Livia Vallini

Using FIR line emission to constrain the ISM of the galaxies across cosmic time

Far-infrared (FIR) metal cooling and molecular lines are an unique tool to constrain the physical properties of the various gas phases within the ISM of the galaxies. ALMA, with its unprecedented sensitivity, make it possible their detection from objects at end of the Epoch of Reionization (z>6), and the next generation FIR/MIR telescope SPICA will allow to observe them arising from galaxies at z~1-2.In this talk I will present a theoretical model that allows to describe the distribution of the neutral diffuse gas inside high redshift galaxies, and to predict the luminosity of several FIR metal cooling lines arising from it. The model is based on high resolution radiative transfer cosmological simulations, further implemented with sub-grid prescriptions to account for the cooling and the heating processes taking place in the ISM. I will show how the model has been successfully tested against recent ALMA detections, and how the comparison can be used to put constraints on the metallicity of high redshift galaxies. Moreover I will discuss how the results can be useful to predict line fluxes from sources that can be observed with SPICA.

Paolo Donati

Open clusters, free entry (almost)!

The open clusters of our Galaxy are unique astrophysical testbeds of stellar evolution theory and offer a favoured point of view to study the Galactic chemical evolution...all this information for "free". Not exactly, unfortunately. A "little bit" of effort is required to have homogeneous and accurate data sets. The Gaia-ESO Survey and the Bologna Open Clusters Chemical Evolution project are moving their steps forward along this direction and I will give a general description of their main results, differences and complementarity.

Felice Cusano

Variable stars and stellar populations in the dwarf galaxy Andromeda XXI

Maria Ida Moretti

Type II Cepheids in the Large Magellanic Cloud

Type II Cepheids (T2CEPs) are pulsating variable stars showing periods from about 1 to about 20 d. They are brighter but less massive than RR Lyrae stars for similar metal content. T2CEPs are often separated into BL Herculis stars (BL Her; periods between 1 and 4 d) and W Virginis stars (W Vir;

periods between 4 and 20 d) and originate from hot, low-mass stellar structures, starting their central He burning on the blue side of the RR Lyrae gap. The VISTA (Visible and Infrared Survey Telescope for Astronomy) survey of the Magellanic Clouds system (VMC) is collecting deep Ks-band time-series photometry of the pulsating variable stars hosted in the MCs. In this talk I will show the results obtained analyzing the near-infrared light curves of a sample of 130 Large Magellanic Cloud (LMC) Type II Cepheids (T2CEPs) for which identification, pulsation period and optical magnitudes are already known.

Edoardo Prospero Lagioia

The temperature distribution of horizontal branch stars in globular clusters: the case of M15

As part of a large project aimed at characterizing the UV properties of globular clusters, we present here a theoretical and observational analysis aimed at setting the framework for the determination of horizontal branch (HB) temperature distributions. This is a crucial information to understand the physical parameters shaping the HB morphology in globular clusters and to interpret the UV emission from unresolved stellar systems. We found that the use of zero age HB color--Teff relations is a robust way to derive effective temperatures of individual HB stars. We investigated the most suitable colors for temperature estimates, and the effect on the color-Teff relations of variations of the initial chemical composition, and of the evolution off the zero age HB. As a test case, we applied our color-Teff calibrations to the Galactic globular cluster M15.

Antonio Sollima

Realistic tidal field in Monte Carlo simulations of star clusters

Nuria Marcelino

The chemical inventory of pre/proto-stellar cores

Cold dark clouds are the sites of low-mass star formation and future planetary systems. They exhibit a complex gas-phase ion-neutral chemistry leading to the formation of a large variety of molecules. The lack of internal heating sources and violent physical processes, like shocks, make these dense and quiescent cores the best sites to explore and to model interestellar gas-phase chemistry and molecular depletion into the dust grain surfaces. However, they have been found to be less chemically simple than previously thought. Using the IRAM 30m radiotelescope in Spain, we have performed a spectral line survey of the whole 3mm band (82.5-117.5 GHz) toward two prestellar cores, B1-b and TMC-1. Indeed spectral scans are the best tool to provide a complete view of the molecular complexity of dark clouds.

Furthermore, unexpected species can provide new information about the physical and chemical evolution of molecular cores toward star formation and complement the usual tracers. In this talk I will present the results of the full 35 GHz scan in B1-b. So far we have detected 325 lines from 109 molecular species and isotopomers. These include unexpected discoveries such as the methoxy radical (CH3O) and other complex molecular species.

Francesca Annibali

Star formation histories and chemical properties in dwarf irregular galaxies

Gabriele Cocozza (on behalf of the INAF-OABo+DIFA postdocs)

Overview of postdoc positions at INAF and DIFA

Angelo Adamo

Quantificare la divulgazione - un tentativo di applicare criteri quanto più possibile scientifici nella scelta di strategie divulgative

Dopo una lunga, prima fase qualitativa, il nostro gruppo ha deciso di misurarsi con approcci divulgativi di tipo diverso. La lunga esperienza acquisita negli anni con differenti tipi di pubblico, oltre a fornirci una notevole quantita` di dati sui quali gia` poter operare statisticamente, ci ha convinti che la nostra ricerca puo` e deve svilupparsi nella direzione di uno studio accurato degli approcci da noi usati. Tale esigenza si e` consolidata anche grazie al workshop da noi organizzato l'anno scorso in Fiera. Grazie a quell'evento, infatti, tutti I partecipanti sono entrati in contatto con realta` di tipo differente, e dal confronto reciproco ne e` scaturito un accordo globale sulla necessita` di sottoporre le metodologie divulgative a valutazioni anche numeriche. Valutazioni che altro non sono se non la ricerca di un modo ideale, se esiste, di fare divulgazione, nel rispetto di cio` che studi sociologici e pedagogici suggeriscono. Di un simile discorso ne hanno risentito molte delle attivita` divulgative dell'OABO che sta iniziando una campagna di "misure" della reale incidenza della sua comunicazione esterna, da effettuare in tutte le iniziative che sta promuovendo (incontri con scuole, UniJunior, Museo di Loiano, etc.). La descrizione di queste attivita` e di tali approcci sara` oggetto del mio intervento al post-doc day.

Olga Cucciati

Study of environment in galaxy surveys

The environment where galaxies reside is known to shape their properties,

at least under given circumstances (given galaxy stellar mass, redshift, scale-length, etc). As a consequence, to understand galaxy evolution it is important to determine in a precise way in which kind of small- and large-scale structures galaxies live. I will present some results of environment parametrization in recent galaxy redshift surveys, and the challenges for future galaxy surveys.

Veronica Sommariva

The evolution of stellar metallicity in high redshift galaxies

Metallicity is a fundamental property of galaxies, and it's study can place important constraints on galaxy evolution. In particular, stellar metallicity is a direct measure of the amount of metals present in a galaxy, as a large part of the heavy elements lie in its stars. In spite of its importance, stellar metallicity has been measured only a handful of high-z sources, as high signal to noise and very long exposures are required to measure it from well defined photospheric absorption features in the UV rest frame. Our pilot study of the mass-stellar metallicity relation at z~3 (Sommariva et al. 2012) with FORS2 has confirmed the feasibility of such studies at high-z as well as the low metal content derived independently for the gas phase component. But due to the faintness of the targets at z~3 only a limited sample has been collected, and the sparse data at lower redshift do not allow yet to study the cosmic evolution of the stellar metallicity. Here I will present the new results coming from MODS and GMASS data observed at z~2. The aim of this work is to trace, for the first time, the cosmic evolution of stellar metallicity from z~2 to z~3, and compare the observational results with the predictions of the theoretical models.

Michele Moresco

Further and deeper: improving cosmological constraints with cosmic chronometers and galaxy clustering

In this talk, I will briefly review my scientific activity, which is mainly divided into three parts: higher-order correlation functions, cosmology with cosmic chronometers, and evolutionary study on passive early-type galaxies. After a synthetic overview, I will discuss the main projects I am working at, which are (i) setting new constraints on the expansion history of the Universe, H(z), improving the current accuracy at intermediate redshift with BOSS and reaching high redshifts with passive ETGs at z>1.4, and (ii) measuring the 3PCF in both galaxy surveys (VIPERS) and simulations.

Nico Cappelluti

Signatures of the first black holes

Margherita Talia

AGN feedback and outflows: the road to star formation quenching

The unique synergy of spectroscopy from large surveys (VUDS, zCOSMOS, public surveys in the GOODS-S), complemented with public HST imaging, Chandra X-ray data, and Spitzer and HERSCHEL infra-red data is exploited to investigate the relationships between galaxies and AGNs at z>=1.
First exploratory results based on a small sample of galaxies at 1 < z < 3 with ultradeep spectroscopy from the GMASS survey (Cimatti et al. 2013) showed possible evidence of the feedback processes triggered by AGNs, that are thought to lead to the rapid suppression of the star formation activity in high redshift galaxies. In the colour-mass plane, two parallel trends emerge during the ~2 Gyr between the average redshifts z~2.2 and z~1.3: while the red sequence becomes rapidly more populated by ellipticals, the majority of AGNs disappear from the blue cloud/green valley where they were hosted predominantly by star-forming systems with disk and irregular morphologies. At z~2.2, the ultraviolet spectra of active galaxies show possible gas outflows with velocities up to about -500 km s-1 that are not observed neither in inactive systems at the same redshift, nor at lower redshifts. These outflows indicate the presence of gas that can move faster than the escape velocities of active galaxies. The ejection of part of the inter-stellar medium can lead to a rapid decrease of the star formation in host galaxies and the morphological transformation from disky/irregular to spheroidal galaxies.
In this work we have extended the analysis to a larger sample of galaxies in order to put more stringent constraints on the outflow velocities and gas properties, and study their dependence on galaxy properties such as stellar mass, star-formation rate, and AGN luminosity. I will present the results of our spectroscopic analysis and discuss how they are contributing to uncover the key role played by AGN feedback in galaxy evolution.

Stephane De Barros

Star-forming galaxy properties at z~4 and impact of nebular emission: learning lesson from z~2

While main optical and near-IR emission lines are not yet observable at high redshift (z > 3), it has been recently shown that nebular emission could affect physical parameter derivation of distant galaxies. We use a sample of 149 spectroscopically-confirmed UV-selected galaxies at z~2 to investigate the relative dust attenuation of the UV continua and the nebular emission in these galaxies. For each galaxy of the sample, at least one optical (rest-frame) emission line has been measured and 41 galaxies have additional observations with Spitzer/MIPS at 24micron. We find that our code is able to reproduce all the quantities for galaxies with no or little extinction, while we need to apply an extra amount of dust attenuation toward nebular emission in comparison with stellar attenuation for attenuated galaxies.
We also find a tight correlation between star formation rate and the amount of extra attenuation which can explain the discrepant results about difference in attenuation between nebular and stellar emission at z~2.

Finally, assuming that nebular emission has the same properties (dust attenuation) at z~4 than z~2, we update the estimation of the impact of nebular emission at z~4 using the latest CANDELS data with a large spectroscopic sample (N~200).

Marco Baldi

Simulating momentum exchange in the dark sector

I will present the first results of cosmological simulations of a new type of interaction in the dark sector characterized by pure momentum exchange between Cold Dark Matter perticles and a generic Dark Energy fluid. This model resembles a form of elastic scattering in the dark sector, and is shown to feature several observational signatures both in the linear and in the nonlinear regime of structure formation, with the latter being more significant by up to one order of magnitude. The nonlinear regime is therefore a highly promising observational window to constrain the scattering cross section between Dark Energy and Cold Dark Matter.

Dominik Leier

Perks of being a lens modeller

Finding the most accurate representation of the distribution of dark and baryonic matter in lensing galaxies has become an art. Much like painting a picture, there is a variety of available tools and choosing one is to some degree a matter of taste. Working on both sides of the story with diverse tools -- spans a gamut from questions of star formation to cosmology and from observations to theory. Hence this talk will be dedicated to two fairly different problems: the question of how the concept of ellipticity is efficiently implemented in lensing codes and the question of how lensing constrains the stellar initial mass function.

Fabien Nugier

Time delays and flux anomalies in Glamer

I will speak about two aspects of strong lensing that we are studying with Glamer. The first one is the time delays between images of distance sources (like quasars), a useful probe for the structure of halos and a powerful way to constrain the Hubble parameter (hence cosmology). I will also speak about our attempt to explain (radio) flux ratio anomalies with the code and the possible effect from structures along the line of sight.

Monica Trasatti

Non-thermal radio synchrotron emissions in galaxy clusters

Radio relics and radio halos are diffuse Mpc-scale synchrotron emissions related to the diffuse medium in galaxy clusters. The emission from these sources helped in unambiguously prove the presence of weak magnetic fields (~micro-Gauss) and relativistic electrons in the intra-cluster medium (ICM), together with the hot thermal plasma emitting X-rays. Even though their existence has been known for three decades, their origin is as yet debated. The main difficulty in explaining such extended emissions arises from the combination of their Mpc size and the relatively short radiative lifetime of the emitting electrons that require some form of in-situ production or re-acceleration. Both phenomena are mostly present in un-relaxed clusters, suggesting that cluster mergers play a key role in producing them. All these ingredients make the study of these sources not only relevant in terms of their physics, but also crucial for a comprehensive description of the composition and dynamics of the ICM, for the study of particle-acceleration mechanisms as well as for a global understanding of the mechanisms at play during the processes of cluster assembly in the Universe.
I will show the status of recent EVLA observations of selected galaxy clusters.

Filippo D'Ammando

The Fermi extragalactic view. New discoveries and open questions after 6 years of observations

The Fermi Gamma-ray Space Telescope with its main instrument on-board, the Large Area Telescope (LAT), opened a new era in the studies of high-energy emission from Active Galactic Nuclei (AGN). Thanks to its high sensitivity, large field of view and sky survey operating mode the Fermi-LAT has detected several hundred blazars and a few radio galaxies, but also different types of gamma-ray emitting AGNs such as the narrow-line Seyfert 1 galaxies. When combined with simultaneous ground-and space-based observations, Fermi-LAT achieves its fully capability to reach a deeper insight into the jet structure and the emission mechanisms at work in radio-loud AGNs. Here we discuss the radio-to-gamma-rays properties of blazars, radio galaxies, and narrow-line Seyfert 1 galaxies, highlighting major findings and open questions regarding the physics of AGNs in the Fermi era.

Elisabetta Liuzzo

Jets in nearby radio loud AGN

Jets appear in a wide range of astrophysical sources. In extragalactic systems, they signal accretion onto a supermassive black hole, providing unique testbeds in which to probe an array of fundamental physics processes. Over the past decade, major advances have been made in understanding jets due to the advent of an unprecedented number of space-and ground-based telescopes covering the entire electromagnetic spectrum, in parallel with commensurable progress in theory and simulations. Here, I will review my results on jets in different type of nearby radio loud AGN obtained with VLBI

technique and recently with ALMA. I will also show promising perspectives in this kind of study thanks to next generation facilities.

Roberto Ricci

Assessing the AGN Component in the Faint Radio Population

The radio/optical analysis of a sample of 28 faint radio sources extracted from the ATESP survey has revealed a class of flat/inverted-spectrum objects associated with early-type galaxies up to z=2. A possible explanation requires low radiative efficiency accretion models, in some cases possibly co-existing with outflows or jets. In this talk I will discuss results obtained from a radio follow-up between 5 and 40 GHz carried with the ATCA in two observing campaigns in 2007/8 and 2011/2. Understanding the radio spectral properties of the sample is crucial since different accreting mechanisms show different spectral features in the radio domain.

Giorgio Lanzuisi

The most obscured AGN in the COSMOS

I will present results from the recently published paper Lanzuisi et al. 2014 (arXiv:1409.1867) on the black hole (BH) and host galaxy properties of a sample of highly obscured AGN from the COSMOS survey, spanning a large range of redshift (0.1<z<3) and Luminosity (43<Log(L(2-10keV))<45 erg s-1). Our results point toward a scenario in which highly obscured AGN: 1) harbor smaller and more rapidly accreting BHs with respect to unobscured AGN, and; 2) are hosted in highly star-forming and preferentially interacting/merging systems. These sources therefore represent a crucial step toward the local relations characterizing the AGN-galaxy co-evolution paradigm.

Mauro Roncarelli

The SZ effect(s) and non-standard cosmologies revisited

Mauro Sereno

Comparison of galaxy cluster masses in literature

The 'CoMaLit' (COmparing MAsses in LITerature) program aims to assess our present capability to measure cluster masses, and to develop methods to measure scaling relations through Bayesian techniques.

Alessandra Giannuzzi

Transferring optical technology from telescopes to solar concentrators

Technological analogies between ground based telescopes and solar concentrators for the exploitation of solar radiation suggest that design principles used to optimize telescopes mirrors can be applied to improve features of the optical collection in concentrators related to efficiency.
A new method to boost performances in these devices has been hence developed and numerical simulations implemented. The method consists in computing and applying static deformations to the concentrating mirrors in order to obtain, for an adopted concentration ratio, a light spot matching the receiver features better than conventional reflectors. The Zernike polynomials formalism has been adopted for both surfaces and deformations. A dense array photovoltaic concentrator for direct electricity production has been extensively investigated and modelled: the uniformity reached in the collected irradiance profile can exploit the PV device close to its efficiency limit. For this invention a patent has been already filed. Another configuration called "solar furnace" has been explored and compared with standard imaging solutions to evaluate the possibility to enhance the spot irradiance uniformity at ultra-high concentrations.

Ilaria Formicola

Galaxy Morphologies with Megamorph

Several novel approaches to aid the decomposition of galaxy images into their constituent physical components were developed inside the MegaMorph Measurement of Galaxy Morphology) project. In particular, Galapagos and Galfit codes make use of the multi-wavelength imaging available from modern surveys to measure galaxy structural properties. I will describe the first application of these two codes to HST images of a statistical sample of galaxies inside the CLASH cluster sample. The characterization of galaxy properties in different environments and their changes with the wavelength will be used to improve lensing simulations produced with the SkyLens code.

Fabio Bellagamba

Fast and robust modelling of gravitational lenses

I will present the new code "Lensed" we developed to perform the modelling of strong lensing systems. It takes advantage of the computational speed of Graphical Processing Units in order to perform in short time a statistically robust exploration of the space of parameters needed to describe both sources and lenses. The tests we made on mock images will be presented, as well as the application to real data, such as the Sloan Lens ACS (SLACS) sample. I will also talk about the possibility to extend the same approach to different problems, such as the joint weak and strong lensing analysis of galaxy clusters.

Olga Melnyk

Star-forming and colour properties of isolated galaxies

Andrii Elyiv

Dynamic void finders with respect to cosmological probes

Cosmic voids are effective tool to discriminate among competing world models. The identification of voids is generally based on density or geometry criteria. Due to their very nature, it is prone to shot noise errors. We propose two void finders that are based on dynamical criteria to select voids in the Lagrangian coordinates and minimize the impact of sparse sampling. The first approach exploits the Zeldovich approximation to trace back in time the orbits of galaxies located in the voids and their surroundings. The second one uses the observed galaxy-galaxy correlation function to relax the objects' spatial distribution to homogeneity and isotropy. In both cases voids are defined as regions of the negative velocity divergence in Lagrangian coordinates, that can be regarded as sinks of the back-in-time streamlines of the mass tracers. We find that the void divergence profiles are less scattered than the density ones, so their stacking constitutes a more accurate cosmological probe. The significance of the divergence signal in the central part of voids obtained from both our finders is 60% higher than for overdensity profiles in the classic ZOBOV case. The ellipticity of the stacked void measured in the divergence field is significantly closer to unity, as expected, than what is found when using halo positions. These results show that our new void finders are complementary to the existing methods, that should contribute to improve the accuracy of void-based cosmological tests. We demonstrate the application of void finder on a dark matter halo catalogue extracted from an N-body simulation CoDECS and SDSS DR7.

Simona Righini

Astronomical Validation of the Sardinia Radio Telescope

The Sardinia Radio Telescope, formally inaugurated in late 2013, is now undergoing the Astronomical Validation (AV) phase. Its performance is being verified in all the available observing modes, by means of both elementary and advanced tests conceived so as to compare its capabilities to the ones of similar radiotelescopes. I will briefly show the AV status, also showing my contributions to its accomplishments.

Gabriele Cocozza

Gaia’s first anniversary

Gaia is an astrometric cornerstone mission of the ESA Space Program succesfully launched on December 19, 2013. Gaia is expected to produce the largest, most precise three-dimensional map of our Galaxy by surveying approximately 10^9 stars (down to V~20 mag). To achieve this goal, Gaia will measure positions, parallaxes, and proper motions at microarcsecond precision. Gaia's main goal is a census of the Milky Way but it will have a major impact across all areas of astronomy and astrophysics, and on all scales, from Solar system objects to Quasars, to fundamental physics. After a general introduction to the Gaia mission, I will review the commissioning and preliminary results and will describe our progress in the last year.