	Harvard-Smithsonian Center for Astrophysics - USA	poster
Daria Dobrycheva	Main Astron. Obs. of NAS of Ukraine - Ukraine	poster
Donovan Domingue	Georgia College & State Univ. - USA	poster
Elena D'Onghia	Univ. of Wisconsin-Madison - USA	invited S5
Yohan Dubois	IAP - France	talk S1
M. Carmen Eliche-Moral	Univ. Complutense de Madrid - Spain	talk S5/poster
James Etherington	ICG Portsmouth - UK	poster
Stefano Ettori	INAF-OA Bologna - Italy	-
Renato Falomo	INAF-OA Padova - Italy	poster
Sarah Fazlollahpour	IPM Tehran - Iran	-
Mirian Fernández Lorenzo	Inst. de Astrofísica de Andalucía-CSIC - Spain	talk S5
Matteo Fossati	Univ. Sternwarte Munich & MPE - Germany	talk S1
Amelia Fraser-McKelvie	Monash Univ. - Australia	talk S2
Emily Freeland	Stockholm Univ. - Sweden	talk S3
Michelle Furlong	ICC, Univ. of Durham - UK	talk S2
Anna Gallazzi	INAF-OA Arcetri - Italy	talk S4
Adriana Gargiulo	INAF-OA Brera - Italy	poster
Giuseppe Gavazzi	Univ. of Milano Bicocca - Italy	invited S3

Myriam Gitti	Univ. of Bologna - Italy	poster
Violeta González-Pérez	Univ. of Durham - UK	poster
Gian Luigi Granato	INAF-OA Trieste - Italy	talk S2
Meghan Gray	Univ. of Nottingham - UK	invited S1
Laura Greggio	INAF-OA Padova - Italy	poster
ChangHoon Hahn	NYU CCPP - USA	talk S1
Chris Haines	Univ. de Chile - Chile	talk S4
William Hartley	ETH Zurich - Switzerland	talk S2
Peter Hatfield	Univ. of Oxford - UK	poster
Antonio Hernán-Caballero	Inst. de Fisica de Cantabria, Santander - Spain	poster
Michaela Hirschmann	IAP - France	talk S1
Marc Huertas-Company	GEPI - Obs. de Paris - France	talk S4
Angela Iovino	INAF-OA Brera - Italy	SOC
Shogo Ishikawa	NAOJ - Japan	poster
Inger Jorgensen	Gemini Observatory - USA	poster
Dietmar Kaletta	Univ. of Tuebingen - Germany	-
Anastasia Kasparova	SAI & Moscow Lomonosov State Univ. - Russia	poster
Kshitija Kelkar	Univ. of Nottingham - UK	poster
Suk Kim	Chungnam National Univ. - Korea	poster
Takanobu Kirihara	Univ. of Tsukuba - Japan	poster
Tadayuki Kodama	National Astron. Obs. of Japan - Japan	SOC
Katarina Kovač	ETH Zurich - Switzerland	invited
Yusei Koyama	ISAS/JAXA - Japan	talk S1
Janusz Krywult	Jan Kochanowski Univ. - Poland	poster
Francesco La Barbera	INAF-OA Capodimonte - Italy	talk S2
Khee-Gan Lee	MPIA - Germany	talk S3
Youngdae Lee	Chungnam National Univ. - Korea	poster
Brian Lemaux	LAM - France	talk S1
Yen-Ting Lin	ASIAA - Taiwan	talk S2
Ewa Lokas	Copernicus Center, Warsaw - Poland	talk S4
Marcella Longhetti	INAF-OA Brera - Italy	-

Ilaria Lonoce	Univ. Insubria & INAF-OA Brera - Italy	poster
Carlos López-Sanjuan	CEFCA Teruel - Spain	talk S5
Manuela Magliocchetti	INAF-IAPS Rome - Italy	talk S1
Christian Maier	Univ. of Vienna - Austria	talk S4
Nicola Malavasi	Univ. of Bologna - Italy	LOC/poster
Gary Mamon	IAP - France	talk S5
Allison Man	Dark Cosmology Centre - Denmark	talk S5
Raffaella Anna Marino	Univ. Complutense de Madrid - Spain	poster
Olga Melnyk	Univ. of Kyiv - Ukraine	LOC/talk S5
Gustavo Morales	ARI, Univ. of Heidelberg - Germany	poster
Thibaud Moutard	Laboratoire d'Astrophysique de Marseille - France	poster
Emiliano Munari	Univ. of Trieste - Italy	poster
Thorsten Naab	MPA Garching - Germany	invited S2
Brenda Namumba	Univ. of Kwazulu-Natal - South Africa	poster
François Nehlig	Obs. Astr. de Strasbourg - France	poster
Carlo Nipoti	Univ. of Bologna - Italy	talk S4
Allison Noble	Univ. of Toronto - Canada	talk S4
Pierre Ocvirk	Obs. Astr. de Strasbourg - France	talk S3
Alvaro Orsi	CEFCA - Spain	talk S1
Carmen P. Padilla-Torres	TNG FGG - Spain	poster
Rosita Paladino	Univ. of Bologna, INAF-IRA - Italy	talk S5
Ciro Pappalardo	CAAUL, OAL Lisbon - Portugal	poster
Anna Pasquali	Univ. of Heidelberg - Germany	invited S4
Dave Patton	Univ. of Trent - Canada	invited S5
Milena Pawlik	Univ. of St. Andrews - UK	talk S5
Yingjie Peng	Univ. of Cambridge - UK	talk S4
Jaime Perea	Inst. de Astrofísica de Andalucía CSIC - Spain	talk S5
Akash Pirya	CRyA - Mexico	poster
Bianca Poggianti	INAF-OA Padova - Italy	talk S3
Paola Popesso	Excellence Cluster Universe Munich - Germany	talk S1
Lorenzo Posti	Univ. of Bologna - Italy	poster

Lucia Pozzetti	INAF-OA Bologna - Italy	-
Ryan Quadri	Texas A&M University - USA	talk S4
Tim Rawle	ESAC, ESA - Spain	poster
Alvio Renzini	INAF-OA Padova - Italy	poster
François Rérat	LASTRO, EPFL - Switzerland	poster
Soo-Chang Rey	Chungnam National Univ. - Korea	poster
Donatella Romano	INAF-OA Bologna - Italy	poster
Deise Aparecida Rosa	Univ. do Vale do Paraíba-UNIVAP - Brasil	poster
Gregory Rudnick	Univ. of Kansas - USA	talk S4
José Sabater	IfA, Univ. of Edinburgh - UK	talk S2
Amélie Saintonge	UCL - UK	invited S3
Quentin Salomé	LERMA/Obs. de Paris - France	poster
Jean-Baptiste Salomon	Obs. Astron. de Strasbourg - France	poster
Angela Sandrinelli	Univ. of Insubria - Italy	talk S5
Paolo Saracco	INAF-OA Brera - Italy	poster
Debora Sijacki	Univ. of Cambridge - UK	invited S1
José M. Solanes	Univ. of Barcelona - Spain	poster
Veronica Sommariva	Univ. of Bologna - Italy	LOC
Oliver Steele	ICG Univ. Portsmouth - UK	talk S4
Alina Streblyanska	IAC - Spain	poster
Margherita Talia	Univ. of Bologna - Italy	LOC/poster
Saeed Tavasoli	IPM, Tehran - Iran	poster
Rita Tojeiro	Univ. of St. Andrews - UK	talk S1
Crescenzo Tortora	INAF-OA Capodimonte - Italy	poster
Christy Tremonti	Univ. of Wisconsin-Madison - USA	invited S2
Milena Valentini	Univ. of Bologna - Italy	poster
Francesco Valentino	CEA Saclay - France	poster
Remco van der Burg	CEA Saclay - France	poster
Tiziana Venturi	INAF-IRA Bologna - Italy	poster
Daniela Vergani	INAF-IASF Bologna - Italy	-
Tracy Webb	McGill Univ. - Canada	talk S2

David Wilman	MPE Garching - Germany	SOC
Yu-Ting Wu	ASIAA - Taiwan	poster
Sukyoung Yi	Yonsei Univ. - Korea	talk S5
Gianni Zamorani	INAF-OA Bologna - Italy	-
Alessandra Zanichelli	INAF-IRA Bologna - Italy	poster
Stefano Zarattini	Inst. de Astrofisica de Canarias - Spain	poster
Dongyao Zhao	Univ. of Nottingham - UK	talk S2
Elena Zucca	INAF-OA Bologna - Italy	-