ABSTRACT

Marco Antonucci

Università di Roma Tor Vergata

Multi-epoch X/UV variability in the CDFS

The effect of variability on the anti-correlation between the alpha_ox spectral index and the UV luminosity of active galactic nuclei can be analysed using samples with simultaneous X-ray and UV measures. Following previous analyses of a serendipitous source sample by XMM-Newton and of a low-redshift sample by Swift (separately presented as poster by F. Vagnetti), I will present the study of a multi-epoch sample extracted from the XMM deep survey in the CDF-S by Comastri et al. The repeated, simultaneous X-ray/UV observations of the same field over many epochs are ideal for this analysis, and allow us to characterise the variability of the X-ray/UV ratio of individual sources.

Vincenzo Antonuccio-Delogu

INAF-Catania Astrophysical Observatory

Backflow in AGNs: Self regulation of accretion and jet emission

The interaction of relativistic jets from AGNs with the Interstellar Medium (ISM) of their host galaxies can induce the formation of a low-density, high-temperature hollow region (the "cocoon"). This extended structure is the main driver of the mechanical and thermodynamical feedback which the AGN can induce on is host galaxy. We have previously demonstrated that one of the distinctive features of this cocoon is the presence of an almost laminar backflow, which drives almost zero angular momentum gas back towards the central accretion region around the Supermassive Black Hole (V. A.-D. & Silk, MN 405, 1303, 2010). This flow then self-feeds the jet Here we present a series of 3D simulations which validate this model, exploring a range of parameters representative of the AGNs population from z~4-5 to 0. In particular, we have varied the two parameters which mostly affect the morphology and energy distribution of the cocoon: jet's mechanical power (10^41 <= P_j <= 10^45 erg*sec^-1) and the central ISM density. We have adopted an Adaptive Mesh refinement (AMR) CFD code, with an enchanced resolution around the BH down to sub-parsec scale, within a global simulation box of few tens of kpcs. This allows us to make a model for the final fate of this backflow. Our simulations confirm that this backflow is stable, and supplies the central accretion region with rates very weakly dependent on the global parameters. The peak rates of these flows in 3D, however, are strongly dependent on a dimensionless ratio involving P_j and (n,T)_ISM. Outside the central BH accretion region our simulations have a resolution sufficiently high (~25 pc in a box of 40 kpc) to compute properties like the VHE gamma ray emissivity arising from complex phenomena like the interaction of the jet-cocoon with dusty, cold, star-forming clouds and with BAL clouds. We conclude our talk presenting this and other high-energy results.

Ranieri D. Baldi

SISSA, Trieste

Study of low-luminosity radio galaxies at z~1-3

We model the Spectral Energy Distributions (SEDs) of the first sizeable sample of low-luminosity radio galaxies at high redshifts. The photometric data (from FUV to MIR band) are taken from the COSMOS survey. The careful visual inspection of the genuine counterparts has allowed us to infer the correct SEDs and their properties which, otherwise, would have been compromised in the case of blind use of COSMOS data. We use two different template-fitting techniques: the Hyperz code that only considers single stellar templates and our developed technique 2SPD that also includes young stars and dust emission. The resulting photometric redshifts range from z~0.7 to 3 and are in substantial agreement with measurements

from earlier work. The SEDs of the most objects of the sample are consistent with a dominant contribution from an old stellar population with an age ~1 - 3 X 10^9 years. The inferred total stellar mass range is ~10^10 - 10^12 M(sun). Dust emission is needed to account for the emission detected at 24micron and significant excesses above the stellar emission is observed at shorter wavelengths in 8 galaxies. Estimates of the dust luminosity yield values in the range L(dust)~10^43.5 -10^45.5 erg s^(-1). The global dust temperature, crudely estimated for the sources with a substantial dust excess at ~8 micron (rest frame), is in the range 300-850 K. Similarly, an UV excess is often observed with a luminosity in the range 10^42 - 10^44 erg s^(-1) at 2000 A. Suggestive trends between the radio power, dust and UV luminosities may indicate a possible significant contribution from the central AGN in UV and MIR bands rather than from starlight. A deeper analysis of the sample, which focuses on the host and nuclear properties, will be subject of forthcoming works in order to explore the nature of the emission at different wavelengths.

Stefano Bianchi (INVITED)

Dipartimento di Fisica, Università degli Studi Roma Tre

AGN structure from the BH to the host galaxy

In this talk, we review the various ingredients which constitute the structure of AGN on different scales, from the vicinity of the black hole to the host galaxy, in order to picture an updated unification scenario explaining the complex observed phenomenology. We conclude by mentioning some of the open issues.

Angela Bongiorno

OAR

Accreting SMBH in the COSMOS field and the connection to their host galaxies

Super massive black holes (SMBHs) seem to be the galaxies' beating hearts. While many observational discoveries support a close link between SMBH activity and the assembly of the host galaxy, the physical processes behind this interplay remain unclear. One of the most efficient way to constrain the physical models of AGN/galaxy co-evolution is to study the effect of accreting SMBHs in the galaxies that host them. Using the rich multi-band photometry in the COSMOS field we explore the host galaxy properties of a large and complete sample of X-ray and spectroscopically selected AGN. Based on a two-components fit to their SED we derive rest-frame magnitudes, colors, stellar masses and star formation rates up to z~3. We find that the scaling relation between BH mass and galaxy mass evolves with redshift for unobscured type-1 AGN but the picture seem to be different for obscured AGN. We find that the probability for a galaxy to host a black hole growing at any given specific accretion rate (the ratio of X-ray luminosity to the host stellar mass) is independent of the galaxy mass and follows a power-law distribution in Lx/M. By looking at the normalization of such a probability distribution, we show how the incidence of AGN increases with redshift as rapidly as (1+z)^4.2, in close resemblance with the overall evolution of the specific star formation rate. Although AGN activity and star formation appear to have a common triggering mechanism, we do not find any 'smoking gun' signalling powerful AGN influence on the global properties of their host galaxies.

Margherita Bonzini

ESO - Garching

RQ AGN: BH and host galaxy properties

Deep radio surveys are a promising window to investigate the evolution of star forming galaxies (SFG) and active galactic nuclei (AGN) since radio observations are by far less affected by dust extinction compared to

similar surveys performed in the optical and the X-ray band. We are therefore studying a sample of about 900 radio sources detected at 1.4 GHz in a deep VLA survey of the Extended Chandra Deep Field South (E-CDFS). Thanks to the wealth of data available in this field, we are able to use a multi-wavelength approach to separate AGN from SFG using the ratio between their FIR and radio emission, their flux ratio in the optical and radio bands, and the level of X-ray luminosity. The microJy sensitivity of our survey allows us to explore the faint end of the radio population and to detect not only the radio loud AGN, but also a significant population of radio quiet (RQ) objects according to the standard classification. Based on our analysis, the radio emission detected in the radio quiet AGN is produced by star-formation activity rather than accretion on the central SMBH. We have therefore the remarkable opportunity to use the radio emission itself to estimate the star-formation level in the host galaxy. We compare it with the star formation rate (SFR) derived from Herschel observations. In addition, we correlate the accretion level of the radio selected AGN with the stellar masses and morphological appearances of their host.

Gabriele Bruni

IRAM

BAL Quasars: from Radio to NIR band

The origin of broad-absorption-line quasars (BAL QSOs) is still an open issue. Accounting for ~20% of the QSO population, these objects present broad absorption lines in their UV spectra, generated from outflows with velocities up to 0.2 c. During a three year-long observational campaign, we have collected data from Radio to Near Infrared band to study the orientation, the age, the central black hole mass and the physical conditions of this class of AGNs. I will present the results of this multi-frequency study, and compare them with the predictions from the different models present in literature.

Marcella Brusa (INVITED)

MPE - Garching

Lessons on AGN from X-ray surveys

I will review how and why X-ray surveys are critical in studying and characterizing AGN, from the "cosmological" horizon down to the "event" horizon. I will focus on the most recent results (past 2 years) on AGN-galaxy co-evolution and in particular on observed AGN and galaxy properties that have been used in the recent years to constrain models of AGN triggering and evolution. I will also discuss the expected contribution of multi-wavelength follow-up observations towards a better understanding of the co-eval AGN-galaxy growth.

Giorgio Calderone

Università di Milano - Bicocca

Black hole mass estimation in NLS1 through accretion disk spectrum fitting

Narrow-line Seyfert 1 (NLS1) sources are characterized by small width of Balmer lines. This implies that virial black hole mass estimates are at the lower end of the mass distribution of AGN. As a consequence they are often super-Edington, and lie below the M-sigma_* relation. This prompted several authors to propose modifications to the simple virial method, to take into account preferential viewing angle of a flattened BLR, or radiation pressure. We developed a new method (independent from the virial one) to estimate black hole masses, based on Shakura&Sunyaev accretion disk spectrum fitting. The BLR luminosity is a measure of the bolometric disc luminosity, and fixes the accretion rate. The observed continuum constrains the frequencies

at which the accretion disc contributes, and fixes the black hole mass. We find that our mass estimates are on average a factor ~3 above the virial ones, and are in agreement with the M-sigma_* relation. Our estimates are robust: if the black hole mass were smaller, the accretion disk spectrum would become too hot to account for the observed spectrum.

Alessandro Capetti

INAF - Osservatorio di Torino

Revising the census of low luminosity AGN

Most nearby galaxies show emission lines in their spectra and about 50% of them have line ratios typical of AGN. Apparently, this is an indication that most galaxies host an active nucleus, albeit of low luminosity. However, the emission line fluxes are strongly correlated with the stellar continuum. This result is very difficult to account for if the emission lines are powered by an AGN. Conversely, it points to a stellar origin of the emission lines. This requires to fundamentally revise the current census of AGN based on optical spectroscopy, particularly for those of low luminosity. We show that i) a significant progress can be achieved by using spectra obtained with a smaller aperture, thus reducing the contamination from the stellar lines, ii) a complete agreement is found from the census obtained from Chandra and HST observations, iii) TNG spectra provide a census as reliable as that derived from the HST data.

Nico Cappelluti

INAF-OABO

The Nature of the unresolved soft extragalactic CXB: beyond Chandra and XMM-Newton

We investigate the power spectrum of the unresolved 0.5-2 keV CXB with deep Chandra 4 Ms observations in the CDFS. We measured a signal which, on scales >30", is s significantly higher than the Shot-Noise and is increasing with the angular scale. We interpreted this signal as the joint contribution of clustered undetected sources like AGN, Galaxies and Inter-Galactic-Medium (IGM). The power of unresolved cosmic sources fluctuations accounts for 12% of the 0.5-2 keV extragalactic CXB. Overall, our modeling predicts that 20% of the unresolved CXB flux is made by low luminosity AGN, 25% by galaxies and 55% by the IGM (Inter Galactic Medium). We do not find any direct evidence of the so called Warm Hot Intergalactic Medium (i.e. matter with 105K<T<107K and density contrast d<1000), but we estimated that it could produce about 1/7 of the unresolved CXB. We placed an upper limit to the space density of postulated X-ray emitting early black hole at z>7.5 and compared it with SMBH evolution models.

Gianluca Castignani

SISSA - Trieste

The cluster environment of high redshift FRI radio galaxies

I will discuss the potential of low power radio sources for large scale structures studies. At variance with the powerful Fanaroff-Riley type II (FRII) radio sources, the great majority of low power radio sources (FRIs) are found in clusters, at least in the low redshift Universe. In order to prove that this also holds at high redshifts, and that these AGNs can be efficiently used as beacons for high-z clusters, we select a sample of bona fide Low Luminosity Radio Galaxies (LLRGs) at z~1-2 in the COSMOS field. By adopting a new method based on photometric redshifts and number counts to search for dense environments in the field of the LLRGs, we find evidence that about 70% of them reside in groups or clusters of galaxies. This is in excellent agreement with results obtained from low redshift studies. Our work indicates that the approach is effective to search for

clusters when conventional techniques of selection (searches for concentrations of red galaxies, X-ray surveys or searches for the Sunyaev-Zeldovich effect) are impractical or have low efficiency.

Luigi Costamante

Università di Perugia

Blazars: do we really understand them ?

Though Fermi-LAT and Cherenkov telescopes have broadly confirmed the main picture of the blazar phenomenon from the Egret era, they have also unveiled a new phenomenology which does not seem to ”fall in line" with the expectations. I will review the most problematic aspects, in particular on classification, structure, emission mechanisms and location of the high-energy emission.

Filippo D'Ammando

Dip. Fisica, Univ. Perugia & INFN

Not only typical flaring blazars in the Fermi gamma-ray sky. The strange cases of SBS 0846+513 and PKS 0521-36

Most of the extragalactic objects observed in gamma rays during a flaring activity by the Large Area Telescope (LAT) on board the Fermi satellite are typical blazars. However, the large field of view, improved sensitivity with respect to previous gamma-ray experiments and the all-sky survey mode allowed us to catch in outburst also different types of Active Galactic Nuclei (AGN). Two peculiar cases are SBS 0846+513 and PKS 0521-36. SBS 0846+513 is an AGN optically classified as a Narrow-Line Seyfert 1 galaxy, likely hosted in spiral. PKS 0521-36, first classified as an N galaxy, then as a BL Lac object, showed a knotty jet structure in radio similar to the radiogalaxies M87 and 3C 120. The unexpected strong gamma-ray flares observed from SBS 0846+513 and PKS 0521-36 in June 2011 and June 2010, respectively, indicate the presence of a relativistic jet as powerful as those of blazars, challenging the emission mechanisms responsible for high-energy emission in these sources. In this talk we present the gamma-ray data collected by Fermi-LAT during the first three years of operation (August 2008-August 2011) and describe the properties of SBS 0846+513 and PKS 0521-36 by means of new and archival radio-to-gamma-ray data. Finally, we discuss the characteristics of these two objects in the context of the blazar scenario.

Alessandra De Rosa

INAF/IAPS

AGNs observed with LOFT: strong gravity effects and inner structure.

LOFT, with its extremely high throughput and good spectral resolution, will open up a whole new domain of X-ray spectral-timing analysis. Thanks to its sensitivity and broad energy range (2-50 keV), LOFT will be able to determine with very high signal to noise and accurate continuum subtraction the profile the Fe K-lines in AGN. In this talk we will present detailed simulations showing that observations of 1e4 s exposure will provide a high enough S/N to detect broad Fe lines in 1 mCrab flux AGN, measuring the inner radius of the disk down to the marginally stable orbit and, from this, derive the spin of the BH with a 20% accuracy (10% for fast spin). Moreover the very high throughput of LOFT will permit to investigate the Fe line response to flares, and reveal the orbital motion of individual blobs providing BH mass and spin with 25% and 20% accuracy. These results will be compared with those available in the near future with XMM-Newton and NuStar combined observations. In addition, thanks to the wide energy band and the large effective area

above 10 keV, the LOFT observatory science dedicated to bright AGN will bring new results in the study of the emitting/absorbing regions nearby the central black hole

Roberto Decarli

MPIA

Seeing the invisible: Quasar host galaxies from SDSS stacked images

Quasar host galaxies have been studied for more than 20 years, by using state-of-art instruments in exquisite seeing conditions, or with adaptive optics, or from space. However, less than 50 quasar host galaxies have been resolved in more than one band. Huge uncertainties, mostly due to the modelling and subtraction of the nuclear light, prevent us from answering some key questions: 1) what is the age of their stellar population? 2) which is their morphology? 3) do they follow the Mbh--host relations established for lower luminosity AGN and quiescent galaxies? 4) is there any evolution of their properties in redshift? For the first time now we can answer all these questions. Through stacking SDSS images of spectroscopically confirmed quasars, we are able to constrain colors, mass-to-light ratios, stellar masses and morphological parameters with unprecedented accuracies.

Agnese Del Moro

Durham University, Durham, UK

Radio-excess: a signature of AGN in distant star-forming galaxies

Completing the census of AGN in the Universe is the key to understanding the cosmic evolution of supermassive black holes (SMBH) and galaxies, and to resolving the spectrum of the X-ray background (XRB). However, a large population of AGN, especially the heavily obscured, Compton-thick AGN, are still missing from even the deepest X-ray surveys. Through detailed SED decomposition over a wide infrared-radio waveband, using some of the deepest IR, radio and X-ray data in the GOODS-Heschel (North) field, we identified many of these missing AGN, bringing us closer to identifying all of the distant luminous AGN in the GOODS-N field. With this analysis we identified a sample of 51 AGN out to z~3 with excess radio emission over that expected from star-formation; this radio-excess is a signal, often the only signal, of the presence of nuclear activity within the galaxy. Indeed, ~50% of our radio-excess AGN are not detected in the X-rays, suggesting that they might be heavily obscured. Moreover, their IR SED revealed that radio-excess AGN have rather varied galaxy properties that differ from those of typical X-ray selected AGN hosts, with star-formation rates (SFRs) ranging from normal star-forming galaxies to passive galaxies. This suggests that our radio-excess AGN sample might be a snapshot of different stages of galaxy-SMBH coevolution. I will also present the unprecedented NuSTAR contribution in identifying AGN in the E=10-30 keV band, where the XRB peaks.

Ivan Delvecchio

Dipartimento di Astronomia - Bologna

AGN accretion history from Herschel

Here we present the first ever estimate of the BHAR over cosmic time from an infrared survey. The sample that we probe includes about 600 far-infrared (FIR) selected galaxies within a multi-frequency coverage area in the GOODS-South field (300 arcmin^2). FIR data have been obtained by Herschel-PACS photometry within the Pacs Evolutionary Probe (PEP) project. We provide a meaningful physical characterisation of our sources basing on a broad-band SED-fitting analysis. By decomposing each integrated SED into a nuclear

and a host-galaxy component, we find that the AGN contribution is small with respect to the star-formation activity one in low-luminosity AGNs like Seyfert 2, while it can be as high as 50% of the 8-1000 micron luminosity in power-law AGNs like Quasars. By considering the AGN contribution derived for each source and the evolutionary paths derived for each AGN population from the Herschel Luminosity Function (Gruppioni et al. 2012, in prep.), we are able to trace for the first time the AGN accretion history through cosmic time from a robust estimator as the IR luminosity and to compare our estimate with the previous ones obtained from X-rays.

Immacolata Donnarumma

INAF/IAPS

MeV blazars: results and perspectives with next generation gamma-ray telescopes

We will review the results carried out on MeV blazars with both AGILE and Fermi, discussing open issues in this respect. The investigation of this kind of objects is crucial in constraining the contribution of the blazar population to the Extragalactic Gamma-ray Background (EGB). The estimation of this contribution is actually still debated, due to the blazar duty cycle and to the uncertainty of the percentage of unresolved blazars which are expected to contribute mostly to the low energy EGB (< 400 MeV). In order to achieve significant improvements in this study, gamma-ray telescopes with higher sensitivity in the energy range 10 MeV-1 GeV will be crucial. We will then present the concept study of next generation gamma-ray instruments (Gamma-LIGHT, Gamma-400), aimed in particular at obtaining a breakthrough Point Spread Function at lower energies (below 400 MeV). Gamma-Light and Gamma-400 will enable to detect variability at lower energies (E<100 MeV) for the steeper spectra objects and to reduce the confusion limit and then the underestimation of the blazar contribution to the EGB in the calculation of the blazar luminosity functions.

Emanuele Paolo Farina

Università Insubria di Como

Exploring the cool gas halo of quasars

The study of absorption systems in QSO spectra allows to probe the gas and the dust content of galaxies even if these components are too dim to be detected with direct imaging. In this work we investigate a sample of 13 close projected QSO pairs (projected distance between 60 kpc and 120 kpc) to detect the MgII and CIV absorption lines that the extended gas halo of the foreground QSO imprints on the spectra of the background QSO. We identify absorption features associated to the foreground QSO in 7 out of 10 systems for MgII, and only one out of 3 for CIV. In contrast with the case of quiescent galaxies, strong (EW > 1 ang) absorption lines are present also beyond a radius of 70 kpc. Rescaling the impact parameter with the host galaxy mass, we find no difference between absorptions associated to QSOs or to inactive galaxies. In the spectra of foreground QSO there are no signs of MgII absorptions of the same strength seen in the background QSO, while 2 are present for CIV. This implies that the absorbing gas around the QSO is not homogeneous. This is possibly a consequence of the non isotropic emission of the central QSO.

Anna Feltre

ESO – Garching

Modeling Herschel and Spitzer observations of AGN

One of the most important and recent results in the context of the analysis of the spectral distributions (SEDs) of Active Galactic Nuclei (AGN) is the evidence that nuclear gravitational accretion is often

accompanied by a concurrent starburst (SB) activity. The large availability of IR data provided by Spitzer and Herschel allow us to extensively investigate both these phenomena. Firstly, we carried out a comparative study of various AGN SED modeling approaches. In this talk I will first focus on the much-debated issue about the geometry of the dust distribution in the toroidal structure surrounding the AGN. The properties of dust in AGN as measured by matching observations (be it broad band IR photometry or IR spectra) with models, end up to strongly depend on the choice of the dust distribution. Then, I will present a multi-component fitting procedure which turned out to be a very powerful tool to investigate the physical properties of active galaxies and the AGN-SB connection. Herschel PACS and SPIRE FIR and sub-mm observations play a crucial role providing much improved constraints on the models. I will finally describe the main results of a SED fitting analysis obtained combining photometric data from the Herschel Multi-tiered Extragalactic Survey (HerMES) Key Programme with Spitzer IRS spectra.

Fabrizio Fiore

INAF - Osservatorio Astronomico di Roma

AGN feedback through the cosmic time

Fabio Fontanot(INVITED)

INAF Osservatorio Astronomico di Trieste

AGN/Galaxy co-evolution: using observations to constraint our theoretical perspective

In recent years, a number of observational constraints on the AGN/galaxy co-evolution has become available, both locally (e.g. the distribution of AGN classes as a function of host stellar mass and parent dark matter halo mass) and at higher redshifts (e.g. the differential redshift evolution of the AGN luminosity function, or "AGN downsizing"): in my talk I will show that it is possible to compare those results with the predictions of theoretical models, in order to get strong insight in our understanding of these phenomena. I will first review the different theoretical approaches to the problem of co-evolution between Active galactic nuclei (AGN) and galaxies, with particular emphasis on the different paradigms describing gas accretion onto super massive black holes and their impact on the properties of their host galaxies. I will thus show that AGN feedback is nowadays a crucial ingredient for models of galaxy and AGN formation and evolution, not only to explain the redshift evolution of the AGN population but also for setting up a variety of observed host galaxy properties, such as the evolution of their stellar masses and their star formation levels. I will then extensively discuss the different "modes" of AGN feedback, their triggering mechanisms and relate them to the physical condition of the host galaxies. Finally, I will discuss the main successes and failures of the current paradigm for AGN/galaxy co-evolution and introduce possible improvements.

Gabriele Giovannini

Dipartimeno di Astronomia & IRA/INAF

The kinematic of HST-1 in the M87 jet

Thanks to multi-epoch VLBI observations we constrain the structural variations within the HST-1 region downstream of the radio jet of M 87, in general as well as in connection to the episodes of activity at very high energy (VHE). We analyzed and compared about 30 VLBI observations of the M87 jet, obtained between 2006 and 2012 with the Very Long Baseline Array (VLBA) at 1.7 GHz and the European VLBI Network (EVN) at 5 GHz. HST-1 shows a complex structure with two or more components, the two outermost of which display a significant proper motion with a superluminal velocity around ~4 c. The motion of a third feature that is detected upstream is more difficult to characterize. The overall position angle of HST-1 has changed during the time of our observations from -65° to -90°, while the structure has moved by

over 80 mas downstream. Our results on the component evolution suggest that structural changes at the upstream edge of HST-1 can be related to the VHE events.

Marcello Giroletti

INAF/IRA

The radio/gamma-ray connection in Active Galactic Nuclei in the Fermi era

Authors: M. Giroletti, V. Pavlidou, A. Reimer on behalf of the Fermi-LAT collaboration
We present a detailed statistical analysis of the correlation between radio and gamma-ray emission of the active galactic nuclei (AGNs) detected by Fermi during its first year of operation, with the largest data sets ever used for this purpose. We use both archival interferometric 8.4 GHz data (from the Very Large Array and ATCA, for the full sample of 599 sources) and concurrent single-dish 15 GHz measurements from the Owens Valley Radio Observatory (OVRO, for a sub sample of 199 objects). Our unprecedentedly large sample permits us to assess with high accuracy the statistical significance of the correlation, using a surrogate data method designed to simultaneously account for common-distance bias and the effect of a limited dynamical range in the observed quantities. We find that the statistical significance of a positive correlation between the centimeter radio and the broadband (E > 100 MeV) gamma-ray energy flux is very high for the whole AGN sample, with a probability of <10-7 for the correlation appearing by chance. Using the OVRO data, we find that concurrent data improve the significance of the correlation from 1.6 × 10-6 to 9.0 × 10-8. Our large sample size allows us to study the dependence of correlation strength and significance on specific source types and gamma-ray energy band. We find that the correlation is very significant (chance probability < 10-7) for both flat spectrum radio quasars and BL Lac objects separately; a dependence of the correlation strength on the considered gamma-ray energy band is also present, but additional data will be necessary to constrain its significance.

Federica Govoni (INVITED)

INAF - Osservatorio Astronomico Cagliari

AGN and galaxy clusters

I will present a qualitative picture on the connection between AGN and galaxy clusters, and discuss the possibility to derive physical properties of galaxy clusters through radio observations of AGN.

Dafne Guetta

OAR

The absorbing column density: GRBs vs QSO

We will discuss what can be the possible origin of the absorbing column density in Gamma Ray Bursts and will compare these results with the ones obtained for the QSOs.

Francesco Haardt

Università dell'Insubria

Limits on the high redshift growth of massive black holes

We place firm upper limits on the global accretion history of massive black holes at $z\gta5$ from the recently measured unresolved fraction of the cosmic X--ray background. The maximum allowed unresolved intensity observed at 1.5 keV implies a maximum accreted mass density onto massive black holes $\rho_{\rm acc} \lta 1.4 \times 10^4$ M$_\odot$Mpc^{-3} for $z\gta 5$. Considering the contribution of lower--z AGNs the value reduces to $\rho_{\rm acc} \lta 0.66 \times 10^4$ M$_\odot$Mpc^{-3}. The tension between the need of efficient and rapid accretion required by the observation of massive black holes already in place at $z\gta 7$, an the strict upper limit on the accreted mass derived from the X--ray background may point towards "selective accretion" as a possible solution.

Alessandra Lamastra

INAF - OAR

Star formation and mass assembly in the interaction-driven scenario

Two main modes of star formation are known to control the growth of galaxies: a relatively steady one in disk-like galaxies, and a starburst mode. However it is less clear what their role is in the global star formation process and buildup of stellar mass in the Universe. We investigate this issue using a semi-analytic model of galaxy formation, in which galaxy encounters occuring during their merging histories trigger both starburst events and AGN activity. We derive the SFR-M relation in AGN host and inactive galaxies and compare the model predictions with the observations.

Marco Landoni

Università degli Studi dell'Insubria

Optical spectroscopic studies of BLLacs

The determination of the redshift of the BL Lac objects is crucial in order to understand their physics in terms of accretion flow, released power and high energy emissions from relativistic jets. Their spectra are characterized by the absence (or extreme weakness , EW < 5 Angstrom) of emission lines. Therefore, the measurement of their redshift is challenging. For this reason, high S/N spectra are mandatory in order to detect (if present) the weak spectral features. We will summarize the results of an ongoing observational campaign that covers circa 100 objects. We were assigned 6 runs at the European Southern Observatory VLT (8 mt) using the FORS and FORS2 spectrograph and 1 run using the new generation high-resolution spectrograph XShooter at the VLT. We clearly derived the redshift for 28 sources and for the remaining featureless targets we were able to infer a lower limit value on their redshifts. 30 objects have found to be bad candidates (such as quasars or white dwarf stars). In particular, we will focus on the results regarding the last two unpublished campaign with VLT-FORS2 that cover 25 BL Lac for which we derived 4 new redshifts and 21 lower limits. We will also present the well-known source PKS 0048-097 observed in a large spectral range (3000-15000 Angstrom) by X-Shooter (Period 85 – 6 targets) for which we were finally able to derive its redshift (z = 0.635) from the detection of very weak emission lines.

Rocco Lico

IRA/INAF (CNR Bologna)

VLBA monitoring of Mrk421 at 15 & 24GHz

Authors: R. Lico, M. Giroletti, M. Orienti, G. Giovannini, B. Cotton, P. G. Edwards, L. Fuhrmann, T. P. Krichbaum, K. Sokolovsky, Y. Kovalev, S. Jorstad, A. Marscher, M. Kino, D. Paneque, M. A. Perez-Torres and G. Piner.
We present a detailed analysis of new high resolution radio observations of the nearby TeV blazar Markarian 421 (z=0.031). This study is part of an ambitious multifrequency campaign, with observations in sub-mm (SMA), optical/IR (GASP), UV/X-ray (Swift, RXTE, MAXI), and gamma rays (Fermi-LAT, MAGIC, VERITAS). In this manuscript we consider data obtained with the Very Long Baseline Array (VLBA) at twelve epochs (one observation per month during 2011) at 15 and 23.8 GHz. We investigate the inner jet structure on parsec scales through the study of model-fit components for each epoch. We identified 5-6 components which are consistent with being stationary. The aim is to try to shed light on questions such as the nature of radiating particles, the connection between radio and gamma-ray emission, the location of emitting regions and the origin of the flux variability.

Elisabetta Liuzzo

Istituto di Radioastronomia - INAF- Bo

Radio and gamma-ray emission in Faint BL Lacs

Contrary to the previous campaigns, Fermi reveals that BL Lac objects are the most abundant emitters in gamma-ray band. However, since they are relatively weak sources, most of their parsec scale structures as their multifrequency properties are poorly understood and/or not investigate with a systematic approach. Our main goal is to analyse the radio and gamma-ray emission properties of an homogeneous sample of 42 faint BL Lacs, selected, for the first time in literature, with no constraint on their radio and gamma-ray flux densities/emission. We took from the Roma-BZCat all BL Lac objects with z<0.2 and located in the SDSS sky area. We asked and obtained new VLBA observations at 8 and 15 GHz for the whole sample. We analyse their gamma -ray emission properties using the 2LAC Fermi results and we compare them with our new radio information. We found, at the fist, that a large group of objects have very peculiar properties respect to the "classical" BL Lacs. Here, I will discuss our main new multiwavelength results on faint BL Lacs.

Alessandro Marconi (INVITED)

Università di Firenze

Black hole masses and their relations with host galaxies

I will review black hole mass measurements in normal and active galaxies, following the so-called black hole mass ladder, and I will discuss their accuracy and reliability both in the local universe ad at high redshift. I will then present an overview of the scaling relations between black holes and their host galaxies both in the local universe and at high redshift, discussing in particular possible biases and uncertainties. Finally, I will discuss the implications that can be drawn on black hole mass functions and their cosmological evolution and on the origin of scaling relations and their meaning for galaxy evolution.

Andrea Marinucci

Università degli Studi di Roma Tre

A time and space resolved portrait of the inner reflector in NGC 4945

We present spectral, timing and imaging analysis of the X-ray reflector in NGC 4945, revealing its geometrical and physical structure with unprecedented detail. NGC 4945 hosts one of the brightest AGN in the sky above 10 keV, but it is only visible through its reflected/scattered emission below 10 keV, due to absorption by a column density of 4x10^24 cm^-2. Using several X-ray observations spread over 11 years, we find a remarkable constancy (within 4%) of the reflected component while Swift-BAT reveals strong intrinsic variability on time scales longer than one year. We show that the reflector is at a distance >30-50 pc, well within the imaging capabilities of Chandra at the distance of NGC 4945. Accordingly, the imaging analysis reveals a resolved, flattened, 150 pc-long clumpy structure, whose spectrum is fully due to cold reflection of the primary AGN emission. The clumpiness may explain the small covering factor derived from the spectral and variability properties. We stress the importance of an investigation on the neutral Iron emitting structures in Compton-thick Sy2s and present future perspectives of a Chandra imaging campaign.

Giorgio Matt (INVITED)

Dipartimento di Fisica, Università degli Studi Roma Tre

The future of high energy astrophysics from space

Even if the medium-to-long term future of high energy astrophysics from space is very uncertain, and perspectives not very bright indeed, in the present/near future the situation is still good, thanks to NuSTAR (just launched), eRosita and Astro-H (to be launched in a few years), not forgetting proposed missions like XIPE and missions in an advanced stage of competition like LOFT. In this talk I will discuss the advances in our knowledge of AGN physics and morphology expected from these missions.

Gabriele Melini

Università Roma Tre

Measuring the obscured black hole growth phase of z=1-3 galaxies

One of the main observational efforts in AGN evolution is to measure the density of the most obscured Compton-thick AGN, as they are believed to represent the primordial phase of AGN activity in galaxies, and moreover are necessary to properly reproduce the Cosmic X-ray Background. We have measured the density of Compton-thick AGN in mid-infrared selected samples from COSMOS and GOODS surveys, where deep Chandra observations exist. We made use of new selection criteria, taking advantage of model predictions, in order to select a population of CT candidates which have been confirmed through X-ray spectral analysis of stacked data. Our measures show that at 1<z<3, while the CT AGN densities are compatible with previous AGN LF estimations at higher luminosities, the density of fainter CT AGN is significantly higher than expected.

Fabio Muleri

INAF/IAPS

XIPE: The X-ray Imaging Polarimetry Explorer

The X-ray Imaging Polarimetry Explorer is a mission proposed to ESA Small Mission Call 2012. Its main objective is to open the polarimetric window also in the X-rays with a set of two focal plane polarimeters sensitive in the 2-10 keV energy range. Additional instruments are dedicated to solar flares polarimetry and Sun photometry. To be complaint with the tight schedule and cost limits of small mission program, XIPE is largerly based on existence items and mature technologies. Nonetheless, XIPE will have the sensitivity to study the acceleration of particles in pulsar wind nebulae, shell-like supernova remnants and jets in microquasars and blazars. It is also expected to give important results in the study of matter in extreme conditions, providing a measurement of the spin of black holes, the orientation of magnetic field versus rotation axis in magnetized neutron stars and testing theories of fundamental physics by using cosmic scenarios as a laboratory.

Roberto Nesci

INAF-IAPS

Simultaneous NIR and Gamma-ray observations of southern Blazars

We observed our objects with the REM telescope in J,H,K and R bands nearly twice every month during their visibility window and derived light curve and spectral slopes. Simultaneous Gamma-ray data were derived from the Fermi-GST database, with weekly averages. Six sources were never detected during our monitoring, proving to be fainter than their historical 2MASS level. All the detected (16) sources showed marked flux density variability, while the spectral slopes remained unchanged within our sensitivity limits. Steeper sources showed on average a larger variability. We also computed from the NIR light curves a variability speed index for each detected source. Only one source (PKS 0208-512) underwent an optical flare during our monitoring. Half of the sources showed a regular flux density trend on a 1 year time scale, but do not show any other peculiar property. The alpha_ro index looks as a good proxy for the NIR spectral slope. The Gamma-ray/NIR flux ratio showed a large spread, QSO being generally Gamma-loud and BLLac Gamma-faint, with a marked correlation with the alpha_ro index. The agreement between Gamma-ray and NIR light curves is generally good for sources with good S/N ratios, suggesting a correlation between the two emission processes.

Fabrizio Nicastro

INAF - OAR

When Illusions become Paradigms

What if orientation-based unification schemes were just wrong? What if the fat suburban doughnut did not exist? What if the monster was quiet and slow, and flickering was just apparent? What if relativistically broadened lines were an illusions? What if AGN skies were rarely bright and clear? Several new (and not that new) pieces of evidence suggest that this might actually be the case. ...Did I tickle your curiosity? If so, give me a talk!

Monica Orienti

Università di Bologna - INAF-IRA

On the connection between radio and gamma rays at low and high redshift the extraordinary case of PKS 1510-089 and TSX 0536+145

Powerful radio emission is not commonly found in active galactic nuclei (AGN) and is associated with the presence of outflows of relativistic plasma produced in the innermost region. When the jet axis is aligned with our line of sight, the emission is characterized by strong variability across the entire electromagnetic spectrum, high polarization level, and presence of superluminal jet components. An intriguing aspect still unclear is the connection between the regions responsible for the emission at the various wavelengths, particularly in radio and gamma-ray bands. In this contribution I will discuss results from multiwavelength observations of the flaring blazars PKS 1510-089 (z=0.361) and TXS 0536+145 (z=2.69). Since 2011, PKS 1510-089 has undergone to an extraordinary active phase in both radio and gamma rays, with an exceptional flaring episode in October 2011. On the other hand, TXS 0536+145 is the most luminous and distant flaring blazar detected up to now by Fermi-LAT. I will investigate the possible connection between high-energy and low-energy bands by comparing the gamma-ray light curves collected by Fermi-LAT with those derived in the radio, by means of single-dish telescope monitoring campaigns, and optical bands. Very Long Baseline Interferometry observations with VERA, EVN and VLBA will be presented to constrain the ejection of new superluminal components on parsec-scale close in time with high-energy flares.

Luigi Pacciani

IAPS-INAF

What can we learn from high energy flares in the Fermi sample of FSRQ, a case study

In 2008 AGILE and Fermi detected gamma-ray flaring activity from the unidentified EGRET source 3EG J1236+0457, recently associated with a flat spectrum radio quasar (GB6 J1239+0443) at z=1.762. The optical counterpart of the gamma-ray source underwent a flux enhancement of a factor 15-30 in 6 years, and >10 in half a year, which we propose demonstrates a transition from accretion disk to synchrotron jet dominated emission. From archival data we made an estimate of the mass of the central black hole and of the accretion disk luminosity. During the gamma-ray flare, Fermi observed a flat gamma-ray spectrum, extended up to 15 GeV, with no statistically-significant sign of absorption from the broad line region, suggesting that the blazar-zone is located beyond it. We obtained the same results from the modeling of the broad-band spectral energy distribution for the flaring activity periods, which is well constrained by the multiwavelength data collected, and from the accretion disk luminosity and black hole mass that we estimated from the archival data.

Maurizio Paolillo

Università degli Studi Federico II

Recent results on high-z AGN X-ray variability, from the deepest Chandra and XMM surveys

We will present the latest updates on the variability properties of high redshift AGNs. The full Chandra 4 Ms and XMM 3 Ms XMM observations of the CDFS, have now monitored the CDFS for over 10 years, allowing to derive high quality lightcurves. These data allow to confirm most of the results based on the 1 Ms data, including the suggested increase of variability with redshift. We will discuss the possible explanations of such results based on accretion models of nearby AGNs, highlighting the discrepancies between the models and the observations.

Michele Perna

Università di Roma La Sapienza

Reverberation mapping of high luminosity quasars

Virial estimates of the black hole mass in the center of AGNs, derived from single-epoch observations of luminosity and emission line widths, are now available for several thousands of object at all redshifts and luminosities, so that studies of the cosmological evolution of the AGN mass function are becoming possible. These estimates are based on the empirical luminosity-size relation measured through reverberation mapping at low redshifts end luminosities. For this reason the spectrophotometric monitoring of 4 luminous quasars was started in 2003, with the 1.8 m telescope of the Asiago Observatory. I adopt a new method (Zu et al. 2011) for reverberation lags determinations and I present the estimate of the broad line region size and black hole mass for the quasar PG 1247+267, which is the most luminous object with reverberation measures to date. Measures with both CIV and CIII] provide consistent results, which suggest a flattening of the size-luminosity relation at high luminosity.

Francesca Pozzi (INVITED)

Università di Bologna

AGNs surveys, the MIR/FIR side

I will review the main properties of the dust thermal emission of AGNs in the MIR/FIR band, underlying the key observational and theoretical aspects. I will describe the main results obtained at these frequencies, from the first pioneering IRAS satellite, up to the present Herschel Telescope. I will finally discuss the prospects offered in this field by the forthcoming SPICA satellite.

Isabella Prandoni

INAF - Istituto di Radioastronomia

Next Generation Radio Surveys and Deep Fields: probing AGN activitydown to the radio-quiet AGN regime

I will review ongoing/future projects aimed at characterizing the physicaland evolutionary properties of the faint radio population, focusing on theAGN component. In this respect, I will illustrate the capabilities ofnext-generation radio facilities (from LOFAR, JVLA, eMERLIN, to ASKAP,MeerKAT, and SKA), where unprecedented sensitivity and/or spatialresolution will be reached, allowing us to probe the AGN activity down tothe radio-quiet AGN regime.

Roberto Ricci

INAF-Istituto di radioastronomia

Spectral properties of a sample of 20-GHz selected radio sources

I will present results obtained in the Pilot Project of the K-band Northern Wide-area Survey (KNoWS) that aims at covering the Northern Sky at the radio frequency of 20 GHz down to a limiting flux density of 50 mJy/beam. I will focus on the Pilot Survey Northern Polar Cap sample of 73 radio sources observed in a range of frequencies between 5 and 30 GHz. I will discuss the radio spectral properties of the different radio populations in colour-colour scatter plots and how these compare with the results obtained in other high-frequency selected samples (AT20G, WMAP, Planck).

Angela Sandrinelli

Università dell'Insubria/INAF OAB

Near-infrared/optical multi-wavelength monitoring of Bl Lac objects

Systematic near-infrared/optical observations of six Bl Lac sources are presented as part of a long-term photometric monitoring program started in 2005 and still ongoing in 2012. Some of the studied sources are OJ287, PKS2155-304, WComae, AO0235+16, PKS0537-441 and PG1553+113. Data are obtained by the REM Telescope, located at the ESO premise of La Silla (Chile). Light curves are derived in the VRIJHK bands (from 0.55 to 2.15 μm) with a near-daily cadence and in several cases with multiple intra-night observations. Continuous monitoring, independent of the activity of the sources, guarantees high statistics and allows us to draw an unbiased view of different activity states. Here, we present results about long and short-term variability, color evolution, and cross-correlation analysis. Near-infrared/optical variability, coupled when available with multi-wavelength low- and high-energy data (radio, mm, X-ray and ?-rays), allow us to get important insights about the location and physical processes in blazars.

Eleonora Sani

INAF-OAA

Physical properties of dense molecular gas in centres of Seyfert galaxies

We present new ~1" resolution data of the dense molecular gas in the central 50-100 pc of four nearby Seyfert galaxies. PdBI observations of HCN and, in 2 of the 4 sources, simultaneously HCO+ allow us to carefully constrain the dynamical state of the dense gas surrounding the AGN. Analysis of the kinematics shows large line widths of 100-200 km/s FWHM that can only partially arise from beam smearing of the velocity gradient. The observed morphological and kinematic parameters (dimensions, major axis position angle, red and blue channel separation, and integrated line width) are well reproduced by a thick disk, where the emitting dense gas has a large intrinsic dispersion (20-40 km/s), implying that it exists at significant scale heights (25-30% of the disk radius). To put the observed kinematics in the context of the starburst and AGN evolution, we estimate the Toomre Q parameter. We find this is always greater than the critical value, i.e. Q is above the limit such that the gas is stable against rapid star formation. This is supported by the lack of direct evidence, in these 4 Seyfert galaxies, for on-going star formation close around the AGN. Instead, any current star formation tends to be located in a circumnuclear ring. We conclude that the physical conditions are indeed not suited to star formation within the central ~100 pc.

Tullia Sbarrato

Università degli Studi dell'Insubria

The jet-disc connection in blazars

The connection between the accretion disc and the relativistic jet is a hot topic of AGN physics. Gamma-ray loud blazars (detected by Fermi) with optical spectroscopic observations can be the best tools to study this issue: the gamma-ray luminosity is a proxy for the jet power, and the broad emission lines are a measure of the accretion disc luminosity. We already found a correlation between these two quantities, but now we are able to double our previous sample with new observations. This improvement strengthens our earlier findings, and we can study more deeply the different mass accretion rates of the two subclasses of FSRQs and BL Lacs. Moreover, by using different estimators of the jet power, such as the radio luminosity, we try to shed a new light on the jet-disc issue.

Raffaella Schneider (INVITED)

INAF/Osservatorio Astronomico di Roma

From the first stars to the first quasars

Theoretical models and numerical simulations are not yet able to predict the formation path of the first z ~ 6 quasars starting from seed BHs. BH seeds with masses ~100 Msun may naturally arise at these early epochs from the collapse of Pop III stars. An alternative, direct route to the formation of ~ 10^5 Msun BHs in the first galaxies involves the rapid collapse of metal-free gas irradiated by a strong UV flux, which suppresses H2 formation and fragmentation into stars Yet, fragmentation is inevitable if high-redshift dark matter halos are already enriched with at least trace amounts of metals and dust produced by prior star formation in their progenitors. Once formed, accreting BHs can release large amounts of radiative and kinetic energy to their surroundings and when they reach quasar-like luminosities, they are expected to generate outflowing winds that eventually expel most of the gas in the host galaxy, preventing further star formation. In this talk I will review current scenarios for the formation of the first quasars. I will discuss how the observed chemical and dynamical properties of their host galaxies allow to constrain their star formation history, the properties of the stellar populations, and the outflow rate powered by SN and by the central BH.

Francesco Tamborra

Roma Tre

MoCa: a Monte Carlo Code for Accretion

The X-ray emission of Seyfert galaxies is believed to be produced by Comptonization (Inverse Compton scattering) of the soft UV photons emitted by the accretion disk, from a hot (but thermal) corona of electron-positron pairs surrounding the disk. In the simplest scenario, the primary continuum is well reproduced by a power law distribution with a spectral index function of the electrons temperature and optical depth of the corona. Moreover the emerging radiation should be linearly polarized, with a degree mainly depending on the geometry of the corona and inclination angle with respect to the line of sight. In a fully special relativistic context we developed MoCA, a Monte Carlo code, in order to study the spectrum and the polarisation of radiation produced by such processes. Varying disk and corona parameters, the code can be applied to many astrophysical situations and, combined with a ray-tracing code, can offer a fully (special + general) relativistic description of this kind of phenomena.

Francesco Tombesi

NASA/GSFC and University of Maryland

X-ray ultra-fast outflows in AGNs

X-ray evidence for massive, highly ionized, ultra-fast outflows (UFOs) has been recently reported in a number of AGNs through the detection of blue-shifted Fe XXV/XXVI absorption lines. We present the results of a comprehensive spectral analysis of a large sample of 42 local Seyferts and 5 radio galaxies observed with XMM-Newton and Suzaku. We find that UFOs are common phenomena, being present in >40% of the sources. Their outflow velocities are mildly-relativistic, in the range ~0.03-0.3c. Their location is constrained at sub-pc scales from the central black hole, consistent with that of accretion disk winds/outflows. The mass outflow rate is in the interval ~0.01-1Msun/yr and the associated mechanical power is high, in the range ~10^43-10^45 erg/s, comparable to that of jets in radio-loud sources. Therefore, these wide angle outflows are powerful enough to provide a concurrent feedback effect to that of the collimated jets. In particular, a comparison between X-ray observations and VLBA radio images of the inner jet in the radio galaxy 3C 111 suggests the possibility to place also these UFOs in the context the known disk-jet ejection cycles, in analogy with Galactic black holes.

Francesco Ursini

Università di Firenze

Obscuration in Seyfert Galaxies by Broad Line Region clouds

We present an analysis of the X-ray spectral variability in a sample of type 1-1.5 Seyfert Galaxies, based on XMM-Newton and Suzaku observations. We studied variations in the X-ray spectrum of the sources, in order to explore the possibility of explaining these variations with occultations of the primary X-ray source by "clouds" with variable density and covering factor. Our results confirm the hypothesis, while other possible explanations of variability are discarded. We interpret these results as a proof that clouds from the Broad Line Region may "eclipse" the X-ray source even in usually unobscured AGNs, modifying their spectral properties. Finally, our analysis allows to probe the physical properties of the obscuring clouds and to estimate the X-ray source size, that turns out to be of a few gravitational radii.

Rosa Valiante

INAF-Osservatorio Astronomico di Roma

Quasar feedback in the early Universe: the case of SDSS J1148+5251

Galaxy-scale gas outflows triggered by active galactic nuclei have been proposed as a key physical process to regulate the co-evolution of nuclear black holes and their host galaxies. The recent detection of a massive gas outflow in one of the most distant quasar, SDSS J1148+5251 at z = 6.4, presented by Maiolino et al. (2012) strongly supports this idea and suggests that strong quasar feedback is already at work at very early times. In a previous work, Valiante et al. (2011), we have presented a hierarchical semi-analytical model, GAMETE/ QSOdust, for the formation and evolution of high-redshift quasars, and we have applied it to the quasar SDSS J1148+5251, with the aim of investigating the star formation history, the nature of the dominant stellar populations and the origin and properties of the large dust mass observed in the host galaxy. A robust prediction of the model is that the evolution of the nuclear black hole and of the host galaxy are tightly coupled by quasar feedback in the form of strong galaxy-scale winds. In the present letter, we show that the gas outflow rate predicted by GAMETE/QSOdust is in good agreement with the lower limit of 3500 Msun/yr inferred by the observations. According to the model, the observed outflow at z = 6.4 is dominated by quasar feedback, as the outflow rate has already considerably depleted the gas content of the host galaxy, leading to a down-turn in the star formation rate at z < 7 - 8. Hence, supernova explosions give a negligible contribution to the observed winds at z = 6.4, driving outflow with a rate of < 10 Msun/yr.

Shaji Vattakunnel

Università degli Studi di Trieste

Results from the VLA–E-CDFS Survey: X-ray properties of radio sources

We present and discuss the X-ray properties of the sources detected in the deep 1.4 GHz VLA Radio and 4Ms Chandra X-ray of the Extended Chandra Deep Field South (E-CDFS). Among the 1571 radio sources detected (Miller et al. 2012), we find 268 sources with X-ray counterparts (three times more than the previous work in Tozzi et al. 2009). Thanks to the optical and IR identification (Bonzini et al. 2012) we have all the spectroscopic or photometric redshifts, and therefore we are able to derive their intrinsic properties from X-ray spectral analysis. We adopt classification based on X-ray and radio data, exploiting the X-ray spectral features and time variability, that takes advantage of observations scattered across more than ten years, and selected sources whose emission is dominated by nuclear activity. We discuss the X-ray spectral properties and their correlation with radio emission for about 180 AGN. We find that radio detected X-ray AGN (L_X > 10^42 erg/s) are not more heavily obscured than the X-ray selected AGN. This argues against the use of radio surveys as an efficient way to search for the missing population of strongly absorbed AGN. We measure the X-ray-Radio luminosity relation for 43 star forming galaxies at high redshift (z ~ 0.5-1.5). The

inclusion of star forming galaxies detected only in radio or X-ray bands is in agreement with the first X-ray-radio relation and with the local one (Ranalli et al. 2003). We conclude that, at the faintest radio flux level (below 100 microJy), the radio source population starts to be dominated by star forming galaxies, in agreement with our multiwavelength and morphological analysis (Padovani et al. 2009, 2011).

Fabio Vito

INAF-OABO, UNIBO-Dip.Astronomia

The high-redshift (z>3) AGN population in the 4 Ms CDF-S

We present results from spectral analysis of a sample of high-redshift (z>3) X-ray selected AGN in the 4 Ms Chandra Deep Field South (CDF-S), the deepest X-ray survey to date. The sample is selected using the most recent spectroscopic and photometric information available in this field. It consists of 34 sources with median redshift z=3.7, 80 median net counts and median rest-frame absorption-corrected luminosity L_(2-10 keV)~10^44 erg/s. Spectral analysis for the full sample is presented and the intrinsic column density distribution, corrected for observational biases using spectral simulations, is compared with the expectations of X-ray background (XRB) synthesis models. We found that ~57% of the sources are higly obscured (N_H>10^23 cm^-2). Source counts in the 0.5-2 keV band down to flux F(0.5-2 keV)~4x10^(-17) erg/s/cm^2 are also presented. Our results are consistent with a decline of the AGN space density at z>3 and with no evolution of the AGN obscured fraction with redshift.