Oral Presentations

Dr. J. Aird
Title: The demographics and evolution of AGN from multiwavelength surveys
Abstract: Large surveys provide us with a plethora of methods to identify AGN, determine their properties, track their evolution over cosmic time, and understand how they are connected to the galaxy population. Different selection methods may identify different AGN populations and are subject to a range of selection biases. I will review recent work on measurements of AGN luminosity functions at different wavelengths, discuss the overlap in multiwavelength selected AGN populations and present recent studies quantifying how the AGN incidence depends on the properties of galaxies.

Ms T. Ananna
Title: The Stripe 82

Abstract: The shape of the Cosmic X-ray background (CXB) can help us impose some constraints on the X- ray spectral parameters of AGN, as the CXB in the range 10$-$100 keV is dominated by AGN contribution. We find that there is an inconsistency in measures of average photon index $\langle \Gamma \rangle$ and dispersion σ_Γ found in most surveys, and the values which can reproduce the CXB. For example, a lower σ_Γ ($\simeq 0.1$) can reproduce the CXB well at $\langle \Gamma \rangle = 1.9$ and cutoff energy $\langle$E$_{\rm C}\rangle$ = 200 keV. A higher σ_Γ ($\simeq$ 0.2) only reproduces the CXB if $\langle$E$_{\rm C}\rangle$ is significantly lower ($\simeq$ 80$-$140 keV). This inconsistency might point to selection bias in survey samples. In this work, we explore the parameter space using two approaches: a Bayesian approach and a neural network. In the Bayesian approach, we find the best fit distribution of X-ray spectral parameters for any given underlying AGN population (X-ray luminosity function; XLF) to fit the CXB. Using this approach, we constrain the parameter space. This approach assumes that these XLFs have to be approximately correct. In the second approach, instead of assuming an XLF, we assume a set of spectra, and let a neural network converge on an AGN population which best reproduces the CXB given the spectra. This approach rules out parts of the parameter space which never reproduces the CXB. We find a correlation between photon index $\langle \Gamma \rangle$ and cutoff energy $\langle$E$_{\rm cutoff}\rangle$. For a low photon index dispersion of $\sigma_{\Gamma} = 0.1$, we find that CXB is well-fitted when the population follows $\langle {\rm E}_{\rm cutoff} \rangle = e^{(2.85\pm0.25) \langle \Gamma \rangle}$ in the range $\langle \Gamma \rangle = 1.5-2.1$. This finding will help us probe selection biases in surveys by comparing AGN parameter spaces found in observed samples with whether or not such a sample could reproduce the CXB.

Dr. J. Buchner
Title: What makes clumpy obscuration and X-ray occultation events?
Abstract: Most active galactic nuclei are seen through thick circum-nuclear gas and dust. Also, these column densities vary on time scales of days to years, indicating that the obscurer is made from clumps. We present the first clumpy obscurer model that reproduces eclipse events and column density distributions. We developed a new, open-source Monte Carlo code, XARS, to X-ray illuminate arbitrary geometries, including warped disks, outflowing winds and clump arrangements, and produce high S/N X-ray spectra for XSPEC for these. Preliminary fits show good agreement with NuSTAR spectral observations of some nearby AGN. I will demonstrate how the eROSITA survey will be able to systematically monitor millions of AGN on year-time scales for occultation events, probing the granularity of the obscuring medium.

Dr. M Jones

Title: A universal mode of black hole accretion uncovering AGN in the Cosmic X-ray background

Abstract: From observations of active galactic nuclei (AGN) we may improve our understanding of the growth of black holes across cosmic time and their impact on their host galaxies, but observations alone may be limited by complex biases. Here I will present our results from modeling the whole AGN population while accounting for observational biases. I will begin by showing that the Eddington ratio distribution for optically-selected AGN is consistent with a broad power-law that is independent of host galaxy type or age. This broad Eddington ratio distribution is also observed in the X-rays, suggesting that a universal Eddington ratio distribution may be enough to describe the full AGN population. From these results, I have developed a new semi-numerical galaxy formation simulation with a straightforward prescription for AGN accretion. I will show that our simple model for AGN accretion can broadly reproduce the observed properties of X-ray AGN host galaxies and halos. I also find a trend between Eddington ratio distribution and redshift, consistent with the behavior predicted by hydrodynamic simulations. Finally, I will describe a new synthesis model for the Cosmic X-ray Background based on this semi-numerical model and present our results investigating the physical properties of the AGN population and their host galaxies and halos that contribute to this background emission.

Dr. T. kawamuro

Title: A Chandra and ALMA Study of X-ray-irradiated Gas in the Central ~100 pc of the Circinus Galaxy

Abstract: The AGN effect on host galaxies is an interesting topic that has been often discussed so far. The AGN is usually X-ray luminous, and thus X-ray irradiation by the AGN is unavoidable for its host galaxy. We report our recent study on X-ray-irradiated gas in the central ~100 pc of the Circinus galaxy (TK+19), a Compton-thick AGN host, at 10-pc resolution using Chandra and ALMA. Based on ~200 ksec Chandra/ACIS-S data, we created an image of the Fe Kalpha line at 6.4 keV, tracing X-ray-irradiated dense gas. The ALMA data in Bands 6 (~270 GHz) and 7 (~350 GHz) cover five molecular lines: CO(3--2), HCN(3--2), HCN(4--3), HCO^+(3--2), and HCO^+(4--3). The detailed spatial distribution of dense molecular gas was revealed, and compared to the iron line image. The molecular gas emission appeared faint in regions with bright iron emission. Motivated by this, we quantitatively discuss the possibility that the molecular gas is efficiently dissociated by AGN X-ray irradiation (i.e., creating an X-ray-dominated region). Based on a non-local thermodynamic equilibrium model, we constrained the molecular gas densities and determined that they are as low as interpreted by X-ray dissociation. Furthermore, judging from inactive star formation (SF) reported in the literature, we suggest that the X-ray emission has potential to suppress SF, particularly in the proximity of the AGN.

Mr. Uddipan Banik

Title: Constraining the mass density of free-floating black holes using razor-thin lensing arcs

Abstract: Strong lensing of active galactic nuclei in the radio can result in razor-thin arcs, with a thickness of less than a milliarcsecond, if observed at the resolution achievable with very long baseline interferometry (VLBI). Such razor-thin arcs provide a unique window on the coarseness of the matter distribution between source and observer. In this paper, we investigate to what extent such razor-thin arcs can constrain the number density and mass function of 'free-floating' black holes, defined as black holes that do not, or no longer, reside at the centre of a galaxy. These can be either primordial in origin or arise as by-products of the evolution of supermassive black holes in galactic nuclei. When sufficiently close to the line of sight, free-floating black holes cause kink-like distortions in the arcs, which are detectable by eye in the VLBI images as long as the black hole mass exceeds $\sim$1000 Solar masses. Using a crude estimate for the detectability of such distortions, we analytically compute constraints on the matter density of free-floating black holes resulting from null-detections of distortions along a realistic, fiducial arc, and find them to be comparable to those from quasar milli-lensing. We also use predictions from a large hydrodynamical simulation for the demographics of free-floating black holes that are not primordial in origin and show that their predicted mass density is roughly four orders of magnitude below the constraints achievable with a single razor-thin arc.

Prof. E. Giallongo

Title: The space densities and UV emissivities of AGN at z>4

Abstract: The study of the space density of moderately bright AGNs at $z > 4$ has been subject to extensive effort given its importance for the estimate of the cosmological ionizing emissivity and growth of supermassive black holes. In this context we have recently derived high space densities of AGNs at $z \sim 4$ and $-25 < M1450 < -23$ in the COSMOS field from a spectroscopically complete sample. Now we extend the knowledge of the AGN space density at fainter magnitudes ($-23 < M1450 < -18$) in the $4 < z < 6.1$ redshift interval by means of a multiwavelength sample of galaxies in the CANDELS GOODS-South, GOODS-North and EGS fields. Including our COSMOS sample as well as other color selected spectroscopic samples of bright QSOs ($M1450 < -27$) allows a first guess on the broad shape of the UV luminosity function at z>4 characterized by a double power law with a sharp break. The resulting emissivity and photoionization rate obtained for AGNs with $M1450 < -18$ appear consistent with that derived from the photoionization level of the intergalactic medium at $z \sim 4.5$. An extrapolation to $z \sim 5.6$ suggests an important AGN contribution to the IGM ionization if there are no significant changes in the shape of the UV luminosity function.

Prof. Ingyin Zaw

Title: A Uniformly Selected, All-Sky, Optical AGN Catalog

Abstract: We have constructed an all-sky catalog of optical active galactic nuclei (AGNs) with $z < 0.09$, collecting and uniformly analyzing available optical spectra, taken with different instruments, from the parent sample of galaxies in the 2MASS Redshift Survey. In addition to providing the catalog of AGNs and spectral line measurements, we quantify the effects of spectral quality and analysis in AGN identification. We find that the spectral signal-to-noise and spectral resolution affect not only the overall detection rate of AGNs but also the ratio of broad-line to narrow-line AGNs. Furthermore, narrow-line AGN identification is dependent upon the stellar population models used to subtract the galaxy contribution. These effects must be taken into account when determining the demographics of optical AGNs in a single survey, when comparing the results from different optical surveys, and in comparing optical AGN demographics with those from other wavelengths. We cross-correlate our catalog with available, all-sky, X-ray, infrared, and radio catalogs to study the multi-wavelength properties of these AGNs.

Dr. L. Zappacosta
Title: The realm of hyperluminous quasars

Abstract: We are performing a systematic study of the the X-ray properties of the most luminous (L_bol>10^47 erg/s) quasars in the Universe spanning from optical-NIR- MIR-selected sources at z=2-3. These AGN exhibit widespread outflow signatures at all scales and they are the sources where we expect quasar feedback to manifests in full force. Hence they are in a transit phase, predicted in quasar merger-driven evolutionary scenarios, where powerful winds sweep out the obscuring-dust and leads to optically bright quasars. Our study aim at investigating the link between nuclear energetic output and the acceleration of winds. We find a mixture of unobscured and obscured sources with column density values reaching ~10^24 cm-2. Given the high Eddington ratio this is indicative that the nuclear regions in most of these systems are in the blow-out phase. Furthermore we discover that, despite the similarly high bolometric luminosity, the coronal X-ray radiative output varies by 1.5 dex and anti-correlate with the broad line region wind velocity. This evidence points to a link between the presence of winds and the nuclear radiative output.

Mr. R. Pfeifle

Title: New Results from Chandra: The Incidence of Dual AGNs in Mergers

Abstract: Observational campaigns and theoretical studies have shown both that supermassive black holes (SMBHs) reside at the centers of most galaxies and that galaxy interactions are ubiquitous in the Universe. Galaxies are predicted to grow and evolve hierarchically through collisions, which also fuel and consequently grow the SMBHs at their centers causing them to manifest as active galactic nuclei (AGNs). Dual AGNs are therefore expected to be found in late stage mergers where they are predicted to undergo their most rapid growth. Identifying dual AGNs is of vital importance, as the frequency and characteristics of such dual AGNs have important astrophysical implications on the SMBH mass function, the interplay between SMBHs and the host galaxies, and the M-sigma relation. In this talk, I will summarize the results from our latest multiwavelength campaign designed to identify dual AGNs in mid-infrared preselected late stage galaxy mergers. Using the all-sky WISE survey, we identified a population of over one hundred strongly interacting galaxies that display extremely red mid-infrared colors, suggestive of buried, powerful AGNs. In a recent Chandra and XMM-Newton investigation of a subset of these mergers selected by WISE, we find dual AGN candidates in 8 out of 15 mergers – one of which has been realized as a triple AGN – and several of the dual systems offer no evidence for AGNs based on optical spectroscopy. Our results demonstrate that 1) optical studies miss a significant fraction of single and dual AGNs in advanced mergers, and 2) mid-infrared pre-selection is extremely effective in identifying dual AGN candidates in late stage mergers. Our multiwavelength observations suggest that the buried AGNs in these mergers are highly absorbed, with intrinsic column densities in excess of log(N_H/cm^2) > 23 – 24, consistent with hydrodynamic simulations.

Ms Y. Diaz

Title: Constraining X-ray reflection in the low luminosity AGN NGC3718 with NuSTAR and XMM- Newton

Abstract: In understanding the place of LINERs within AGN unified schemes, a question of importance is whether LINERs has an obscuring torus. Theoretically, models predict that below a certain Eddington rate the torus and broad line region disappear. The X-ray spectrum is a useful tool to study the properties of the obscuring material in AGN because it contains specific features arising from the scattering in this medium, even in unobscured sources. There are many prominent features seen in the X-ray spectra of AGN, one of the most important is the reflection component, produced by Compton scattering of the primary emission, resulting in a broad hump-like shape, peaking at 30 keV. The measurement of the reflector is a difficult task because it depends on the intrinsic absorption (observed at soft energies), the uncertain intrinsic spectral slope of the primary coronal emission and its cut-off energy. In this work, we study the X-ray spectrum of the LLAGN NGC3718 (L/L Edd approx. 10^-5) combining observations from the most sensitive X-ray observatories in overlapping energy bands (XMM-Newton with 18.5 ks and NuSTAR 230 ks) to analyze how the fitted coronal parameters depend on the reflection model used. Additionally, we put constraints on the geometry and physical features of the reflector: if the emission is dominated by a neutral reflector (torus) it has to be Compton thin and cover a high fraction of the sky. If the scattered light is instead is dominated by an ionized reflector, the accretion disk has to be highly ionized.

Prof. P. R. Hidalgo
Title: (Extremely!) High Velocity Outflows

Abstract: We present a survey of extremely high velocity outflows (outflowing at speeds between 0.1c and 0.2c) observed as broad blueshifted CIV absorption lines in Sloan Digital Sky Survey Data Release 9 catalogue quasar spectra (DR9Q). We normalized and analyzed the 6760 quasar spectra with signal-to-noise larger than 10 and of quasars with redshift larger than 1.9. This realm of the parameter space of quasar outflow's velocity has not been included in previous surveys of quasar spectra, and might pose the biggest constraints for theoretical models. Moreover, the kinetic luminosity of outflows at 0.2c is two orders of magnitude larger than those speeding at typically high velocities (~10,000 km/s). Studying extremely high velocity outflows can help us understand the interaction between the central supermassive black hole and the host galaxy, so we will discuss the characteristics and properties of the found quasar sample, which appears to show larger black hole mass and bolometric luminosity than previously known BALQSOs.

Dr. Dawei Xu
Title: SBS 1411+533: a New “Changing-look” Quasar with a “Turn-on” Transition

Abstract: We present the spectroscopic study of a changing-look quasar SBS 1411+533 (SDSS J141324+530527.0) at z = 0.4563, which shows a “turn-on” spectral type transition from Type-1.9/2 to Type-1 within a rest-frame timescale of 1–10 yr by a comparison of our new spectroscopic observation and the Sloan Digital Sky Survey archive database. The invariability of the line wing of Mg IIλ2800 emission and timescale argument (the invariability of [OIII]λ5007 line blue asymmetry) suggests that a variation of obscuration (an accelerating outflow) is not a favorable scenario. The timescale argument allows us to believe the type transition is possibly caused by either a viscous radial inflow or a disk instability.

Ms Lara Alegre
Title: SUPA, Institute for Astronomy, Royal Observatory
"Classification of radio sources with LOFAR"

Abstract: The LOw Frequency ARray (LOFAR) is a new generation of radio telescope that has been mapping the Northen sky at meter wavelengths, detecting hundreds of thousands of previously unknown galaxies hosting supermassive black holes. In my research I am using the LOFAR Two-metre Sky Survey Data Release 1 (LoTSS-DR1, February 2019) to improve the current radio source's cross-identification methods with machine learning.

Ms Jenna Cann

Title: The Hunt for Intermediate Mass Black Holes in the JWST Era

Abstract: While the properties of supermassive black holes (SMBHs) and their host galaxies have been well-studied in massive galaxies, very few SMBHs have been found in galaxies with low masses, low metallicities, and those with small bulges. This is a significant deficiency, because the study of this population allows us to gain an understanding of merger-free pathways to black hole growth, and to gain insight into the origin and growth of SMBH 'seeds', thought to have formed at high redshift. Most studies aimed at finding SMBHs have been conducted using optical spectroscopic studies, where active SMBHs display distinctive optical emission lines indicative of accreting SMBHs. However, in low mass galaxies, these studies are significantly biased in searching for active low mass black holes. I will discuss some of our theoretical work highlighting the diagnostic power of infrared coronal lines in identifying black holes in the low mass regime and constraining their properties, and report on the preliminary results of our pilot sample observations testing the usage of these diagnostics.

Dr. G. Lanzuisi
Title: Compton-thick AGN at high redshift

Abstract: I will present results (published in Lanzuisi et al. 2018), on the X-ray selection of CT AGN at high redshift in the COSMOS field. Adopting a physically motivate model to reproduce the toroidal absorber and MCMC methods to efficiently explore the parameter space, we selected 67 CT AGN up to z=3.5 from the Chandra Cosmos Legacy survey. After correcting for selection bias and completeness, we found that the fraction of CT AGN increases as a function of redshift from ∼0.2 at z = 0.1–1 to ∼0.3 at z = 1–2, and to ∼0.5 at z = 2–3.5 at average log(LX)=44.5 [erg/s]. Based on HST morphology, we found that the fraction of CT AGN in merging/interacting systems is systematically higher, by a factor ~3, than that observed in the parent sample of X-ray selected C- thin AGN.

Dr. K. Ichikawa

Title: IR View of X-ray AGN: The Covering Factor of Gas and Dust in Swift/BAT AGN

Abstract: We quantify the luminosity contribution of active galactic nuclei (AGN) to the 12 um, mid-infrared (MIR; 5–38 um), and total IR (5–1000 um) emission in the local AGN detected in the all-sky 70 month Swift/BAT ultrahard X-ray survey. We decompose the IR spectral energy distributions (SEDs) of 587 objects into the AGN and starburst components using templates for an AGN torus and a star-forming galaxy. This enables us to recover the emission from the AGN torus including the low-luminosity end, down to log L(14-150keV)~41, which typically has significant host galaxy contamination. The total IR AGN luminosity obtained through the IR SED decomposition enables us to estimate the fraction of the sky obscured by dust, i.e., the dust covering factor. We demonstrate that the median dust covering factor is always smaller than the median X-ray obscuration fraction above an AGN bolometric luminosity of log Lbol(AGN)~42.5. Considering that the X-ray obscuration fraction is equivalent to the covering factor coming from both the dust and gas, this indicates that an additional neutral gas component, along with the dusty torus, is responsible for the absorption of X-ray emission.

Mr. K. Birchall
Title: X-ray Selected AGN in Dwarf Galaxies

Abstract: Black holes are near ubiquitous higher up the galactic mass scale so AGN activity is inevitable at some point in the host's lifetime, but how prevalent are AGN in the regime of dwarf galaxies? Moreover, dwarf galaxies are considered a good analogue for galaxies in the high redshift Universe thus studying these objects also promises insights about black hole formation and growth. Focusing on the nearby Universe ($z < 0.25$), we present results from one of the first robust and large-scale quantifications of X-ray selected AGN in this redshift and mass regime. Starting from a parent sample of 4,331 dwarf galaxies, we combined data from the MPA-JHU catalogue (based on SDSS DR8) and 3XMM DR7, performed a careful review of the data to remove misidentifications and produced a sample of 61 dwarf galaxies ($M_{stellar} < 3e9$ Msun) that exhibit nuclear X-ray activity indicative of an AGN. To better understand these AGN we performed several additional measurements. First, we compared X-ray selection to BPT diagnostics and found this method misses 85% of our AGN population. We then probed the environments of the central supermassive black holes by calculating their specific accretion rates. Most are found to be accreting at around 0.1% of their Eddington luminosity or lower. Finally, we correct our sample for the varying sensitivity of 3XMM and find evidence of a broad range of central black hole specific accretion rates and an AGN fraction that increases with host galaxy mass (up to about 6%) but is constant with redshift.

Mr. C. Carroll

Title: An extreme population of heavily obscured AGN

Abstract: Obscured quasars represent a large fraction of the total number of powerful active galactic nuclei (AGN). Understanding the complete quasar population requires a full accounting of these sources, which is difficult in the presence of complex selection effects. Additionally, dust extinction in obscured quasars allow us to observe their host galaxies and make connections between AGN emis- sion and physical properties of their hosts. Using UV to mid-IR broadband photometry from SDSS, WISE, UKIDSS, and GALEX, we model the spectral energy distributions (SEDs) for these systems with no prerequisite AGN selection and uncover dozens of powerful obscured quasars which lack hard X-ray counter- parts in either Chandra, XMM, or NuSTAR observations. At X-ray flux limits, a lack of detection indicates extremely heavy obscuration with hydrogen column densities beyond 10^25 cm^−2. This points to a population of very deeply buried AGN. We explore the host galaxy properties of these AGN and compare to sim- ilar samples with lower obscuration to investigate connections between level of obscuration, host galaxy environment, and AGN fueling.

Mr. S. Amarantidis

Title: The first Super Massive Black Holes: indications from models for future observations

Abstract: We present an exploration of the expected detection of the earliest Active Galac- tic Nuclei (AGN) in the Universe from state-of-art galaxy formation and evolution semi-analytic models and hydro- dynamical simulations. We estimate the number and radiative characteristics of Super Massive Black Holes (SMBHs) at $z>6$, a redshift range that will be intensively explored by the next generation of telescopes, in particular in the radio through the Square Kilometre Array (SKA) and at high energies with ESA's Athena X-ray Observatory. We find that Athena will be able to observe over 5000 AGN/deg2 at the Epoch of Re-ionization (EoR), $6<z<10$. Similarly, for the same redshift range the models/simulations suggest that SKA will detect at least 400 AGN/deg2. Additionally, we stress the importance of the volume of the simulation box as well as the initial physical conditions of the models/simulations on their effect on the luminosity functions (LFs) and the creation of the most massive SMBHs that we currently observe at the EoR. Furthermore, following the evolution of the accretion mode of the SMBHs in each model/simulation, we show that, while the quasar dominates over the radio mode at the EoR, detection at radio wavelengths still reaches significant numbers even at the highest redshifts. Finally, we present the effect that the radiative efficiency has on the LFs by comparing results produced with a constant value for the radiative efficiency and more complex calculations based on the spin of each SMBH.

Prof. D. Alexander

Title: AGN activity in our cosmic backyard: obscuration and identification challenges

Abstract: Deep X-ray, optical, and infrared surveys have identified AGNs out to high redshift, placing constraints on the global growth of black holes and the role of AGNs in the formation and evolution of galaxies. However, despite this great progress, we still lack a complete picture of AGN activity even within the very local Universe. In this talk I will demonstrate the challenges in the identification of AGNs just out to $d < 15$ Mpc, quite literally our own "cosmic backyard". Utilising a range of observations, most principally the NuSTAR observatory, I will characterise the properties of these closest AGNs and place constraints on the fraction that are obscured and Compton thick.

Dr. C. Ricci

Title: Galaxy mergers and obscured black hole growth, an hard X-ray view

Abstract: Mergers of galaxies are believed to cause inflows of gas which trigger rapid accretion onto supermassive black holes (SMBHs). During this process the SMBH is predicted undergo through a phase in which it is completely enshrouded by gas and dust. However, due to the difficulty in detecting and studying these very obscured black holes, the dynamics of this process, and of the possible feedback from the AGN, are still largely unknown. One of the best approaches to study these sources is to observe them in the hard X-ray band, where photons are significantly less affected by obscuration. In my talk I will present the results obtained studying with NuSTAR a sample of 50 local Luminous and Ultra-luminous IR galaxies in different merger stages from the GOALS sample. About half of these objects were presented in Ricci et al. (2017 MNRAS), while the rest were observed as a part of a dedicated campaign carried out in the past two years. This includes a very long observation of IRAS 08572+3915 (200ks with NuSTAR+120ks with XMM-Newton), the most energetic, embedded galactic nucleus in the local Universe. I will discuss how different multi-wavelength proxies of AGN activity fare in recovering the intrinsic power of the accreting SMBHs, and how the merger process affects the properties of the SMBHs (i.e., luminosity, obscuration), comparing our results with recent numerical simulations.

Prof. C. Vignali

Title: The X-ray view of the Jackpot Nebula at z=2: an amazing source overdensity and extended emission revealed in X-rays

Abstract: The recent discovery of a quadruple AGN non-lensed system embedded in a giant (310 kpc) and luminous Ly_alpha nebula at z=2 (the so-called Jackpot Nebula), coupled with the presence of a >20 overdensity of Ly_alpha emitters (LAEs) at the same redshift, has opened a new observational window in terms of tracing proto-clusters at high redshift. The 140ks Chandra observation of this field has allowed us to characterize the X-ray emission of the four AGN and to detect additional three AGN likely associated with the same structure on larger scales. Even more intriguingly, we detected significant diffuse X-ray emission in the inner region, where the extended Ly_alpha emission is more prominent. These results support the interpretation of the field as hosting a protocluster with a very high incidence of AGN. Finally, we comment on the possibility to detect similar high-redshift systems with deep Chandra observations and, on a longer term, with Athena.

Dr. Yoshiki Toba

Title: Physical properties of luminous radio galaxies at $0 < z < 1.7$ selected with Subaru Hyper Suprime-Cam and VLA FIRST survey

Abstract: We present physical properties of radio galaxies (RGs) with f1.4GHz > 1 mJy discovered by Subaru Hyper Supreme-Cam (HSC) and VLA Faint Images of the Radio Sky at Twenty-Centimeters (FIRST) survey. For 1056 FIRST RGs with HSC counterparts in about 100 deg^2, we compiled multi-wavelength data of optical, near-infrared (IR), mid-IR, far-IR, and radio (150 MHz). We derived their color excess (E(B-V)), stellar mass, star formation rate (SFR), IR luminosity, the ratio of IR and radio luminosity (qIR), and radio spectral index (alpha_radio) that are derived from the SED fitting with CIGALE. We also estimated Eddington ratio based on stellar mass and integration of the best-fit SEDs of AGN component. We found that E(B-V), SFR, and IR luminosity clearly depend on redshift while stellar mass, qIR, and alpha_radio do not significantly depend on redshift. Since optically-faint (i_AB > 21.3) RGs that are newly discovered by our RG survey tend to be high redshift, they tend to not only have a large dust extinction and low stellar mass but also have high SFR and AGN luminosity, high IR luminosity, and high Eddington ratio compared to optically-bright ones. The physical properties of a fraction of RGs in our sample seem to differ from a classical view of RGs with massive stellar mass, low SFR, and low Eddington ratio, demonstrating that our RG survey with HSC and FIRST provides us curious RGs among entire RG population (Toba et al. 2019, ApJS, re-submitted).

Dr. R. Arcodia

Title: Testing the disk-corona interplay in radiatively-efficient broad-line AGN

Abstract: The correlation observed between monochromatic logarithmic X-ray and UV luminosities, representing a fundamental tracer of the disk-corona interplay in radiatively-efficient AGN, still lacks a clear theoretical explanation, despite being used for many applications. We tested a self- consistently coupled disk-corona model against the observed Lx-Luv, that can explain its observed slope in terms of modified viscosity prescriptions in the accretion disk, intrinsically yielding an X-ray corona whose emission increases less than the disk emission going from low- to high-accretion states. We used a reference sample of broad-line AGN, selected from the XMM-XXL survey and boasting SDSS BOSS follow-up, to perform a quantitative observational test: the disk-corona emission for each single source was modeled in the Lx-Luv plane and the observed slope, normalization and scatter of the relation were used to constrain the theoretical model. We found viscosity prescriptions which are able to reproduce the slope of the observed Lx-Luv correlation, but cannot simultaneously reproduce the normalization, in the sense that they yield a coronal emission that is too weak. The tension between data and model can be relaxed assuming a higher accretion efficiency implying, on average, highly-spinning black holes. This test shows how we can use multi-wavelength tracers from both X-rays and optical-UV surveys to unveil the innermost (and most powerful) region of accreting AGN.

Prof. G. Risaliti

Title: Quasars as standard candles

Abstract: I present an analysis of the X-ray and UV properties of a sample of several thousands of quasars. All objects have an optical/UV SDSS spectrum, and an X-ray spectrum from either the 3XMM Point Source Catalog, or the Chandra Source Catalog. A non-linear relation between the UV and X-ray luminosities of optically blue, X-ray steep quasars holds at all redshifts, with a dispersion as small as ~0.15 dex. This dispersion is almost entirely due to X-ray variability and disk inclination. Therefore, there must exist a universal physical mechanism linking the accretion disk to the X-ray corona, producing the observed relation. Moreover, the non-linearity of the relation can be used to estimate the luminosity of quasars, turning them into standard candles". A further, unexpected result of our analysis is a population of X-ray weak quasars with "normal" (blue) and luminous UV spectra, accounting for about 1/3 of the quasar population at z~3.

Dr. A. Masini

Title: The Chandra Deep Wide Field Survey: pushing deeper the central 6 deg^2 of the Bootes field

Abstract: X-ray surveys are one of the most efficient ways to detect active galactic nuclei (AGN) and perform statistically meaningful population studies. In the past decade, important results in this field came from both wide and deep X-ray surveys of the sky, performed following the well-known "wedding cake" approach.Thanks to these surveys, there is now compelling evidence that there is a strong connection between the growth of Black Holes (BHs) and the evolution of large-scale structures.To further test this picture, the Chandra Deep Wide Field Survey (CDWFS) was designed, able to probe large volumes and detect large numbers of AGN at the luminosities and redshifts that comprise the bulk of the growth of BHs. Indeed, the CDWFS pushes deeper the wide layer of the "wedding cake", to align with the sensitivity-area locus of the most recent Chandra surveys. In this talk, the status of the survey and its perspectives will be discussed: we will take advantage of the exquisite Chandra angular resolution and sensitivity in order to study in detail the large-scale clustering of AGN and their Eddington-ratio distribution, to probe the AGN-Dark Matter halo and AGN-Star Formation connections.

Mr. E Pouliasis

Title: Robust Identification of Active Galactic Nuclei through HST Optical Variability in GOODS- S: Comparison with the X-ray and mid-IR Selected Samples

Abstract: Identifying Active Galactic Nuclei (AGNs) through their X-ray emission is efficient, but necessarily biased against X-ray-faint objects. We aim to characterize this bias by comparing X-ray-selected AGNs to the ones identified through optical variability and mid- IR colours. We present a catalogue of AGNs selected through optical variability using all publicly available z-band Hubble Space Telescope images in the GOODS-South field. For all objects in the catalogue, we compute X-ray upper limits or discuss detections in the deepest available ∼7 Ms Chandra

Deep Field South images and present the Spitzer/IRAC mid-IR colours. For the variability study, we consider only sources observed over at least five epochs and over a time baseline of up to ten years. We adopt the elevated median absolute deviation as a variability indicator robust against individual outlier measurements and identify 113 variability-selected AGN candidates. Among these, 26 have an X-ray counterpart and lie within the conventional AGN area in the Fx/Fopt diagram. The candidates with X-ray upper limits are on average optically fainter, have higher redshifts compared to the X-ray detected ones and are consistent with low luminosity AGNs. Out of 41 variable optical sources with IR detections, 13 fulfill the IR AGN colour selection criteria. Our work emphasizes the importance of optical variability surveys for constructing complete samples of AGNs including the ones that remain undetected even by the deepest X-ray and IR surveys.

Dr Timur Mufakharov
Title: Multifrequency study of the GPS-sources

Abstract: Gigahertz-Peaked spectrum (GPS) sources are compact active galactic nuclei, presumably a young predecessors of the bright radio sources at early stages of their evolution. The study of their radio properties gives us information about the features of synchrotron radiation in extragalactic structures. In this paper we present a multifrequency study of GPS, based on the quasi-simultaneous measurements with the RATAN-600 radio telescope in 2006-2017. We present a catalog of the flux densities of the GPS that were obtained with the RATAN-600 at the frequencies: 1.1, 2.3, 4.8, 7.7 / 8.2, 11.2 and 21.7 GHz. In addition we used data of low-frequency surveys GLEAM (GaLactic and Extragalactic Allsky Murchison widefield array survey) and TGSS (Tata institute for fundamental research GMRT Sky survey), and a high-frequency measurements of Planck to analyze the radio spectra. 164 GPS were classified as GPS sources and candidates, 17 of them at the first time. It makes up an insignificant fraction of GPS in the original sample of bright AGNs - about 2 %. Heterogeneity of physical properties and conditions for the synchrotron radiation formation in the two types of GPS has been detected. The deficit of distant GPS ($z > 2$) with low frequencies of the spectral maximum (less than 1 GHz) was confirmed. The existing anti-correlation “size – maximum frequency” looks continuous.

Ms Silvia Belladitta
Title: An extremely X-ray weak blazar at z=5.0

Abstract: Looking for radio-loud (RL) Active Galactic Nuclei (AGNs) in the early Universe is crucial to understand when and how the first super massive black holes formed, how they are related to galaxy formation and what is their role in the reionisation process. High redshift (z>4.5) RL AGNs are rare sources, and only next decade deep and wide-field surveys will allow us to increase exponentially their discovery.
Using the surveys available now, we have recently start a project which combines optical, IR, and radio datasets to identify RL AGNs at z>4.5. In this framework, I will present the multi-wavelength properties of DESJ014132.4-542749.9, a newly discovered extremely radio-loud (radio loudness>10^4) quasar at z=5.0. This source has been selected by combining the first data release of the Dark Energy Survey with the Sydney University Molonglo Sky Survey radio catalog and it was spectroscopically confirmed using EFOSC2 at the NTT and X-Shooter at the VLT.
DESJ014132.4-542749.9 is a very interesting AGN: its radio features (bright in radio, extremely radio-loud and with a flat radio spectrum) suggest that we are observing it very close to the direction of the relativistic jet, i.e. it is a blazar. However, the X-ray emission measured by the XMM-Newton and Swift satellites is weak with respect to blazars, at similar or at lower redshifts.
Finally DESJ014132.4-542749.9 hosts a black hole of few 10^8M⊙, much smaller than radio-loud quasars previously known at high-z.

Mr Lingsong Ge
Title: Bayesian Hierarchical Method of AGN X-ray Spectral Fitting

Abstract: We present our first results on the study of the distribution and evolution of obscuration in AGN from the XMM-COSMOS and XXL fields. We developed a new approach based on a Bayesian hierarchical model in order to propagate correctly the uncertainties on the components, like reflection and soft-excess, that are present in the X-ray spectra of AGN, but not necessarily detectable in medium-sensitivity surveys. In order to validate our approach and identify the limitations in the recovery of main parameters, we create and analyse 1000 realistic simulations of AGN spectra, and also compare our results with those obtained with more usual methods. In a second step, we will model the full AGN population, taking into account the full selection function induced by the survey sensitivity and the method.

Ms Chance Spencer
Title: Measuring Black Hole Masses in Active Galactic Nuclei from Time Resolved Observations with the 1m Nickel Telescope of Lick Observatory

Abstract: Active galactic nuclei (AGNs) are exotic objects in the center of some galaxies with luminosities that can greatly outshine the stars of the host galaxy across the entire electromagnetic spectrum. The origin of the UV/optical light is thought to be due to accretion of material onto the supermassive black hole in their centers. Since these objects are too far away to resolve the gravitational sphere of influence of the black hole directly, we make use of a method called reverberation mapping. We measure the lag between the AGN power-law continuum emitted by the accretion disk and the Doppler-broadened emission lines which originate in gas clouds orbiting the black hole at high speeds while being ionized by the power-law continuum. Using light travel time arguments, the observed lag time can be translated into the size of the broad-line region. Combined with the width of the broad emission lines, we can estimate the black hole mass. The Seoul AGN Monitoring Project (SAMP) uses the 1m Nickel telescope of Lick Observatory to study the variability of the optical continuum emission. Combining these observations with spectroscopy of the broad-line region of the same AGNs, we can perform reverberation mapping. Our team, consisting of a handful of Cal Poly undergraduate students, is in charge of the optical imaging, controlling the 1m telescope remotely from Cal Poly. In this poster, we will present an overview of both the optical imaging campaign led by the Cal Poly undergraduate students as well as the first results of the continuum variability of the AGNs. Our study is special in that it targets AGNs at the high-mass end over a multi-year long campaign.

Yashpal Bhulla
Title:
Abstract: We present the results of black hole X-ray binary 4U 1630-47. Our observations, made with RXTE/PCA and AstroSat/LAXPC. We report on a comparative study on the spectral behaviour of observations occurred in 2008 and 2016. We analysed all the data collected by the Rossi X-ray timing Explorer (RXTE) during 2008 and AstroSat in 2016. All observstions are well fitted with a combination of modeled of a multicolor disk blackbody and thermal component. During our observations of different instruments, 4U 1630-47 exist in soft state, intermediate state and high soft state. We show that spectral behaviour in the energy range between 3 and 30 keV. The source do not show any hard X-ray emission at above 30 keV throughout the observations. We proposed that the changes in the disk flux are caused by the variability in the temperature of the accretion disc and inner disk radii along the soft state. The disk flux scales with inner disk temperature as T^3.6 instead of T^4.

Dr. V. Allevato
Title: The interplay between SMBHs and the large-scale structure of the Universe

Abstract: Almost every galaxy in the local Universe hosts a SMBH at its center. SMBH masses tightly correlate with several global properties of the host galaxy and with the galaxy environment, suggesting a fundamental link among SMBH, host galaxy and the cosmic large-scale structure, although the contribution of the underlying physical processes is not yet fully understood. AGN clustering provides a unique way to probe the BH-host galaxy-host halo connection statistically classifies the typical AGN environment and quantifies how SMBHs populate dark matter halos, providing independent constraints on AGN evolutionary models and BH triggering scenarios.I will give a review on our current understanding of the clustering properties of multi-wavelength selected AGN, as a function of spatial scale, redshift, luminosity, obscuration and host galaxy properties. This is crucial to probe the environment in which SMBH accretion occurs and the BH-galaxy co-evolution.

Dr. N. Schartel
Title: 20 years of XMM: The contribution of XMM Newton to the study of AGN

Abstract:

Dr. G. Mountrichas

Title: The dependence of the X-ray AGN clustering on the properties of the host galaxy

Abstract: In the last decade there has been growing evidence supporting the coeval growth of galaxies and their resident Supermassive Black Hole. However, it is still not clear what are the physical mechanisms that drive the BH growth, how the large-scale environment (Dark Matter Halo mass, DMH mass) affects these feeding mechanisms and what is the connection between the properties of BHs (e.g. BH mass, Eddington ratio) and the host galaxy properties, e.g. Star- Formation Rate (SFR), stellar mass (M⋆) and specific SFR (sSFR). One way to shed light on these questions is via a clustering analysis.

In my talk, I'll present results using X-ray AGN and galaxies in the XMM-XXL survey, to study the X-ray clustering dependence on SFR, M⋆ and sSFR. in an attempt to disentangle those three galaxy properties. I'll also compare the clustering properties of active and normal galaxies to examine whether the activity of the central SMBH affects the large-scale environment of the host galaxy.

Mr. E. Iani
Title:

Abstract: The intracluster medium surrounding brightest cluster galaxies (BCGs) inhabiting cool core clusters is known to be highly dynamic since generally perturbed by large gaseous bubbles, outflows, cocoon shocks, sonic ripples and turbulent mixing. Simulations and theory have shown that all these phenomena are likely produced by a supermassive black hole (SMBH) hosted by the BCG. In fact, the amount of mechanical energy released by the active galactic nucleus of BCGs can effectively counterbalance the hydrostatic radiative losses of the surrounding medium, preventing massive inflows of gas towards the central galaxy and solving the long-standing problem of cooling flows, i.e. the inflow of 'cold' (T~10^4K), subsonic, pressure-driven intracluster medium towards the central galaxy. Finally, the SMBH feedback have been found to strongly influence the star formation activity of the host galaxy, although it is still unclear whether it triggers or quenches star formation.

With spatially-resolved MUSE observations and a suite of multi-wavelength ancillary data, we investigate the properties of the intermediate-redshift radio-loud BCG residing in the extremely X- ray bright cool core cluster Abell 2667. We find a clumpy star-forming filament around the BCG spatially extending down to its core. We also detect the presence of two kinematically decoupled ionised gas streams: a redshifted stream extending along the clumpy filament, and a more compact blueshifted stream surrounding the BCG nucleus. From the stellar velocity and velocity dispersion maps, we estimate the mass of the SMBH hosted by the BCG to be 3.8x10^9 Msun, and by using spatially-resolved diagnostic diagrams, we determine whether SMBH outflows or star formation is the primary mechanism powering the observed emission lines. Our findings indicate that the emission coming from the star-forming filaments are originated by both star-formation and AGN activity, thus suggesting a positive contribution by the SMBH to the star formation in the filaments. Based on these results, we believe that the BCG in Abell 2667 is going through chaotic cold gas accretion which is fuelling both new star formation and the central SMBH, triggering strong outflows that in turn regulate both accretion and star formation.

Dr. C. Villforth

Title: Fuelling AGN - the impact of mergers on luminous unobscured AGN and reddened AGN with powerful outflows

Abstract: The processes that fuel black hole accretion remain poorly understood. Major mergers of galaxies have long been believed to drive black hole accretion at the very least in luminous and heavily obscured AGN. I will show HST imaging studies for luminous unobscured AGN (log Lbol ~ 46 erg/s) as well as reddened AGN with powerful outflows (FeLoBALs). Our data show no excess in merger features compared to a mass matched control galaxies in these two samples believed to be strongly linked to early major mergers. I will discuss the constraints this sets on the timing of AGN activity and possible delays between a tentative early obscured phase and unobscured AGN phase. I will also discuss the upper limit these results set on the fraction of AGN triggered by major galaxy mergers.

Mr. K. Mehrgan

Title: The dynamical imprint of a 40-billion-solar-mass supermassive Black Hole in Holm15A

Abstract: Holm15A, the brightest cluster galaxy of Abell 85 has been claimed to possibly host a 10^11 solar mass black hole, based on its extremely diffuse central region. This 4 − 5 kpc large region is ∼ 0.5 mag fainter than any other known diffuse core of a massive elliptical galaxy with a black hole measurement.

The galaxy's surface brightness profile, however, is near exponential in shape (Sérsic index n ∼ 1), distinguishing itself from the typical core-Sérsic profiles of massive core ellipticals. We observed the galaxy with MUSE and detected an enormously massive (4.0 ± 0.8) × 10^10 Msol black hole, as well as a tangential orbital bias, within the central ∼ 4 kpc of Holm15A using Schwarzschild orbit models. We find that the stellar velocity anisotropy profile as well as the observed surface brightness of the galaxy are well consistent with recent Numerical merger simulations of repeated binary supermassive black hole 'core scouring' - i.e. the ejection of stars on radial orbits by gravitational slingshots. It has not been tested yet whether other ultra-energetic processes such as AGN-feedback might also lead to the formation of diffuse cores with tangentially biased central regions in massive early-type galaxies. The detection of an unprecedentedly large supermassive black hole in an atypical early-type galaxy, opens up new discussion on the formation of depleted cores and the most massive black holes in the local universe.

Dr. M. Powell

Title: Clustering of Hard X-ray-selected AGN

Abstract: The spatial clustering statistics of AGN can characterize the typical host dark matter halos, and therefore large-scale environments, of accreting supermassive black holes. However, biases from AGN selection techniques can muddle the interpretation of such studies. To untangle these biases, we analyze the clustering of X-ray-selected AGN as a function of various AGN and host galaxy properties to search for the main drivers of AGN clustering. For AGN in the local universe from the Swift/BAT AGN Spectroscopic survey, we find that AGN occupy dark matter halos consistently with inactive galaxies of the same stellar mass distribution. However, when breaking up the sample in bins of column density, we find that obscured AGN reside in denser environments than unobscured AGN, despite no

significant differences in their luminosity, redshift, stellar mass, or Eddington ratio distributions. I also present recent measurements of the clustering of luminous X-ray-selected quasars at z~2 using AGN from the Stripe 82X and XMM-XLL-North surveys. We measure typical host halo masses of ~10^13 Msun/h, consistent with previous measurements of moderate-luminosity X-ray AGN and significantly larger than those found for optical quasars of similar luminosities and redshifts. This suggests that the clustering differences between optical and X-ray AGN are dominated by host galaxy selection biases, and not due to a dependence on AGN luminosity.

Dr. G. Vergara
Title: Clustering of galaxies around z~4 quasars

Abstract: Luminous quasars at z~4 are the most strongly clustered population in the universe, which demands that they are tracers of the most massive dark matter halos at these epochs. This implies that high-redshift quasars should be associated with large overdensities of galaxies. However, previous studies have failed to find convincing evidence for these overdensities. Currently, about 30 individual quasar fields have been studied for this purpose at z>~4, and some of them show overdensity of galaxies, whereas others exhibit a similar number density of galaxies compared with blank fields (i.e fields without quasars). Here, I present the first measurement of the quasar-LBG and quasar-LAE cross-correlation function at z~4, based on the study of 23 quasar fields imaged by VLT/FORS. My results indicate that both LBGs and LAEs are clustered around quasars with a galaxy number density ~1.5 times higher than the expected in blank fields. We compare our results with the predictions from a deterministic bias model, whereby LAEs and quasars probe the same underlying dark matter overdensities, and we find that the quasar-LBG cross-correlation function is in well agreement with these predictions whereas the quasar-LAE cross-correlation function fall short of these expectations, which overpredicts the LAE overdensities by a factor of 2.1. We discussed possible reasons why the deterministic bias picture could break down for LAEs, including large-scale quenching or the presence of excess dust in the quasar environment, although it is puzzling that it appears to hold for LBGs. I will explain how multi-wavelength studies could help to clarify the nature of this puzzle.

Dr. C. Wethers

Title: Testing the Evolutionary Picture of LoBALs: Star Formation Rates and Environments.

Abstract: Tight correlations have long been observed between galaxies and the mass of their central black hole, leading to the idea that galaxies and quasars coevolve. Whilst this idea is now generally accepted, the mechanisms by which quasars influence their host remains poorly understood. Broad Absorption Line (BAL) quasars are a subclass of quasars showing evidence for energetic mass outflows and may therefore provide a unique insight into such quasar feedback mechanisms. The exact nature of BALs however is also disputed, with many studies suggesting an 'orientation' model in which BAL winds exist in most (if not all) quasars but are visible only along specific lines of sight. Although this scenario appears sufficient in explaining the high-ionisation class of BALs (HiBALs), an alternative evolutionary scenario may also be plausible in the case of low-ionisation BALs (LoBALs), whereby LoBALs represent a short-lived but key evolutionary phase in the lifetime of a quasar, following an active starburst. With FIR Herschel SPIRE observations and new targeted IR spectra from the Nordic Optical Telescope (NOT), I will explore the properties of a sample of LoBALs at z~2 - a peak epoch in both star formation and black hole accretion. In particular I shall look for evidence of enhanced star formation and differences in environments compared to other quasar populations, with the aim of testing the proposed evolutionary picture of LoBALs.

Dr. E. Koulouridis

Title: X-ray AGN in galaxy clusters

Abstract: There is compelling evidence that the presence of AGN is closely linked to the large-scale environment, and that galaxy mergers and interactions play an important role in AGN triggering and evolution. As the most massive self-gravitating entities of the universe, clusters are ideal laboratories to investigate the impact of dense environments on AGN demographics. Previous studies have shown that AGN in clusters are strongly affected by their environment, but in a complicated way. The AGN fraction was found to depend on the distance from the cluster centre, the mass of the cluster and the redshift. Interestingly, in contrast to the lack of AGN in the centres of massive clusters, a number of studies have found an excess of X-ray AGNs in the cluster outskirts, supporting the presence of an in- falling population triggered by galaxy mergers. In this talk I will focus on recent results from the XXL survey and from the five most massive and distant galaxy clusters in the Planck and South Pole Telescope (SPT) surveys. These results provide observational evidence of the physical mechanisms that drive AGN and galaxy evolution within clusters.

Mr. B. Davis

Title: Black Hole Mass Scaling Relations for Spiral Galaxies

Abstract: I will present the details of my recent study of all the known 48 supermassive black holes with directly measured dynamical masses in spiral galaxies. For this sample, I have measured their logarithmic spiral arm pitch angles and conducted extensive multicomponent decomposition analyses of their surface brightness profiles to determine accurate bulge, disk, and total stellar masses. Also, I explore relations with the central stellar velocity dispersion, disk rotational velocity, and estimates of the dark matter halo mass. I will report on the resulting black hole mass scaling relations and discuss the implications for the co-evolution of supermassive black holes and their host galaxies. Finally, I will identify intermediate-mass black holes in late-type galaxies of the Virgo Cluster as predicted by these scaling relations and corroborated by nuclear X-ray sources detected by Chandra.

Mr. C. Marsden

Title: Towards creating robust AGN mock catalogue

Abstract: Robust mock galaxy catalogues containing Active Galactic Nuclei (AGN) are scarce. At Southampton, our team is developing a new state of the art accretion model to solve this problem, through modelling the coevolution of Supermassive Black Holes and their host galaxies from the ground up. This model is uniquely built on the foundation of velocity dispersion and bias from clustering, in turn yielding information on black hole triggering. In this talk I will present our preliminary results from these models, and how this approach to leads to a robust pipeline for adding AGN to a galaxy mock.

Dr Zhu Chen
Title: Size and Structure Evolution of Massive Galaxies Over 0.5<z<2.5

Abstract: Galaxy size as a fundamental galaxy structure parameter provides important clues about the mass assembly history of galaxies and the relationship to their dark matter halos. The size-mass relation of star-forming galaxies and quiescent galaxies have been build up in local universe and at high redshift. Since we only can observe a snapshot of galaxies, the evolution of individual galaxies is not directly observable. The size evolution of the population of early type galaxies as a whole can be driven by the additional members coming from the late quenching massive, large galaxies (progenitor bias), this scenario can also explain the increasing average size of quiescent galaxies with decreasing redshift. In order to decrease the progenitor bias effect when study the size evolution of quiescent galaxies, tracking galaxies at constant number density is a more effective technique. The basic approach is to assume that the number density of galaxies when ordered by some physical property (e.g., stellar mass) does not evolve. This provides a simple way to link descendant and progenitor populations at different redshifts. In this work, we use the central 1 kpc stellar mass surface density (Sigma1) to rank order galaxies in all five CANDELS fields to select a high Sigma1 sample in redshift range 0.5<z<2.5. Since Sigma1 is more correlate with galaxy central properties, and less affected by galaxy environmental effects, it is a better physical property than galaxy stellar mass to link descendant and progenitor populations. Our result shows the size of massive quiescent galaxies at high redshift are about 2-3 times larger than low redshift quiescent galaxies, while the mass growth is around 0.15 dex from z=2.5 to 0.5, which indicates the size growth of the massive quiescent population is mainly due to minor merger scenario.

Mr Vijay Mahatma
Title: Spectral Ageing in powerful radio galaxies

Abstract: Relativistic radio jets create large-scale lobes -- the extragalactic footprints of accretion onto supermassive black holes, central to radio-loud active galaxies. In these dynamic and energetic structures, the phenomenon of spectral ageing occurs -- the progressive steepening of the radio spectrum in the lobes due to radiative losses. Recent advances in computing capabilities have enabled this physical process to become a tool that can be used to calculate the age of radio galaxies -- an important parameter used to determine their jet power (the time averaged kinetic feedback into the environment). In building the jet power function for all radio galaxies, accurate sources ages are required. Spectral ages, however, are almost always underestimated relative to the dynamical ages of radio galaxies. In this talk I will present a detailed investigation of spectral and dynamical ages of two powerful cluster-centre radio galaxies, using broad-band VLA data at multiple frequencies, and deep X-ray observations with Chandra and XMM-Newton of the shocked medium being driven by the central radio source. We find that the use of broad-band radio data can give a close agreement between spectral and dynamical ages, which is rarely found. These observational results are repeated when analytically modelling the radio sources and their X-ray environments. These findings will be key to building future tools to determine jet powers of all radio-loud AGN, which will be observed in the dawn of deep radio surveys such as the SKA, and will lead to information on the total power output of radio galaxies over all cosmic time.

Mr Akke Viitanen
Title:
Abstract: Clustering measurements provide valuable insights on how growth of nuclear black holes is related to their large-scale environments and the dark matter halos, which in turn sheds light on on the BH-galaxy co-evolution scenario. Recent multi-wavelength surveys such as COSMOS have made it possible to connect the properties of AGN and their host galaxies across cosmic time up to redshift z=4. Thus it is possible to study the environments of AGN in terms of host galaxy stellar mass, specific black hole accretion rate and star-formation rate, and whether the large-scale environments of AGN are different to a comparable non-active galaxy population. I will present the clustering measurements of X-ray AGN in XMM-COSMOS and Chandra COSMOS Legacy Survey by splitting the AGN population in terms of their host galaxy properties. We derive the typical mass of the dark matter halo for our AGN sample, as well as the Mstar-Mhalo relation, which we compare to normal, non-active galaxies.

Dr Stefano Ciprini
Title: The binary supermassive black hole conjecture for two jetted gamma-ray blazars

Abstract: The study of astrophysical accretion phenomenon and binary systems is undoubtedly useful to better understand the role of gravitation in producing high-energy, X-ray and gamma-ray, emission. In particular close gravitationally bound binaries of supermassive black holes (SMBHs) in some active galactic nuclei and blazars are expected to induce cyclical modulations in the observed flux. In the past years, two jetted gamma-ray blazars have been suggested to harbour binary SMBHs: i.e., OJ 287 and PG 1553+113. I will introduce these two peculiar blazars, and present recent achievements made possible thanks to 10-year continuous monitoring observations of their GeV gamma-ray emission by the Fermi Large Area Telescope. In addition data collected thanks to dedicated observations by the Swift, Kepler and Spitzer space telescopes will be also presented.

Dr. F. Nicastro
Title: The Universe's Missing Baryon Mass

Abstract: I will first review the baryon census in the local Universe and show that serious missing-mass problems are present at all scales. I will then present the possible solutions offered by hydro- dynamical simulations for the formation of structures, and show how theory reconciles these different-scale problems in the framework of a single missing-baryon problem. Finally, I will review the history of the hunt for the missing baryons over the past 20 years, and will present the most recent results both on the largest and smallest possible scales in the Universe. This will also show how important this search is in connecting the dots between galaxies and the IGM.

Dr. M. Hirschmann

Title: Co-evolution of galaxies & black holes: New insights from cosmological, hydrodynamic simulations

Abstract: In the traditional picture of co-evolving galaxies and BHs, gas inflows in galaxy mergers are thought to be the main trigger for AGN activity being closely linked to starbursts of the host galaxy. However, recent observations and advanced theoretical models seem to question the universality of this "simple" picture. I will discuss new insights into the cosmic evolution of galaxies and their central BHs out to z=4, by employing large-scale cosmological, hydrodynamic simulations. We find that: (i) mergers play an overall insignificant role for causing AGN activity in galaxies; (ii) AGN preferentially reside in massive, main sequence SF host galaxies; and (iii) solely for most luminous AGN, SFR is tightly correlated with AGN luminosity. Despite of the great success in matching many observational constraints, further comparisons with observations also reveal several deficiencies of the adopted models for BH growth and AGN feedback such as e.g. an under-estimation of active BHs at low redshifts. Future perspectives for further improvement of models for BH growth will be given.

Dr. D. Angles-Alcazar

Title: Cosmological hyper-refinement simulations of AGN fueling and feedback

Abstract: Modeling galactic nuclei fueling and feedback in a full cosmological context is a crucial step toward understanding the nature of black hole-galaxy co-evolution. Despite much recent progress, cosmological hydrodynamic simulations have been traditionally limited by resolution, interstellar medium physics, and the sub-grid treatment of black holes. In this talk, I will present new hyper- refinement simulations that for the first time resolve explicitly the transport of gas down to sub-pc scales in the nuclear regions of massive galaxies at z = 2 in a full cosmological setting. In these simulations, the net gas inflow rate toward the central black hole accounts for gravitational torques between the gas and stellar components, gas consumption by star formation, and a realistic multi- phase interstellar medium shaped by supernovae, stellar winds, and radiation form massive stars. I will then introduce a novel technique that for the first time allows us to simultaneously capture the interaction of fast accretion-driven winds with the multi-phase ISM at 10 pc scales and their impact on galactic and circumgalactic medium scales.

Prof: J. Kotilainen

Title: Black hole – galaxy co-evolution at high-z

Abstract: We present our on-going project to observe the host galaxies of quasars at z=2.5-4, which is the earliest epoch in cosmic history where we can currently estimate all the key ingredients involved in galaxy evolution (BH mass, BH growth rate, stellar host mass, SFR, gas mass,...). We have a large representative sample of 70 quasars from SDSS and COSMOS to probe a wide range in AGN luminosity and BH mass. So far, we have obtained SUBARU IRCS+AO imaging for 14 quasars with 0.1-0.35 arcsec seeing and have detected the host galaxies in multiple bands in several cases. We supplement the NIR imaging (stellar component) with on-going ALMA observations, probing gas masses and spatially resolved CO emission. Our goal is to study the morphological structure in stars and gas and the galaxy-BH co-evolution out to z~4. We finally discuss two case studies of high-z quasars from our survey. The first one is at z=3.8 with undetected host galaxy and faint CO emission, with a large stellar mass deficit compared to BH mass. The second is at z=3.2, with stellar component aligned with a rotating CO disk.

Mr. O. Catmabacak

Title: Effect of early environment and mergers on SMBH growth in FIRE simulations

Abstract: How supermassive black holes (SMBHs) grow and co-evolve with their host galaxies, especially at high redshift, remains to be fully understood. We use 37 cosmological zoom-in simulations from the MassiveFIRE suite, which is part of the Feedback in Realistic Environments (FIRE) project, to investigate how local environment and SMBHs mergers affect the SMBH-galaxy co-evolution. The growth of SMBHs is modeled in post-processing with different accretion models, different choices for SMBH placements, and both with and without accounting for SMBH merging. Placing SMBHs in the densest, most gas-rich environments of galaxies and accounting for SMBH merging results in scaling relations in line with observations at low redshift. However, early growth is severely reduced if SMBHs are positioned at the center-of-mass of a halo and if mergers are neglected. In agreement with previous work, SMBHs start to grow efficiently when their host galaxies reach a stellar mass threshold $\sim \mathrm{10^{10}} \mathrm{M_{\odot}}$, likely as a result of efficient stellar feedback lowering the gas reservoirs in the centers of lower mass galaxies. Overall, we find a transition from Eddington-like accretion rates to sub-Eddington rates when SMBHs reach $\sim \mathrm{10^{6}}$ solar masses. While our sample includes galaxies with dynamical masses similar to the hosts of the most luminous quasars beyond $z \sim 6$, none of our SMBHs reach masses near or above $\mathrm{10^{8}} \mathrm{M_{\odot}}$.

Dr. G. Khorunzhev

Title: X-ray Luminosity Function of Quasars at 3<z<5 from the XMM-Newton Serendipitous Survey. Search for optically bright quasars at z>5.5

Abstract: We present a measurement of the X-ray luminosity function of distant (3<z<5.1) unabsorbed quasars based on the sample of distant high-luminosity quasars (the 2-10 keV luminosity LX higher than 10^{45} erg/s) of Khorunzhev et al. (2016), compiled using the 3XMM-DR4 catalog of the XMM-Newton serendipitous survey and the Sloan Digital Sky Survey (SDSS). This sample consists of 101 sources. Most of them (90) have spectroscopic redshifts zspec>3. The remaining ones are quasar candidates with photometric redshift estimates zphot>3. The spectroscopic redshifts of eight sources have been measured with the AZT-33IK and BTA telescopes. Owing to the record sky coverage area (250 sq. deg at X-ray fluxes ~10^{−14} erg/s/cm2 in 0.5-2 keV), from which the sample was drawn, we have managed to obtain reliable estimates of the space density of distant X-ray quasars with luminosities LX>2x10^{45} erg/s for the first time. Their comoving space density remains constant as the redshift increases from z=3 to z=5 to within a factor of 2. The power-law slope of the X-ray luminosity function of high-redshift quasars in its bright end (above the break luminosity) has been reliably constrained for the first time. We compare the power-law slope value with previous results. We will also present initial results of our ongoing search for optically bright quasars at z>5.5.

Dr. D. Kocevski

Title: Elevated Black Hole Growth in the Progenitors of Compact Quiescent Galaxies at z=2

Abstract: I will present our findings that the black hole accretion rate at z~2 is strongly correlated to the central stellar mass density and star formation rate of the host galaxy. Using data from CANDELS, we find that compact star-forming galaxies (cSFGs) at z~2 host X-ray detected AGN at a rate three times greater than normal galaxies of similar mass and redshift. cSFGs are likely the direct progenitors of the compact "red nuggets" observed at z=2, which are the first population of passive galaxies to appear in large numbers in the early Universe. Our results are consistent with models in which cSFGs are formed through a dissipative contraction that triggers a compact starburst and concurrent growth of the central black hole. Our findings suggest that the first abundant population of quenched galaxies emerged directly following a phase of elevated supermassive black hole growth and further hints at a possible connection between AGN feedback and the rapid quenching of star formation in these galaxies. I will also discuss how the upcoming CEERS survey with JWST will allow us to extend this work to higher redshifts by enabling the study AGN host morphologies beyond z~3 for the first time.

Ms. C. Mazzucchelli
Title: The Environments of z~6 QSOs : a Multiwavelength Perspective

Abstract: Luminous quasars at high redshift (z>6, i.e. in the first Gyr of cosmic history), already hosting ~billion solar masses black holes, are formidable probes of the universe in the Epoch of Reionization. Theoretical models predict them to reside in biased regions, embedded in large galactic overdensities, as potential signposts of the first protoclusters. However, previous UV- based observations of such environments did not provide a clear picture. Conversely, several studies find overdense fields around radio-loud quasars and radio galaxies, over a large range of cosmic time.

Here, I will present our current, multi-wavelength study of the environment of quasars at high-z. I will first report our search for Lyman Alpha Emitters and Lyman Break Galaxies around both a radio-quiet and a radio-loud quasar at z~5.7, using sensitive narrow- and broad-band imaging with FORS2/VLT and LBC/LBT. I will compare our results with what observed in blank fields, and I will report evidence for an overdensity of galaxies around the radio-bright quasar. I will also show follow-up, deep HST/WFC3 and Spitzer/IRAC observations of gas-rich, extremely star forming galaxies in four overdense quasars fields, firstly discovered with ALMA. I will build their spectral energy distributions, and compare them with both observations of local galaxies and models. I will derive compelling constraints on the contribution of their unobscured star formation and their stellar masses, and I will place them in the context of starbursts/starforming galaxies in the early universe.

Dr. L. Bassini

Title: Black hole mass and cluster mass correlation in cosmological hydro-dynamical simulations

Abstract: The correlations between the properties of the brightest cluster galaxy (BCG) and the mass of its central super-massive black hole (SMBH) have been extensively studied from a theoretical and observational angle. More recently, relations connecting the SMBH mass and global properties of the hosting cluster, such as temperature and mass, were observed. We investigate the correlation between SMBH mass and cluster mass and temperature, their establishment and evolution. We compare their scatter to that of the classical $M_{BH}-M_{BCG}$ relation. Moreover, we study how gas accretion and BH-BH mergers contribute to SMBH growth across cosmic time. We employ 135 groups and clusters extracted from a set of 29 zoom-in cosmological hydro-dynamical simulations where the baryonic physics is treated with various sub-grid models, including feedback by active galactic nuclei. In our simulations we find that M_{BH} well correlates with M500 and T500, with the scatter around these relations compatible within 2σ with the scatter around $M_{BH}-M_{BCG}$ at $z=0$. The $M_{BH}-M500$ relation evolves with time, becoming shallower at lower redshift as a direct consequence of hierarchical structure formation. In our simulations, SMBHs mainly grow by gas accretion at redshift $z>2$. At redshift $z<1$ the main growth channel is instead the BH-BH merging. During this last process, substructures hosting BHs are disrupted in the merger process with the BCG and the unbound stars enrich the diffuse stellar component rather than contribute to increase BCG mass. From the results obtained in our simulations with simple sub-grid models we conclude that the scatter around the $M_{BH}-T500$ relation is comparable to the scatter around the $M_{BH}-M_{BCG}$ relation and that, given the observational difficulties related to the estimation of the BCG mass, clusters temperature and mass can be a useful proxy for the SMBHs mass, especially at high redshift.

Mr. V. Marian

Title: The connection between major mergers and high-accretion AGNs at z~2

Abstract: Research over the past decade has shown diminishing empirical evidence for major galaxy mergers being a dominating or even important mechanism for the growth of supermassive black holes in galaxies and the triggering of optically or X-ray selected active galactic nuclei (AGN).

For the first time we test whether such a connection exists at least in the most 'plausible' part of parameter space: the highest specific accretion rate broad-line AGNs at the peak epoch of black hole activity around z = 2. To that end we analyzed two samples – 21 AGN with L/Ledd > 0.7 and 92 stellar mass- and redshift-matched inactive galaxies – with respect to major merger signatures in HST images. We removed the AGN point sources in the active sample and joined the two samples before the individual galaxies are visually ranked according to distortion strength by 10 experts. The ensuing individual rankings were combined into a consensus sequence and from this we derived merger fractions for both samples.

With the merger fractions $f_{m,agn} = 0.24 \pm 0.09$ for the AGN host galaxy sample and $f_{m,ina} = 0.19 \pm 0.04$ for the inactive galaxies, we find no significant difference between both samples. These findings are consistent with previous studies for different AGN populations, and we conclude that even black hole growth at the highest specific accretion rates and at the peak of cosmic AGN activity is not predominantly caused by major mergers.

Ms. A. Efthymiadou

Title: The influence of galaxy mergers on the star formation history of luminous AGN

Abstract: We study the co-evolution of supermassive black holes and their host galaxies focusing on the connection between star formation and black hole growth. Galaxy mergers constitute a potential candidate for providing cold dense gas to the central region of a galaxy, triggering both circumnuclear star formation and AGN activity. We select luminous AGN (L_bol~10^45 erg/s, z ~ 0.3) involved in mergers, i.e. with neighbours at different distances, from SDSS DR7. For each object the full active galaxy spectrum is decomposed into the AGN spectrum and the host galaxy spectrum using 19 spectral components in Bayesian MCMC fitting. We then compare the stellar populations ages between AGN hosts and their neighbours as a function of projected separation using absorption and emission lines indicators. We witness younger stellar populations with decreasing separation for the case of neighbours, confirming the mergers-starburst connection, while the AGN host galaxies do not reveal a similar trend. The activity of the central AGN does not show to be directly driven by the merger as the AGN component does not show an evolution with separation. Our results also support the starburst-AGN activity connection.

Prof. L. Fan

Title: Multiwavelength view of hyperluminous dust-obscured quasars at cosmic noon

Abstract: The massive galaxies and their central supermassive black holes (SMBHs) co-evolution scenario proposes that a gas-rich major merger can trigger the central starburst and feeding the SMBH accretion, and then star formation has eventually been quenched by quasar feedback. In this evolutionary sequence, dust-obscured quasars may represent the critical transition phase between starburst and unobscured quasars. Using WISE All-Sky Survey data, a population of luminous dust-obscured quasars has been recently selected. We utilized the panchromatic emission of these hidden monsters to explore their physical properties, such as dust, gas, stars, morphology and environment etc. Especially, the new results of our ALMA observations will reveal the gas properties in the host galaxies of these obscured quasars. Our results are consistent with the prediction by the merger-driven evolutionary scenario.

Mr Alessandro Pecca
Title: Obscured AGN in the field of J1030+0524: the X-ray and optical/infrared perspective

Abstract: I will present the X-ray spectral analysis of a sample of obscured AGN candidates in the 17'x17' field surrounding the bright z = 6.31 QSO SDSS J1030+0524, observed for 500ks with Chandra ACIS-I. The sample objects are selected to have an hardness ratio HR > −0.1, suggestive of the presence of moderate to heavy obscuration (10^22 □< NH <□ 10^24 cm−2), and a range of net counts (i.e. background subtracted) from a few tens to hundreds, with a median of ∼ 80.
The main goal is to place constraints on the redshifts of the sources, using a multiwavelength approach. Firstly, the analysis has been carried out using X-ray spectroscopy, searching for strong features like the iron Kα 6.4 keV emission line and/or the 7.1 keV absorption edge, that is expected to be very deep in obscured objects. Because of the low photon statistics, the resulting X-ray redshift solutions have also been verified using state-of-the-art simulations. Then, using the large photometric coverage in optical/NIR/MIR bands (LBT, CFHT, CTIO and Spitzer data), independent solutions are calculated performing photometric redshifts.
The comparison between the X-ray and photometric methods can be an efficient tool to estimate redshifts of high-z obscured AGN, which are usually weak in optical/NIR, possibly making the spectroscopic identification challenging. The obtained redshifts are used to identify the physical properties of the sample, such as the intrinsic luminosity and the absorption column density, as well as the properties of the host galaxies in which the obscured AGN candidates reside.
Furthermore, based on an ongoing optical spectroscopic campaign at the LBT, I am confirming the goodness of this method, which will be useful for future X-ray mission like eRosita and Athena, but also in other deep fields like the CDF-S, where a fraction of X-ray sources (∼ 5%) are still not detected in other bands.

Ms Zohreh Ghaffari

Title: Evolution of galaxy overdensities around 3C radio galaxies and quasars at $1<z<2.5$

Abstract: A random sample of 22 high-redshift 3C sources at $1<z<2.5$ has been mapped with the Hubble Space Telescope (28 and 24.5 AB mag at 0.6 and 1.4 micron, resp.) and the Spitzer Space Telescope (22.4 AB mag at 3.6 and 4.5 micron). About half of the 3C radio sources show significant overdensities (>3sigma) within 30 arcsec (250 kpc) projected distance from the radio source compared to the surrounding galaxy densities measured in the 30-70 arcsec annulus. Compared to higher redshifts, at $z<1.4$ the overdensities are, on average, more pronounced and essentially caused by red elliptical galaxy templates. On the other hand, at $z>1.5$ we find increasing overdensities made up of blue star forming galaxies. The results clearly reveal the evolution of overdensities from being composed of mainly blue starforming galaxies at $z=2.5$ to mainly elliptical galaxies at $z=1$.

Ms Hora Mishra

Title: Active galactic nuclei fraction in X-ray selected clusters and fields from z=0-0.5: AGN activity dependence on environment and redshift

Abstract: Most galaxies in clusters have supermassive black holes at their center and a fraction of those black holes show strong activity. These active nuclei are an important probe of galactic evolution in clusters, intracluster medium, and galactic feedback. We have investigated AGN fraction in a sample of X-ray selected clusters from the ROSAT All-Sky Survey and their immediate surrounding field regions, from present day to z = 0.5. The mid-IR selected AGN fractions in clusters and field were found to be (2.90+-0.13)% and (6.54+-0.16)% respectively, which shows a higher fraction of AGNs in low density field environments. We also divided clusters into five redshift intervals to investigate the AGN fraction evolution with redshift and found a steady increase in AGN fraction with redshift. These results agree with previous studies of environmental dependence of AGN fraction which indicate that luminous AGNs are anticorrelated with density at low redshifts which can be interpreted as being a result of reduced merger efficiency in present day clusters. We interpret increase in AGN fraction with redshift to be due to higher availability of cold gas and more mergers in dense, gas-rich cluster environments.

Ms Maria Babakhanyan Stone
Title: Observational studies of low-redshift AGN environments and high-redshift AGN-host co-evolution

Abstract: As part of my Astronomy PhD program at the University of Turku, I work on two research projects. The first project is to extend the assessment of the correlation between black hole and host galaxy bulge masses to a previously unexplored redshift interval of $1<z<2$ for low mass objects based on deep near-infrared imaging data from HAWK-I, VLT, ESO. The second aims to study how nuclear activity may be correlated with the recent star formation in low-redshift Stripe82 QSO-hosts and their companion galaxies as compared to normal galaxies, where we utilize optical spectroscopic data from Nordic Optical Telescope and Gran Telescopio Canarias.

Prof Daniel Whalen
Title: Finding the First Quasars with JWST, Euclid and WFIRST
Abstract: Although more than 160 quasars have now been discovered at z > 6, little is known for certain of their origins or early evolution because observations to date have been limited to z = 7.5. This picture will soon change with the advent of Euclid and WFIRST, whose wide fields and high sensitivities out to nearly 2 um could allow them to detect these rare black holes at much earlier times. I will present synthetic NIR AB magnitudes at z = 6 - 20 for every stage of primordial quasar evolution: the birth of a supermassive Pop III star (SMS), its collapse to a direct-collapse black hole (DCBH), and its subsequent growth in cold accretion flows to ~ 10^9 solar masses by z ~ 7. We find that JWST could detect a SMS and DCBH at z ~ 20 and that Euclid and WFIRST could detect quasars at much earlier stages of their evolution, at z ~ 12 and 15, respectively. Euclid and WFIRST may also detect the seeds of these quasars at z ~ 15 because only modest gravitational lensing would be required to boost their NIR flux above the detection limits of either mission.

Satish Sonkamble
Title: Supermassive black holes in the peculiar galaxy cluster Abell 2626
Abstract: We report a systematic study of two nuclear sources using Chandra. They exhibited dramatic changes over the span of ten years. The NE source that emitted mostly in the soft band in the past disappeared in the recent observations. Instead, an excess emission was seen at 2.2 kpc on its west and required an unrealistic line of sight velocity of ~675*c if is due to its movement. The count rate analysis and spectral analysis exhibited a change in the state of the SW source from a soft state to the hard due to the change in the mass accretion rate. No such spectral change was noticed for the NE source.

Prof. Mariana Lazarova
Title: Are LoBAL QSOs short-lived, sporadic episodes of AGN activity?

Abstract: The extreme outflows characteristic of broad absorption line (BAL) QSOs suggest that, in those systems, we might be observing AGN-driven kinetic feedback capable of affecting the growth of the host galaxy. Motivated by anecdotal studies associating low-ionization BAL QSOs (LoBALs) at low redshifts with major mergers and ultra-luminous infrared galaxies, we investigate that possible connection by looking at their host galaxy morphologies and SEDs. Their infrared luminosities and star formation rates do not suggest they are different from typical type-1 QSOs. We present results from a morphological study of a complete, volume-limited sample of optically-selected LoBALs at low redshift observed with the HST/WFC3. Detailed GALFIT modeling of these type-1 QSOs indicates that the majority (3/4) of the host galaxies have prominent early-type morphology. Signs of recent or ongoing tidal interaction, apparent in 2/3 of the objects, represent various stages of the merger process, from double nuclei to settled morphologies with extended low surface-brightness tidal tails. If the rarity of BALs is due to the short duration of the outflow phase, then these results might be consistent with theoretical predictions of short-lived, sporadic episodes of AGN activity during various stages of the merger process.

Prof. C. Harrison
Title: Relating Supermassive Black Hole Growth with Galaxy Evolution

Abstract: Over the last two decades there has been a huge amount of observational and theoretical work the aims to establish the connection between the growth of supermassive black holes and the growth of their host galaxies. Various pieces of evidence suggest these two processes are intimately linked; for example, (1) the tight relationships between black hole masses and host galaxy properties; (2) the similar cosmic evolution of black hole growth and star formation density; (3) cosmological models cannot reproduce realistic galaxy populations unless the energy released by growing supermassive black holes regulates star formation in the host galaxies. I will aim to provide a broad introduction to the talks on this topic coming throughout the day. Largely from an observational perspective I will summarise: (a) the current state of work that aims to quantify and interpret the relationships between star formation rates and black hole growth rates; (b) the various approaches to establish how growing black holes inject energy into their host galaxies and the impact of these processes on galaxy evolution.

Ms. R. Carraro

Title: Co-evolution of black hole accretion and star formation in galaxies

Abstract: We investigate the co-evolution between the black hole accretion and star formation in galaxies in different life phases: main sequence star-forming galaxies, quiescent and starburst galaxies.

We take advantage of X-ray data from the Chandra COSMOS-Legacy survey which allows us to exploit the unique depth/area combination of the COSMOS field in its entirety in combination with the COSMOS2015 catalog, comprising UVista Ultra-deep observations in COSMOS. Such large datasets allow us to perform an X-ray stacking analysis and combine it with detected sources, in a broad redshift interval ($0.1<z<3.5$) with unprecedented statistics for normal star-forming, quiescent and starburst galaxies.

We focus on the evolution of the average SFR-stellar mass (M*) relation and compare it with the BHAR-M* relation. We find that the ratio between BHAR and SFR doesn't vary significantly with redshift, although at almost any epoch it depends on stellar mass and degree of star formation of the galaxy. We find hints of downsizing for both M* and black hole mass (M_BH) in galaxies in all evolutionary phases.

Our results support the idea that the same physical processes feed and sustain both star formation and black hole accretion in star-forming galaxies while the starburst phase plays a lesser role in driving the growth of the black hole, especially at high redshift. Quiescent galaxies appear to be more efficient at growing the black hole than at forming stars. Our integrated estimates of the M*-M_BH relation at low redshifts is in nice agreement with independent determinations of the local M*-M_BH relation retrieved from AGN samples and Monte Carlo simulations.

Ms. W. Yan

Title: Chandra Observations of the Extended Fe Kalpha Line in galaxies with High SFR

Abstract: As a distinguishing AGN characteristic, fluorescent Fe Kalpha (iron) line emission is routinely interpreted to originate from obscuring materials around the SMBH in a few pc scale. Therefore the iron line can be used as an independent tracer to AGN nuclei- obscuration. However, recent Chandra studies indicate the existence of extended iron line emission extending to kpc scale in the host galaxy. The connection between Fe line emission and large-scale gas can be resolved directly only in nearby sources, but could be inferred in more distant AGN by a connection between line emission and star-forming gas and dust. Here we present the results from stacking analysis and X-ray spectra fitting performed on Chandra Deep Field South 7Ms catalog (1008 AGNs) and the lastest Chandra Deep Wide Field Survey (~6000 AGNs). From the finest and deepest spectra, we found that the strength of the iron line EW(Fe) increases by a factor of 2 with higher star- forming rate in the host galaxies. The other possible contributors to this relation have been excluded (e.g. stellar mass, X-ray luminosity). This suggests AGN reflection over large scales in their host galaxies may be widespread.

Dr. R. Weinberger

Title: Feedback from active galactic nuclei in galaxy and galaxy cluster evolution - lessons learned from simulations

Abstract: Supermassive black holes have, over the past decades, proven to be a key aspect of cosmological structure formation, in particular in the formation of massive galaxies and galaxy clusters.

Feedback from luminous AGN and/or black hole driven radio jets is frequently invoked in numerical simulation of galaxy formation in order to reproduce the observed stellar and gas properties, making this aspect one of the key uncertainties in galaxy formation research. In this talk, I will show what we can learn from simulations of galaxies and galaxy clusters about the nature of AGN feedback and the central engine. I will start with a statistical view, using results from the IllustrisTNG set of simulations, and present lessons learned about the connection between luminous AGN, quenching and galaxy mergers.

I will then focus on more idealized simulations of black hole driven jets interacting with a hydrostatic atmosphere and their impact on the overall gas properties and how we can learn from X-ray, SZ and radio mock observations about the nature of AGN jets and their effects on galaxy cluster centers.

Ms. K. Hall

Title: Probing quasar feedback with the Sunyaev-Zel'dovich Effect

Abstract: Accreting black holes likely impact the evolution of massive galaxies in a crucial way via quasar- driven winds and other forms of feedback. One firm prediction of models of quasar-driven winds is that they are likely to leave behind an extremely hot bubble of post-shock gas. The hot plasma is the most difficult to observe as any emission associated with it would be weak, yet investigating this component is crucial for characterizing quasar winds and quantifying their impact on the surrounding medium. Our group probes this component via the Sunyaev-Zel'dovich (SZ) effect in the millimeter regime of quasar spectral energy distributions. In this presentation, I will present the current status of our efforts to detect hot quasar winds via the SZ effect in the average spectral energy distributions of >100,000 optically selected, radio quiet quasars at $0.3<z<3.5$ using data from the Atacama Cosmology Telescope, the Herschel Space Observatory, and the Very Large Array.

Prof. T. Turner

Title: An occultation event in NGC 3227

Abstract: The environment of the black hole is shrouded in reprocessing gas. X-ray data inform us about the reprocessor over a wide radial range. I present an X-ray spectral hardening event in the Seyfert galaxy, NGC 3227 that is accompanied by a change in the depth of an unresolved transition array (UTA), whose time-dependent behavior is resolved using RGS data. This UTA fingerprint allows us to identify this as an occultation event, where a cloud of column density NH˜ 5E22 /cm^2 passes into the line-of-sight over ~ a day. The occulting gas is likely associated with clouds in the inner BLR. Results such as this are essential for isolating the reprocessing gas and thus for understanding the material flow that links the active nucleus with the host galaxy.

Dr. E. Nardini

Title: Towards an informed quest of quasar accretion disc winds

Abstract: Galaxy-wide outflows are ubiquitous in the most luminous AGN, and their power source must be ultimately linked to the growth of the central SMBH. Very little is known, however, on how the kinetic power of accretion disc winds is transferred from sub-pc to kpc scales. A major impediment to a comprehensive picture of AGN feedback is that so far most detections of X-ray winds have been achieved through either blind searches or follow-ups of peculiar objects. In order to overcome this element of 'fortuity', it is mandatory to understand whether the 'X-ray blow-out' evolutionary phase leaves any distinctive signatures imprinted on the broadband spectral energy distribution of AGN. This effort is compelling in the absence of high-quality X-ray spectra, like for sources around the peak of cosmic accretion history. I will discuss the promising selection method that led to the successful detection of an ultra-fast disc wind in the quasar Ton 28, and its possible implications on the physics behind X-ray weak quasars and the Eigenvector 1 formalism.

Mr. Y. Guo

Title: Extended metal line emissions around quasars at z~3 and implications for galaxy feedback

Abstract: Deep MUSE observations have detected extended Lyα emission haloes surrounding tens of QSOs at redshift 2 to 5. Generally these Lyα haloes are interpreted as tracers of pristine or near-pristine gas inflowing from IGM. In our work, we performed a detailed analysis on a large sample of quasars at z~3 based on MUSE data. We found clear evidence of extended emission of metal lines (NV1240, CIV1549, HeII1640 and CIII]1909) for about 15% of the sample. The stacking of all Lyα haloes also show clear evidence of metal lines. Based on the line ratios between CIV, HeII and CIII], the metallicities of these regions is of the order of 0.1-0.5 solar metallicity. Morphologically, the metal line emission is generally more compact than Lyα, both for individual objects and for stacked results. The stacked results show the CGM of these powerful quasars is composed of two components, a metal enriched one, within a few tens kpc from the quasar (whose enrichment is likely due to quasar-driven outflows), and a near-pristine one, on larger scales, likely associated with gas accreting from the intergalactic medium. These results suggest that a significant fraction of Lyα haloes are not tracing metal poor gas inflow, but CGM that has possibly been enriched by quasar driven outflows, which are thought to regulate or even suppress star formation in massive galaxies

Dr. R. Alexandroff

Title: Multi-wavelength studies of feedback processes in extremely red quasars

Abstract: While in the nearby universe the unification model seems firmly established, we are now seeing hints that at the peak of quasar activity and black hole growth (z~2.5) both obscured and reddened quasars may represent not just a specific quasar orientation but instead a unique stage of quasar evolution. Our group has developed several observational techniques to identify obscured and highly reddened quasars at z~2.5 using a combination of the SDSS spectroscopy and WISE photometry. Our sample contains objects with some of the most extreme ionized gas velocities observed (> 5000 km/s), indicating wind speeds too large to be contained by the galaxy potential. I will present both our sample selection and results from multi-wavelength follow-up of this sample using near-infrared spectroscopy, Keck spectropolarimentry and the VLA to test the AGN unification model and search for evidence of galaxy-wide quasar winds. High levels of polarized light (reaching ~20% of the total continuum emission in some cases) and changes in the polarization fraction and position angle across emission lines may argue for the presence of dusty outflows in our objects. This is supported by evidence from analysis in the radio that presents a correlation between the observed outflow speeds in ionized gas (as measured by [OIII]) and the radio luminosity—arguing for a wind origin for the radio emission in these objects as well. The most extreme of these objects may thus represent the “blowout phase” of AGN evolution that proceeds or accompanies the cessation of star formation in the host galaxy due to the effects of radiatively-driven quasar driven winds.

Dr. M. Bischetti

Title: The gentle monster PDS456 seen by ALMA: the galaxy-scale molecular outflow and its implication for AGN feedback

Abstract: We present the first ALMA observation of the nearby QSO PDS456 (z=0.185), mapping with unprecedented resolution (~700 pc) the molecular gas in the host-galaxy of a hyper-luminous QSO. With a bolometric luminosity LBol~10^47 erg/s, it can be regarded as the local analogue of the QSOs shining at z~2, i.e. the peak epoch of QSO luminosity density.

We report on the discovery of a molecular outflow in PDS456, which also shows the most powerful, persistent, X-ray ultra-fast (0.25c) wind discovered so far. The exquisite ALMA resolution allows us to map this outflow in great detail, revealing a bright compact (R<1.2 kpc) outflow component plus several extended (R~1.3-5 kpc) clumps, characterized by blue-shifted bulk velocities up to -1000 km/s.

For the first time, we get new insights on how multi-phase AGN-driven outflows expand outwards in the high-luminosity regime, finding that (i) the molecular gas may represent a minority fraction of the total outflowing gas mass, and (ii) the outflow in PDS456 can be explained as direct radiation- pressure on the ISM clouds or, alternatively, as an energy-conserving expansion with poor- coupling with the ISM.

Dr. R. Gilli

Title: Galaxy formation promoted by large scale AGN feedback in a protocluster at z=1.69

Abstract: High-z protoclusters are ideal laboratories to investigate the interplay of AGN feedback, ICM heating and star formation at the peak formation epoch of galaxy clusters. Based on the combination of deep VLT/MUSE, LBT/LUCI and VLA data, we recently discovered a galaxy protocluster around an FRII radio-galaxy at z=1.69, which is mostly populated by blue, star forming galaxies. The system, which extends for at least 1 Mpc and is still likely far from virialization, has been further observed by deep HST, ALMA, Chandra and JVLA data. Our 500ks Chandra observation, the deepest to date for a protocluster, reveals significant diffuse X-ray emission, the bulk of which coincides with the Eastern lobe of the radio galaxy. We will discuss the physical origin of this emission, and conclude that the most plausible explanation is a bubble of hot gas (T>5 keV) inflated by the FRII jet. Intriguingly, at least four star forming galaxies in the protocluster are distributed in an arc-like shape at the boundary of the hot gas bubble and also lie within radial separations that are consistent with the bubble size (<400 kpc). We propose that star formation in these galaxies is promoted by the compression of cold gas by the expanding bubble. That is, we are seeing positive AGN feedback on hundreds of kpc scales. The comparison of the galaxies' stellar ages with the FRII lifetime and the bubble expansion velocity supports this interpretation.

Dr. F. Duras

Title: Expanding our knowledge of the AGN/galaxy coevolution through the widest dynamical range ever

Abstract: The existence of a long-lasting link between the central black hole mass and various physical properties of their host spheroids is now a matter of fact. Studying the correlations between the two at different ages is then the best way to rebuild their cosmic evolution. Within this scenario, we have built up two complementary AGN samples able to probe the accreting phases at both a) very high luminosity (>10^48 erg/s) and BH masses (10^9-10 Msol), i.e. the WISSH Sample, and b) very low luminosities (~10^43 erg/s) and BH masses (~10^5 Msol), i.e. studying sources extracted from the SWIFT/BAT catalog. Thanks to a wide (UV-to-FIR) multi-wavelength photometric data-set and using an accurate and dedicated SED-fitting procedure, we are able to derive the main physical properties of both the nuclear engine and the host galaxy of these sources, i.e. bolometric luminosities, star formation rates and stellar masses. I will show the accreting and star formation properties of the most massive black holes compared to the least massive ones, constraining the BH-galaxy scaling relation over three orders of magnitudes in mass and following its evolution from z~3 to z~0. I will show that while the more massive galaxies populate the typical region of the already observed MBH-Mstar relation, the less massive ones are still on their way to reach the MBH-Mstar locus, especially obscured AGN which seem to host less massive BHs compared to unobscured ones, given the same stellar mass. I will also present a new hard X-ray bolometric correction, spanning about seven orders of luminosity, thus allowing to derive more accurate predictions on the coupled history of the AGN and their host galaxies.
I will finally review my results by discussing the promising possibility of combining the SED-fitting procedure with the image decomposition: using the information from the images as a SED constraint, this should indeed help to break some degeneracies which are typical of a pure multi-wavelength SED-fitting approach.

Mr Branislav Avramov
Title: Dynamical Interaction and Energy Exchange of Stars with a Massive Black Hole Binary

Abstract: We use large-scale, high-precision N-body simulations to study the interaction and subsequent ejection of stars by a massive black hole binary (BHB) within a dense, triaxial galaxy merger remnant. The simulations used are highly efficient, fully GPU-parallelized codes which include Post-Newtonian corrections (up to order 3.5) to the BHB equations of motion, in order to account for gravitational wave emission. It has already been established in previous work that stars on centrophilic orbits in a triaxial potential can provide efficient loss cone refilling, in such a way that the BHB maintains a constant hardening rate, instead of stalling. We focus on analyzing the properties and statistics of these stars, including their energy and orbital element changes, as well as phase space distributions. We present the results of both large-scale simulations (with ~6 million particles), as well as smaller 3-body scattering experiments.

Dr Ivan Katkov
Title: Optical and radio view on the two AGN-driven outflow galaxies

Abstract: In the project we are investigating the generation of large scale outflows in galaxies. We are combining optical integral-field spectroscopy data from the MaNGA survey with, sensitive, high-resolution (compatible with optical data ~1'') radio (Jansky Very Large Array; JVLA) observations for sample of 30 galaxies with high-velocity components in the [OIII] emission line, which includes AGN, starbursts and composite sources. In this talk, we will present a case study of two galaxies where AGN are thought to drive the outflow. Despite a common origin, we find a dichotomy in the AGN behavior: the galaxy with a more luminous AGN powers a weaker outflow with no corresponding radio emission, while the galaxy with a weaker AGN powers a more powerful outflow coincident with a radio jet. Furthermore, analysis of the optical morphology of both galaxies suggest both have recently interacted with a neighbor, possibly triggering their AGN activity.

Ms Karla Alejandra Cutiva
Title: A possible correlation between the BLR and star formation rate in AGNs

Abstract: In this work we performed the analysis of 450 galaxies of which 15 were worked and the size of the BLR in the continuous, optical, UV and X-rays during the star formation rate (SFR) was determined with the indicator of PAHs in 11.3 μm, where the correlation between the size of the BLR and the SFR has been found, for the reason of the correlation of the direct relationship between the variables involved and finally a first approximation is confirmed, which for the older the regions of the broad lines of the active nuclei, carry out a greater activity of star formation in the circumnuclear regions of the AGNs.

Ms Ishika Palit

Title: Effects of adiabatic index on the sonic surface and time variability of low angular momentum accretion flows

Abstract: We study the role of adiabatic index in determining the critical points in the transonic low angular momentum accretion flow onto a black hole. We present the general relativistic 2D hydrodynamic simulations of axisymmetric, inviscid accretion flows in a fixed Kerr black hole gravitational field. A relativistic fluid where its bulk velocity is comparable to the speed of light, flowing in the accretion disk very close to the horizon can be described by an adiabatic index of $4/3 < \gamma < 5/3$. The time dependent evolution of the shock position and respective effects on mass accretion rate and oscillation frequency with varying adiabatic index is discussed in the context of the observed microquasars.

Prof. R. Schneider
Title: To grow or not grow: constraints on early black hole formation
Abstract: The first SMBHs represent some of the most extreme astrophysical objects that we currently know at $z > 6$. Their observed properties allow to constrain possible evolutionary models. Here we present some recent results on the nature of their black hole seeds and on their mass growth rate.

Dr. M. Bourne

Title: AGN jet feedback in realistic cluster environments

Abstract: Feedback in the form of powerful jets plays an important role in galaxy cluster evolution, where the large lobes of relativistic plasma they inflate are critical in regulating the heating and cooling of the intracluster medium (ICM). However, the modus operandi of communicating the mechanical energy of the jets isotropically to the ICM remains an open question. Given the large dynamic range in the processes governing AGN feedback and its interaction with the ICM, attempting to simulate all of the relevant scales is a formidable task. I will discuss jet feedback simulations using the moving- mesh code AREPO.The method relies upon a super-Lagrangian refinement technique that provides vastly improved resolution near the SMBH while allowing courser resolution on larger scales. The technique means we can launch jets on relatively small scales and capture their propagation and evolution to large distances(∼100 kpc). I will present results from our most recent works in which we investigate jet evolution in realistic cluster environments. Using our novel method we launch very high-resolution jets into fully cosmologically evolved zoom simulations of galaxy clusters at both high- and low-redshifts, for a range of jet powers. I will discuss how and where the feedback energy is deposited in the ICM, turbulence driving (or lack thereof), as well as the role ICM weather has on distributing the energy. Additionally I will present mock X-ray observations in order to compare with real systems, including comparisons to Hitomi observations of the Perseus cluster.

Dr. E. Choi

Title: Metal in winds: the chemical enrichment by AGN-driven galactic outflows

Abstract: Metals in the hot halos of elliptical galaxies encode the history of star formation as well as the feedback processes that eject metals from the galaxies. Observations suggest that massive elliptical galaxies to have extremely low metal abundance within ISM, but at the same time to have extended metal distribution in gas halos. Meanwhile, the majority of the current simulations underproduce the amount of metal-enriched gas at large distance compared to observations and tend to produce galaxies with metal excesses in their centers and deficits in the outskirts. However, none of these studies include mechanical AGN feedback which may play an important role in driving winds and enriching gas halos at large distance. To elucidate how the chemical enrichment of the hot halos of elliptical galaxies change by AGN feedback, we ran a suite of hydrodynamical simulations incorporating a new treatment of AGN feedback which is implemented in a fully self-consistent way, launching high-velocity mass outflow. We will show that our prescription for AGN feedback is capable of enriching halo gas ‘inside-out’ by spreading centrally enriched metals to the outskirts of galaxies, into the halo and beyond. In addition, AGN feedback effectively enriches the halos ‘outside-in’, as winds propagate further from galaxies at earlier epochs of high AGN activity and then ejected metals recollect into the halos at later times.

Dr. A. Ferre-Mateu

Title: Do massive relic galaxies challenge the SMBH-galaxy coevolution?

Abstract: it has been long assumed that SMBHs form and evolve hand in hand with their galaxy host. However, a sample of nearby massive compact galaxies, fossil relics of the high-z massive population, is telling us a different history (Ferre-Mateu et al. 2015, 2017a). These local red nuggets, massive compact galaxies without merging accretion since z~2, seem to have a set of very thrilling properties. One of them is that they all host seemingly ubermassive SMBHs. This makes them extreme outliers in the SMBH-galaxy local scaling relations, challenging the assumed universal co-evolution. In this talk, I will show that this is due to the uncommon evolutionary path followed by these relic galaxies, whereas the SMBHs grow in an expected way. Finally, I will show that there is a strong dependence with galaxy mass, which changes the nature of such deviations. The relic scenario prevails for massive galaxies, but as we go to less massive ones, stripping of the galaxy mass becomes the relevant process that places them outside the scaling relations.

Dr. A. Fluetsch

Title: Ionised gas outflow in local ULIRGs with MUSE: Outflows and Positive Feedback

Abstract: Galactic winds are invoked in simulations of galaxy evolution to shut down star formation and therefore explain several observed properties, such as the lack of over-massive galaxies or the correlation between the supermassive black hole and its host galaxy. Observational evidence of outflows has been amassed in several different phases, yet the detailed mechanism of launching these winds and the connection between different phases is poorly understood. More recently, there have also been the detections of positive feedback, where feedback by an AGN or starburst can trigger star formation both in the disc through compression by outflows as well as within the outflowing gas.

We study the detailed kinematics of the ionised gas phase using Multi Unit Spectroscopic Explorer (MUSE) in a sample of 20 local (ultra)-luminous infrared galaxies ((U)LIRGs). These objects exhibit powerful outflows and mimic the behaviour at high-z where we expect outflows to play an even more important role. With this study, we aim to achieve two goals. First, we show a detailed characterisation the ionised outflows using the excellent spatial resolution of MUSE and compare them to our previous study on molecular outflow with the Atacama Large Millimetre Array (ALMA). This multi-phase approach allows us to probe different spatial scales and to obtain a more detailed and more complete picture of the mechanism driving outflows.

Second, we investigate the evidence for “positive feedback”, where we directly present diagnostics showing stars being formed within the outflowing gas. To do so, we will present a detailed analysis of these 20 ULIRGs including information on outflow energetics and morphology, BPT diagrams, electron density plots as well as further evidence for positive feedback.

Dr. V. Bennert
Title:

Abstract: The close correlations between black holes (BHs) and their host-galaxies is suggestive of their co- evolution. From a unique sample of ~100 local type-1 AGNs spanning a wide range of BH masses (MBH), morphologies, and stellar masses, we build a robust baseline of the MBH scaling relations, combining spatially-resolved Keck spectroscopy with HST/WFC3 and Gemini/NIRI imaging. We establish the fundamental MBH relationship and determine whether the scaling relations are universal or depend on other parameters such as (minor) mergers, (pseudo) bulges, and/or bars. This identifies the driving force behind the relations, hierarchical assembly vs. AGN feedback. Using VLT/MUSE and Keck/KCWI spatially-resolved kinematics of reverberation-mapped AGNs, we determine the slope of the MBH-sigma relation, its intercept and scatter, constrain the average f factor, and identify dependencies of the relation on luminosity, Eddington ratio and host-galaxy morphology. This builds the crucial low-z anchor for the determination of MBH in AGNs throughout the Universe.

Mr. L. Grimmett

Title: Revealing the differences in the SMBH accretion rate distributions of staburst and non starburst galaxies.

Abstract: After accounting for AGN variability, the positive correlation observed between average X-ray luminosity (a proxy supermassive black hole growth rate) and far-infrared luminosity (a proxy for star formation) supports the existence of a link between galaxy and black hole growth. However, averages, like all summary statistics, do not provide a full description of the underlying population. In order to understand the fine detail of the underlying relationship, we instead consider the full distributions. To this extent, we analysed the X-ray luminosity distribution of ~27000 galaxies and investigated whether those sources with the most extreme star forming properties (i.e., far-infrared-classified starbursts) have a systematically different distribution of X-ray luminosities compared to non-starbursts. Indeed, we find that starbursts have a consistently larger fraction of powerful AGN than non-starbursts. In this talk, I will also highlight future statistical advancements capable of eleciting how distributions evolve continuously with redshift, and do so while also taking all forms of uncertainty (on, e.g., AGN luminosity, stellar-mass, SFR, photo-z) into account.

Dr. A. Bongiorno

Title: The role of AGN activity in the building up of the BCG of the most massive galaxy cluster at z=1.6

Abstract: XDCP J0044-00 is one of the most massive galaxy cluster at z ~ 1.6 showing an unrelaxed dynamical configuration, for which a wealth of multi-wavelength photometric and spectroscopic data have been collected during the last years. I will report on the properties of the cluster members in the very central region (~70kpc x 70kpc) based on deep HST photometry and SINFONI and KMOS IFU spectroscopy, together with Chandra X-ray and JVLA radio data.

In the core of the cluster, we have identified two groups of galaxies, seven of them confirmed to be cluster members, with signature of ongoing merging. These galaxies show perturbed morphologies and, two of them, i.e. located at the center of each group, have been found to be highly accreting AGN (lambda~0.4-0.6) exhibiting broad Halpha line. One of them is also detected in X-ray, while the other one and its companions are spatially related to radio emission.

The discovery of two AGN very close to each other (projected distance ~ 35 kpc) and associated to an overdense and highly star-forming region at z~1.6, suggest that we might be observing the poorly-explored BCG assembly event and probing an extreme structure formation process in dense environment at lookback-time of 9.5 Gyr. According to this picture, in fact mergers would trigger both star formation and nuclear activity and the subsequent possible AGN feedback would be responsible for quenching star formation, thus leaving a red and dead galaxy, as the BCGs observed in the local Universe.

Dr. C. Feruglio

Title: AGN feeding & feedback in 3D

Abstract: Today's ESO's flagship facilities ALMA and MUSE@VLT allow high-fidelity 3D mapping of the cold molecular and warm ionised interstellar medium of nearby AGN host galaxies. I will show results from our recent ALMA survey of ~20 hard X-ray selected nearby AGN host galaxies, complemented with MUSE and Chandra archival data, which probe similar physical scales down to 10s parsecs around the nuclei.

I will illustrate the emblematic case of the nearby Compton-thick AGN ESO428-G14, for which our kinemetry analysis of ALMA and MUSE maps allow us to reconstruct the 3D distribution of the multi-phase ISM, including nuclear inflows onto the SMBH and galactic outflows, thus probing the complex feeding & feedback cycle in this AGN. Matching ALMA with Chandra sensitive observations allow us to put constraints on the nature and spatial distribution of the nuclear X-ray scattering material of this Compton thick AGN.

I will finally discuss our findings in the framework of AGN-host galaxy scaling relations.

Dr. E. Bernhard

Title: The distribution of AGN host SFR: more powerful AGNs typically reside in more MS- like star-forming galaxies.

Abstract: The connection between SMBHs and their host galaxies is now a well accepted paradigm, yet the exact nature of such connection is still heavily debated. Some evidence suggests that the way SMBHs grow via accretion (observed as AGNs) is somehow related to the way galaxies grow via star formation. However, the lack of a relationship between average AGN luminosity and average SFR has undoubtedly challenged this hypothesis. One of the main limitations in such results is that the average SFR is sensitive to the presence of a few bright outliers and might not represent the typical SFR of the full population. To overcome this, we instead measure the full distribution of host SFRs, from which we infer the "typical" SFR (i.e. using the mode of the distribution). To do this, we use a sample of 541 X-ray selected AGNs at z~1 that we separate into two bins of X-ray luminosity (above and below log(Lx/erg/s) = 43.3) and for which we measure host SFRs or upper limits using FIR data. We then normalise our host SFRs to that of the MS (SFRms), and infer the Rms = SFR/ SFRms distributions of our samples. Our main results suggest that galaxies hosting more powerful X-ray AGNs display a narrower Rms distribution which appears to be more comparable to that of typical MS star-forming galaxies, in contrast to their lower Lx counterparts. Despite this, the mean SFRs (as opposed to Rms) measured from these distributions are consistent with the previously observed flat relationship between SFR and Lx. Our results suggest that the typical star-forming properties of AGN hosts change with Lx, and that more powerful AGNs typically reside in more MS- like star-forming galaxies compared to lower Lx AGNs.

Dr. M. Ginolfi
Title: Exploring AGN-feedback on circumgalactic scales with MUSE.

Abstract: Recent observations taken at the VLT-MUSE have revealed ubiquitous Lya nebulae around bright QSOs at z~3-4, extending up to 300 kpc. Such extended Lya emission is mainly produced through circumgalactic gas "fluorescence" powered by the copious AGN-triggered UV radiation. Thanks to its Integral Field Unit (IFU), MUSE can provide information on the 3D-morphology and the kinematic of the cold gas distribution around bright QSOs; thus, these observations are precious for studying the interplay between AGN host galaxies and their surrounding environment. After briefly reviewing previous and current research on this topic, I will present new deep MUSE observations of a Broad Absorption Line (BAL) QSO at higher redshift, z~5, revealing a Lya nebula extending over 60 kpc around the quasar, whose morphology and kinematics suggest that powerful quasar-driven outflows can influence the cold circumgalactic gas emission, pointing to a profound link between the observed properties of the CGM and their host quasars/galaxies.

I will also present new MUSE observations of three hyper-luminous, heavily hot dust-obscured QSOs at z>3. As suggested by ALMA these Hot-DOGs are experiencing massive molecular outflows and dynamical interactions, making them an ideal test-beds for investigating the impact of AGN-feedback on nuclear to circumgalactic scales.

Ms. V. A. Masoura

Title: The dependence of star formation on AGN activity

Abstract: Studies of recent decades have led to the conclusion that there is an inextricable link between galaxies and the Supermassive Black Holes (SMBHs) located in their centre. However, it is still unclear how the activity of the SMBH affects the properties of the host galaxy. Furthermore, there is a scientific debate whether the absorption we observe in some AGN is a geometric effect or an evolutionary phase in the galaxy's lifetime. In my talk, I will present our results on the correlation between the SMBH activity and the SFR of the host galaxy. We use the largest (~3,500) X-ray AGN sample, from the XMM- XXL and the XMM-ATLAS fields in a wide range of redshift and luminosities. We disentangle the effects of stellar mass and redshift on the SFR and show that the AGN enhances the star formation of its host galaxy when the galaxy lies below the main sequence and quenches the star formation of the galaxy it lives in when the host lies above the main sequence.

Prof. F. Muller-Sanchez

Title: Feeding and Feedback in Dual Active Galactic Nuclei

Abstract: Dual Active Galactic Nuclei (AGN) are the Rosetta stone to understand the role of galaxy mergers in triggering nuclear activity and regulating black hole (BH) and galaxy growth. But very little is known about the physical processes required to effectively trigger AGN activity and regulate the growth of the two BHs. The work I will present here characterizes for the first time the properties of the stars, gas (molecular, ionized, and highly-ionized) and dust in all the confirmed dual AGN at $z < 0.05$, using Keck/OSIRIS, VLT/SINFONI, SOFIA/FORCAST, and HST data. I will focus on the interplay between the several complex processes observed in dual AGN, using as an example the prototypical merger system NGC 6240: vigorous star formation, two AGNs, outflowing winds of ionized gas, rippling dust and gas lanes, and tidal tails. In this galaxy, we observe for the first time a dual outflow of different species of gas: an AGN-driven outflow of highly-ionized gas to the northeast and a starburst-driven outflow of ionized hydrogen to the northwest. This shows that stellar feedback and supermassive black hole feedback can work in tandem to regulate the stellar growth of a galaxy after a merger event. These results open a new door to studies of dual AGN and AGN pairs in general, and enable dual AGN to be used, for the first time, for studies of galaxy evolution.

Dr Daniel May
Title: The striking resemblance between the outflows of NGC 4151 and NGC 1068

Abstract: The most representative Seyfert galaxies in the sky (NGC 4151 and NGC 1068) have been studied almost without intersection with regard to the complex nature of their outflows. In fact, it is not expected any sign of a clear similarity between their NLR besides the presence of two noticeable ionization cones. Furthermore, they possess very distinct Eddington ratios with each other (~50 times lower in NGC 4151). Using IFU data of NGC 4151 in the near infrared and with adaptative optics, combined to a thoughtful methodology of data cube treatment, a spatial resolution comparable to the HST is achieved. Thanks to the final data quality this work reveals, in light of the results found for NGC 1068 in May & Steiner (2017), that both AGN have remarkable similarities with each other. Some of them are: the detection of an "hourglass'" structure for the low-velocity [FeII] emission, with the high-velocity emission filling its volume; a molecular outflow detected for the first time in this galaxy; and a transition between the molecular and ionized gas phases through the fragmentation of molecular walls into bullets of ionized gas. Such facts suggest that NGC 4151 could represent a less powerful and compact version of the outflow seen in NGC 1068. Finally, the unexpected similarities among both NLR may unfold some efficient feedback mechanism acting in a quite different AGN.

Ms Andrea Travascio
Title: Evidence of outflowing CGM: broad Lya and CIV extended emissions around an hyper-luminous quasar

Abstract: Luminous quasars are the most promising sources to study energy and matter flows and their coupling from nuclear to circum-galactic scales. Theory and observations suggest them as ideal targets to study feedback in action in the form of AGN-driven outflows from pc to kpc scales. On larger scales, their CGM is being routinely characterized by sensitive VLT/MUSE integral field spectrograph programs which have recently allowed an efficient detection of high-redshift Lyman alpha (Lya) baryon reservoirs (the so-called giant Lya nebulae). I present here the MUSE observation of the WISSH hyper-luminous source J1538+08 at z=3.6. It is an Eddington accreting broad-line quasar that exhibits powerful outflows at all scales both in emission and absorption. I report on the detection of both an extended (150 kpc) and luminous (10^44 erg/s) Lya nebula and the associated CIV extended (70 kpc) emission. The kinematics of the Lya nebula suggests the presence of a spatially coherent blueshifted (~1000 km/s relative to the quasar rest-frame) component on several tens of kpc scales which we interpret as a strong indication of an AGN-driven outflow propagating on circum-galactic scales. This has important implications for understanding the role of AGN outflows in the feeding and feedback mechanism.

Ms Aitor Robleto-Orús
Title: A MUSE study of the Seyfert 1 NGC7469: spatially resolved star-formation and AGN-driven winds

Abstract: NGC7469 is a well-known luminous infrared galaxy (LIRG) hosting a Seyfert 1 AGN. Nuclear winds associated to the AGN and observed in X-rays and UV with velocities in the range $500-2000 \ \mathrm{km \ s^{-1}}$ have been reported by different authors. We use archival optical integral field spectroscopy observations with MUSE in order to look for an extended and spatially resolved counterpart of these winds. We find a high ionization outflow with velocities up to $\sim 1000 \ \mathrm{km \ s^{-1}}$ traced by the [\ion{O}{iii}] $\lambda 5007$ emission line, probably driven by the AGN, and a lower ionization wind with velocities $\sim 400 \ \mathrm{km \ s^{-1}}$, traced by the H$\beta$ recombination line, possibly associated with the well-known starburst circumnuclear ring. Remarkably, the [\ion{O}{iii}] $\lambda 5007$ and Hβ emission appear not kinematically coupled, as it is often assumed when estimating the wind physical parameters of AGN-driven outflows with low spatial resolution. Implications of our findings are presented.

Dr David Sanmartim

Title: Analysis of feedback and its impact on star formation in nearby post-starburst quasars

Abstract: PSQs are broad-lined AGNs that show clear signatures of A stars in their spectra, which characterizes massive post-starburst stellar populations with ages of a few hundred Myrs. These objects are an excellent case to study the AGN feedback mechanisms and the influence of SMBHs in the central kiloparsec of their host galaxies. One of the main issues to be clarified in this context is the cessation of the star formation processes and their relation with the AGN feedback. Two scenarios are possible to explain the simultaneous presence of post-starburst stellar populations and nuclear activity in PSQs: the secular evolutionary scenario and the quenching one. In the first scenario, the gas exhaustion would explain the gradual cessation of star formation, since the gas is consumed in the star formation process before nuclear activity is triggered. In the second scenario, the nuclear activity would be responsible for the abrupt interruption of star formation. In order to test these scenarios and to probe the role of the feedback and its impact in the star formation history in PSQs, we have mapped stellar population, manifestations of nuclear activity and excitation mechanisms in the central kpc of a sample of nearby PSQs by taking IFU observations using the Gemini Multi-Object Spectrograph (GMOS-IFU). The study of one of the PSQs of our sample has supported the evolutionary scenario, since the post-starburst population is not located close enough to the nucleus, where the outflow is observed. Instead, it is located in a ring at ≈500 pc from the nucleus, which is out of the reach of the AGN feedback. In the most central region, internal to the ring, where we observed the outflow, stellar population is predominantly old with some contribution from young stars and it does not show any signature of star formation quenching. On the other hand, for another object of our sample, both scenarios seem to be at play: the quenching scenario is supported by the presence of the AGN feedback close to the nucleus, which is co-spatial with the nuclear outflow, and the evolutionary scenario is suggested by the presence of the ring of post-starburst populations at ≈800 pc from the nucleus. In order to distinguish between the proposed scenarios and to generalize the impact of the AGN feedback in the star formation history of PSQs, we are currently analyzing a wider sample of nearby PSQs. During the conference, we will present more detailed results of the analysis of a sample of 5 PSQs of our sample. From this analysis, we expect to establish stronger constraints between the AGN feedback and its impact on the star formation history, besides indicating more conclusively which one is the favored scenario.

Prof. A. Comastri

Title: Deep X-ray spectroscopy of obscured AGN in the Chandra Deep Field South

Abstract: According to the recent models for the joint evolution of Super Massive Black Holes and their Host Galaxies, heavy obscuration represents an important phase and is expected to play a key role in the feedback mechanisms self regulating the SMBH growth. The smoking gun signature of heavy absorption is the presence of a heavily absorbed or reflected X-ray spectrum plus a strong iron line.

We will present the results of a systematic analysis of a flux limited sample of X-ray selected AGN in the deep (3 Ms) XMM observations in the Chandra Deep Field South (CDFS). We will focus on the absorption distribution of the sources responsible for the bulk of the X-ray background, with particular emphasis on the fraction of Compton thick AGN and the power of deep spectral spectroscopy to obtain redshift estimates more accurate and reliable than available photo-z. The deep exposure of the survey made possible to extend the Fe line study of AGN to redshift beyond z=1. Combining X-ray spectroscopy with iron line intensity study a reliable selection of Compton thick AGN and a robust test of XRB models is obtained.

Perspectives for future observations with future (i.e. ATHENA) deep surveys will be also presented.

Dr. A. Georgakakis
Title: eROSITA
Abstract:

Prof. M. Plionis
Title: The XMM/XXL survey legacy
Abstract:

Prof. D. Whalen
Title: Finding the First Quasars with JWST, Euclid and WFIRST
Abstract: Although more than 160 quasars have now been discovered at z > 6, little is known for certain of their origins or early evolution because observations to date have been limited to z = 7.5. This picture will soon change with the advent of Euclid and WFIRST, whose wide fields and high sensitivities out to nearly 2 um could allow them to detect these rare black holes at much earlier times. I will present synthetic NIR AB magnitudes at z = 6 - 20 for every stage of primordial quasar evolution: the birth of a supermassive Pop III star (SMS), its collapse to a direct-collapse black hole (DCBH), and its subsequent growth in cold accretion flows to ~ 10^9 solar masses by z ~ 7. We find that JWST could detect a SMS and DCBH at z ~ 20 and that Euclid and WFIRST could detect quasars at much earlier stages of their evolution, at z ~ 12 and 15, respectively. Euclid and WFIRST may also detect the seeds of these quasars at z ~ 15 because only modest gravitational lensing would be required to boost their NIR flux above the detection limits of either mission.

Dr. R. Decarli

Title: Quasars at cosmic dawn

Abstract: Quasars at z>6 (age of the Universe: <1 Gyr) are unique laboratories to study the formation and early evolution of massive black holes, the massive galaxies that host them, their small- and large-scale environment, and the intergalactic medium at the dawn of galaxy formation. I will briefly review the on-going efforts to further push the redshift frontier, to study their demography, and characterize their properties. In particular, I will highlight how the synergy of state-of-the-art facilities (ALMA, VLT, Magellan, Keck) is shaping our understanding of the early universe, and the prospects for future studies with future facilities.

Dr. F. Vito

Title: The X-ray properties of z>6 QSOs

Abstract: X-ray observations of high-redshift (z>6) QSOs can provide unique information about the physics of accretion onto SMBHs in the early Universe. I will present the results of an explorative Chandra survey (400 ks in total) of 10 optically selected z>6 QSOs. Including also archival Chandra and XMM-Newton data of additional 15 z>6 QSOs, for the first time we could use a sample with a statistically significant size to investigate their X-ray properties. I will focus in particular on the a_ox parameter and bolometric correction, and compare their distributions with the population of QSOs with similar luminosities at lower redshift. I will also show the results of a joint spectral analysis aimed at deriving the average spectral properties of z>6 QSO. Among the targets, we detected (P=0.9996) hard (2-5 keV) X-ray emission not matched by emission at softer energies (0.5-2 keV) in an interacting QSO/galaxy system at z=6.515. This X-ray source is the first heavily obscured (logNH>~24) QSO candidate at z>6. The X-ray positional uncertainty currently prevents us from assigning the X-ray emission to the optically type 1 QSO or its companion galaxy. I will discuss our current knowledge of this intriguing object based on ALMA/HST/Chandra data.

Prof. N. Cappelluti
Title: High-z AGN search with Chandra and XMM and next decade efforts.

Abstract: Chandra and XMM Newton showed us that AGN existed in the first bilion years of cosmic history but their emergence from the first lights epoch is still beyond reach for current facilities. So far we know that high-z AGN are very rare and background fluctuations studies suggest that they are likely highly absorbed. I will present the current status of the field focusing on the efforts of pushing the capabilities of Chandra and XMM-Newton with wide field surveys and background fluctuations. I will finally show predictions on the capabilities of forthcoming missions like Athena, Lynx and AXIS in disentangling the physics of AGN at z>>6.

Dr. R. Nanni

Title: The X-ray properties of the z~6 quasars

Abstract: More than 200 quasars (QSOs) with spectroscopic redshift z > 6 have been discovered so far. Multi-wavelength observations showed that these objects are evolved systems with large black hole masses (10^8−10^10 M⊙), and that their broad-band spectral energy distributions (SEDs) and rest-frame UV spectra have not significantly evolved over cosmic time. The formation of their Super Massive Black Holes in less than 1 Gyr is still a challenge for theory, with many simulations claiming they formed at the center of primordial overdense regions. I will present a study of all the 29 z∼6 QSOs observed so far in the X-rays, showing that the X-ray spectral properties of high-z QSOs do not differ significantly from those of QSOs at lower-z.

I will also present the results from a deep 500 ks Chandra observation of the field around z=6.31 QSO SDSS J1030+0524, which shows the best evidence of an overdense region around a z∼6 QSO. This is the deepest X-ray observation ever achieved for such a distant QSO. Comparing our results with those from previous XMM observation we found a hardening of the X-ray spectrum and a decrease of the flux by a factor 2.5. This is the first evidence of a variable QSO at such high redshift. I will discuss possible interpretations for the observed variability and discuss prospects for future X-ray observations of distant QSOs.

Ms. M. Sidhu

Title: Obscured Black Hole Growth in the Early Universe

Abstract: It is now universally accepted that galaxies grow their central supermassive black holes through active phases of accretion that produces an Active Galactic Nucleus (AGN). Using multiwavelength surveys, the demographics of these AGN and their host galaxies have been studied up to high redshifts, helping illuminate how accretion and the associated physics at all scales evolves from late times to the earlier universe. However, the extent of obscured black hole growth in the early universe is not yet fully understood due to the difficulty in identifying AGN down to low-luminosities and accurately determining their obscuration properties.

Focusing on the early universe, we present new measurements of the independent X-ray luminosity functions of the broad-line (unobscured) and non-broad-line (obscured) AGN population at z 2-3, allowing us to determine the extent of obscured black growth relative to unobscured periods at these early cosmic times. We use an optical colour pre-selection approach coupled with X-ray imaging from Chandra and XMM-Newton to identify a sample of ~60 X-ray selected AGN at z ≈ 2-3. Optical spectroscopic follow-up data were obtained using LRIS on the Keck telescope that enables us to probe both faint and obscured sources. We developed an automated code which categorises our AGN as either broad-line or non-broad-line and accurately identifies their redshift. Our code is also run on large samples of simulated data that allows us to establish the incompleteness in our optical follow-up and classifications. We apply these completeness corrections to our results to recover the X-ray luminosity function and obtain a robust measurement of the distribution of obscured and unobscured black hole growth in the early universe.

Dr. F. Koliopanos
Title: Searching for the seeds of supermassive black holes

Abstract: Intermediate Mass Black Holes (IMBHs) -- which are defined as BHs with masses between 10^3Msol to a few times 10^5Msol -- are predicted by a variety of plausible scenarios and are the likely seeds for super massive black holes (SMBHs). However, despite the discovery of less than a handful of very strong candidates, we have yet to firmly establish their presence in the universe and are even further from establishing any characteristics of their population (i.e. the existence of two sub-populations of 500-5000Msol and 10^4 − 10^5 Msol). Establishing these facts is a crucial and necessary step in understanding stellar and galactic evolution as well as probing black hole feedback in different mass regimes. More importantly, determining the presence and demographics of IMBHs will shed light on the mystery of the presence of supermassive black holes with masses exceeding 800 million times the mass of the Sun, at a mere few hundred million years after the Big Bang.

In search of the seeds of SMBHs, we have embarked on the most complete multi-wavelength census of the mass of all nearby (<150Mpc) low luminosity AGN. Combining data from radio to X- ray -- mining the vast cache of the GWGC, 2MPZ, 2MASS, XSC, HyperLEDA, Palomar, RC3 and SDSS catalogs, along with inventories of the XMM-Newton and Chandra X-ray observatories and the VLA and e-Merlin radio telescopes -- and using the latest mass-scaling relations, we will provide the most complete and robust mass measurement of nearby SMBHs, to date. In my talk I will present the first results of this project -- which already include ~250 candidates -- and reveal, for the first time, strong indications for the presence of a <8000Msol central black hole in a well known nearby galaxy.

Dr. R. Serafinelli
Title: Searching for supermassive black hole binaries with sub-pc separations in the hard X-rays
Abstract: Supermassive black hole binaries (SMBHB) are a natural outcome of the hierarchical mergers predicted by the LCDM cosmology, and promising sources of nanohertz continuous gravitational wave signals. However, their detection remains elusive. Since hard X-rays are produced in the innermost regions of active galactic nuclei, they are predicted to show the best signatures of SMBHB, namely a double-peaked iron emission line and a periodic light curve (Sesana et al. 2012). I will present new results of a search for SMBHB candidates based on the analysis of decade-long Swift-BAT hard X-ray (E=14-195 keV) light curves.
We focused on the Seyfert 2 galaxy MCG+11-11-032, which shows the evidence for a double-peaked profile of the Fe Kalpha line (Severgnini et al. 2018). We identified a significant (~4sigma) power spectrum peak in the Swift-BAT hard X-ray light curve, at frequency 15+-2 nHz, i.e. P0=26+-4 months. This value is consistent with the hypothesis of a sub-pc scale SMBHB, already suggested in Severgnini et al. (2018). These new results confirm that MCG+11-11-032 may host one of the most promising SMBHB candidates to date.

Dr Federica Ricci

Title: Stormy weather in 3C 196.1: an hybrid radio galaxy shaping its environment up to 100s kpc scale

Abstract: Active galactic nuclei (AGN) feedback have a dramatic impact on cosmic structure formation and evolution, producing the so-called 'cosmic downsizing', the BH-host scaling relations and the quenching of cooling-flows in cluster cores. In particular, radio-loud AGN are expected to experience the most intense galaxy-scale outflows and feedback in the centre of massive galaxies, with jet/intra-cluster medium interaction in the form of cavities (X-ray) and bubbles (radio). We here present a detailed multi-wavelength analysis based on archival radio (VLA and GMRT), optical (HST) and X-ray (Chandra) data of the hybrid radio galaxy 3C 196.1, whose host is a z=0.198 BCG embedded in a kT ~ 4 keV cluster. Chandra snapshot observation allowed us to constrain the physical parameters of the cluster, which has a cool core with a low central temperature ~ 2.8 keV, low central entropy ~ 13 keV cm^2 and a short cooling time of ~ 500 Myr. 3C 196.1 represents an intriguing example of combined effects on the surrounding cluster environment of both AGN activity and merging events. Indeed, analysis of the X-ray and radio images reveals cavities located at galactic-scale (~ 10 kpc) and in the cluster outskirts (~ 300 kpc, ~ 0.3 R500), originated by at least two separate cycles of AGN outbursts, leading to one the biggest and highest energetic (~ 10^60 erg) bubbles ever measured so far.

Elizabeth McGrath
Title: The Prevalence of Massive Quiescent Disks in the Early Universe

Abstract: Using rest-frame optical imaging from the CANDELS survey, we examine the morphologies of massive (>10^10 M_sun), quiescent galaxies over the redshift range 0.5<z<2.5. At the highest redshifts, these galaxies are likely among the first to reach the quiescent ``red sequence", and as such, their structure provides important clues as to the nature of galaxy formation and star-formation quenching in the early universe. We find that at z>1.5, more than 30% of all massive quenched galaxies contain prominent stellar disks that comprise more than 50% of their total integrated light. These quiescent disks, like their spheroid counterparts, are more compact than star-forming galaxies of similar mass and redshift by a factor of two. Furthermore, a near-neighbor analysis suggests these galaxies reside in more overdense environments. The existence of these massive disks implies that large-scale structural transformation from disks to spheroids is not a necessary condition for star-formation quenching. Instead, we suggest that these galaxies likely formed from highly dissipative events following the accretion of cold gas via narrow, dense filaments that were able to penetrate the hot dark matter halos. These cold streams may have subsequently fueled a central AGN which provided the feedback necessary to quench star formation, with maintenance of the quiescence provided by the hot halo or other secular processes both internal and external to the galaxy.

Dr. A. Ruiz
Title:
Abstract:

Dr Malgosia Sobolewska
Title: Understanding evolution of radio galaxies through X-ray study of youngest extragalactic radio jets

Abstract: It is generally accepted that an onset of black hole (BH) activity is accompanied by a formation of a radio jet. Jet's impact on BH surrounding and further BH feeding and growth are believed to be essential to the AGN-galaxy feedback idea. We discuss the most recent results for a sample of four Compact Symmetric Objects (CSO; radio structure sizes 2-16 pc and ages 100-400 years) based on the new high quality broadband radio-to-X-ray/gamma-ray spectral energy distributions including XMM-Newton (AO17), Chandra, NuSTAR (AO4) and Fermi/LAT data. For the first time, we have now means to test theoretical scenarios for the high energy emission of the youngest radio jets (radio lobes origin, shocked ISM, jet, disk corona). We were able to refute the radio lobes origin in at least one source. In addition, we find evidence to support the dichotomy of the CSO environment that we have recently discovered. This dichotomy may suggest that X-ray obscured CSOs have smaller radio sizes than X-ray unobscured CSOs with the same radio power. Thus, the environment may play a crucial role in regulating the early growth of the radio jets. Importantly, X-rays emitted by the X-ray obscured CSO sub-population, in conjunction with the recent developments in the optical/IR and radio bands, offer new insights for understanding the structure and size of the AGN obscuring torus, as they provide information about the radiative processes and environment on the torus (parsec) scale. We discuss the implications of our results for the high energy emission models of radio jets, the earliest stages of the radio source evolution, diversity of the medium in which the jets expand, and jet-galaxy co-evolution. Observing young radio jets at high energies has been challenging as they proved to be relatively faint. New prospects in this field will open with future missions such as ATHENA, Lynx and XRISM.

Dr. E. Lusso

Title: Tension with the LCDM model from a Hubble diagram of quasars.

Abstract: The cosmological concordance model (ΛCDM) well accounts for a wealth of observations, from the existence of Cosmic Microwave background (CMB) to the discovery of the accelerated expansion of the universe from Type Ia supernovae. Yet, it assumes a still unknown form of dark energy and matter and some tensions arose recently as, for instance, the discovery of a >3σ discrepancy between the local (Riess et al. 2016) and Planck (Aghanim et al. 2016) measurement of H0. In addition, the ΛCDM model is poorly tested in the redshift interval between the farthest observed Type Ia supernovae (z~1.4) and that of the CMB (z~1100). We present new measurements of the expansion rate of the Universe in the redshift range z=0.5-5.5 based on a Hubble diagram of quasars. The distance of quasars have been estimated from the observed non-linear relation between the X-ray and ultraviolet emission, following a method developed by our group. The distance-redshift relation of quasars at z<1.4 is in agreement with that of supernovae and with the concordance model. Nonetheless, a deviation from the ΛCDM model emerges at higher redshift, with a statistical significance of ~4σ. We found that, if an evolution of the dark energy equation of state is allowed, our data suggest a dark energy density increasing with time.

Mr. J. Scholtz
Title: Do powerful AGN really suppress star formation?

Abstract: There have been a number studies (Cano Diaz et al 2012, Cresci et al 2015, Carniani et al 2016) that have suggested an anti correlation between ionised outflows (traced with [O III] in IFU data) and star formation (traced using H-alpha in IFU data) in the host galaxies of high-luminosity AGN. However, the H-alpha line as a tracer of star formation is susceptible to obscuration by dust. Therefore, we have utilised the largest sample of AGN observed with IFU at high redshift (the KASHz survey) to select AGN with high quality IFU data, to map both the H-alpha and [OIII] kinematics, and that also have ancillary ALMA (870 micron) data, to map the dust. This combination enables us to map both the obscured and unobscured star-formation as well as any AGN-driven outflows in the host galaxies of these AGN. Using this unique sample of AGN, with a range of luminosities, we have compared the location and sizes of the obscured and unobscured star-forming regions and the star-formation rate inferred from each tracer. We conclude that in order to map all star formation the host galaxies, we must use multiple tracers. Furthermore, using these star formation tracers and the [OIII] data, we see no evidence of AGN driven outflows instantaneously suppressing star formation. I will present these new results before presenting a re-assessement of the flagship examples of suppression of star- formation by AGN-driven outflows in the aforementioned papers. Using our own techniques and comprehensive assessments of the total star-formation with multple star formation tracers, I will address the question: Do powerful AGN really suppress star formation?

Ms. L. Klindt

Title: Fundamental differences between red and blue quasars

Abstract: A key focus of many red quasar studies is to understand whether they fit into the AGN unified scheme, are a transitional phase in quasar-galaxy co-evolution, or represent an intrinsically peculiar population. We report on a systematic, controlled comparison between the FIRST radio properties of red and blue SDSS quasars. We find a factor ~3 enhancement of compact radio sources among red quasars when compared to blue quasars. This result is in disagreement with the

simple unified model and suggests that red quasars are an earlier transitional phase. To better understand the nature of red quasars we have a comprehensive VLT-X-shooter program of ~50 matched red and blue quasars at z~1.5. These data are allowing us to search for differences in the accretion-disc properties, identify the location of the reddening (nuclear or galaxy scales), explore the emission-line kinematics, and the ionisation properties of the BLR/NLR, and the frequency of outflows.

Prof. G. Canalizo

Title: The title is “AGN-driven outflows in dwarf galaxies”

Abstract: Black holes are believed to populate the centers of all galaxies with mass comparable to the Milky Way and above. For massive galaxies, the interaction of black holes and their accretion disks with the surrounding gas leads to the formation of powerful gas outflows that heat up and may eventually escape the galaxy. However, in low mass dwarfs, the most common type of galaxies in the Universe, the incidence of massive black holes is largely unknown and their effects on star formation histories are currently ignored. In this talk, I will present the discovery and measurement of extended gas outflows powered by black holes dwarf galaxies using spatially resolved Keck/ LRIS spectroscopy. The measured outflow velocities are enough to escape the galaxy and their surrounding dark matter halo, leaving behind a gas-depleted and poorly star-forming galaxy. We find some evidence for star formation suppression, mostly by the active galactic nuclei. Galaxy formation models must therefore be able to account not only for the formation and growth of black holes in the centers of dwarf galaxies but should also be revised to include black holes as important --and perhaps dominant-- sources of feedback in low mass galaxies.

Dr. T. Schmidt

Title: Mapping Quasar Light Echoes in 3D with Lya Forest Tomography

Abstract: At z<6, the Intergalactic Medium is kept highly photoionized by a metagalactic UV background. However, due to their high UV luminosity, bright quasars can cause fluctuations in this quasi homogeneous UVB and locally alter the ionization state of the IGM, which is described as the quasar proximity effect.

I will present a novel method that, based on the Lya forest absorption along dozens of background sightlines which all probe the proximity zone of the same foreground quasar, will deliver 3D maps of quasar light echoes. My detailed studies show that with realistic investments of observing time, detailed insights into the emission properties of quasars can be gained. In particular, the full quasar emission history of individual objects can be determined on scales up to 100 Myr and the three dimensional observations allow a direct determination of emission geometry and obscuration. Measurements of this kind are unprecedented and will in the near future deliver key insights into the inner structure of AGNs (geometry of obscuring material/torus) as well as the triggering and feeding processes driving AGN accretion. Based on arXiv:1810.05156

Dr. G. Venturi

Title: Dissecting ionized galactic outflows in nearby AGN

Abstract: AGN outflows are believed to play a major role in shaping the properties of host galaxies, by sweeping away the gas and quenching star formation. In this context our MAGNUM survey aims at investigating in detail the properties and driving mechanisms of galactic outflows and their interplay with star formation processes in nearby Seyfert galaxies which, due to their vicinity, are ideal laboratories to carry out such a study. The sample comprises ten famous nearby Seyfert galaxies so far, such as NGC 1365, Circinus and NGC 4945.

Thanks to its unique combination of large field of view and spectral coverage, VLT/MUSE allowed us to map the ionised gas down to ~10 pc in several nebular emission lines revealing ubiquitous kpc-scale outflows, whose properties (e.g. velocity, mass outflow rate, kinetic rate etc...) were measured with high detail as a function of distance from the active nucleus. The comparison of the optical galactic outflow with the nuclear X-ray wind gave us unique insights on the outflow driving mechanisms. Furthermore, we inferred the outflow 3D shape with kinematic modelling and studied the connection between outflows and radio jets.

We found also evidence of star formation induced by AGN outflows indicating positive feedback. Additionally, recent results from our survey reveal the presence of star formation even within the outflow itself.

Dr. Fabrizio Fiore

Title: Mass/Energy inflow/outflow, black hole growth and feedback (Ending Summary Talk)

Abstract: Black hole accretion and ejection are intimately correlated, making this system a fundamental building block in the AGN/galaxy life-cycle. Despite decades of both observational and theoretical work, the details of this liaison are still rather fuzzy. It is not clear what fraction of the gas accreted near the Bondi radius ultimately reaches the black hole horizon, then contributing to black hole growth; how much gas reaches the innermost accretion disk, efficiently liberating its bounding energy into radiation; and how much is lost on the way, contributing to kinetic outflows, which in turn can be further accelerated by the accretion disk radiation. It is not clear what fraction of kinetic+radiative energy is then returned to the Inter-Stellar Matter (ISM) or to the Circum-Galactic Medium (CGM) , which are the energy transport mechanisms from the micro to the macro scale, and how efficient is the coupling with the ISM/CGM. I will first review mass/energy flows from both geometrically thin and thick accretion disks. I will then compare the available accretion/outflow data to simple energy and momentum transmission models, to limit the parameter space for a coherent AGN/galaxy life-cycle.