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Accepted Abstracts - Submitted Abstracts - Thesis Abstracts
Jobs Adverts - Meetings Adverts - Special Announcements

From the Editor

Welcome to all the new subscribers, and thanks to everyone who contributed to this issue of the Active Galaxies Newsletter.

This newsletter is intended to disseminate paper abstracts, meeting announcements, job adverts and other information which may be of interest to the active galaxies community. It is produced monthly and, whilst the deadline for contributions is the last day of the month, contributions may be submitted at any time.

The Latex macros for submitting abstracts and dissertation abstracts are appended to each issue of the newsletter and are also available on the web page. Please note that the editor may reject submissions which do not use the template. As always, any suggestions or feedback regarding the newsletter are welcome.

Thanks for your continued subscription.

Megan Argo

Abstracts of recently accepted papers

EVN Observations of HESS J1943+213: Evidence for an Extreme TeV BL Lac Object

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We report on the 1.6 GHz (18 cm) VLBI observations of the unresolved, steady TeV source HESS J1943+213 located in the Galactic plane, performed with the European VLBI Network (EVN) in 2014. Our new observations with a nearly full EVN array provide the deepest image of HESS J1943+213 at the highest resolution ever achieved, enabling us to resolve the long-standing issues of the source identification. The milliarcsecond-scale structure of HESS J1943+213 has a clear asymmetric morphology, consisting of a compact core and a diffuse jet-like tail. This is broadly consistent with the previous e-EVN observations of the source performed in 2011, and re-analyzed in this work. The core component is characterized by the brightness temperature of $> 1.8 \times 10^9$ K, which is typical for low-luminosity blazars in general. Overall, radio properties of HESS J1943+213 are consistent with the source classification as an "extreme high-frequency-peaked BL Lac object". Remarkably, we note that since HESS J1943+213 does not reveal any optical or infrared signatures of the AGN activity, it would never be recognized and identified as a BL Lac object, if not its location close to the Galactic plane where the High Energy Stereoscopic System has surveyed, and the follow-up dedicated X-ray and radio studies triggered by the source detection in the TeV range. Our results suggest therefore a presence of an unrecognized, possibly very numerous population of particularly extreme HBLs, and simultaneously demonstrate that the low-frequency VLBI observations with high-angular resolution are indispensable for a proper identification of such objects.

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ALMA resolves the torus of NGC 1068: continuum and molecular line emission

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We have used the Atacama Large Millimeter Array (ALMA) to map the emission of the CO(6–5) molecular line and the 432 μm continuum emission from the 300 pc-sized circumnuclear disk (CND) of the nearby Seyfert 2 galaxy NGC 1068 with a spatial resolution of $\sim$ 4 pc. These observations spatially resolve the CND and, for the first time, image the dust emission, the molecular gas distribution, and the kinematics from a 7–10 pc-diameter disk that represents the submillimeter counterpart of the putative torus of NGC 1068. We fitted the nuclear spectral energy distribution of the torus using ALMA and near and mid-infrared (NIR/MIR) data with CLUMPY torus models. The mass and radius of the best-fit solution for the torus are both consistent with the values derived from the ALMA data alone: $M_{\rm gas}^{\rm torus} = (1 \pm 0.3) \times 10^5\ M_\odot$ and $R_{\rm torus} = 3.5 \pm 0.5$ pc. The dynamics of the molecular gas in the torus show strong non-circular motions and enhanced turbulence superposed on a surprisingly *slow* rotation pattern of the disk. By contrast with the nearly edge-on orientation of the H_2O megamaser disk, we have found evidence suggesting that the molecular torus is less inclined ($i = 34^\circ - 66^\circ$) at larger radii. The lopsided morphology and complex kinematics of the torus could be the signature of the Papaloizou-Pringle instability, long predicted to likely drive the dynamical evolution of active galactic nuclei (AGN) tori.

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J1216+0709 : A radio galaxy with three episodes of AGN jet activity

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We report the discovery of a 'Triple-Double Radio Galaxy (TDRG)' J1216+0709 detected in deep low-frequency Giant Metrewave Radio Telescope (GMRT) observations. J1216+0709 is only the third radio galaxy, after B0925+420 and Speca, with three pairs of lobes resulting from three different episodes of AGN jet activity. The 610 MHz GMRT image clearly displays an inner pair of lobes, a nearly co-axial middle pair of lobes and a pair of outer lobes that is bent w.r.t. the axis of inner pair of lobes. The total end-to-end projected sizes of the inner, middle, and outer lobes are $40''$ ($\sim$ 95 kpc), $1'.65$ ($\sim$ 235 kpc) and $5'.7$ ($\sim$ 814 kpc), respectively. Unlike the outer pair of lobes both the inner and middle pairs of lobes exhibit asymmetries in arm-lengths and flux densities, but in opposite sense, i.e., the eastern sides are farther and also brighter that the western sides, thus suggesting the possibility of jet being intrinsically asymmetric rather than due to relativistic beaming effect. The host galaxy is a bright elliptical ($m_r \sim 16.56$) with $M_{\rm SMBH} \sim 3.9 \times 10^9$ M$\odot$ and star-formation rate of $\sim 4.66^{+4.65}_{-1.61}$ $M_\odot$ yr^{-1}. The host galaxy resides is a small group of three galaxies ($m_r \leq 17.77$) and is possibly going through the interaction with faint, dwarf galaxies in the neighbourhood, which may have triggered the recent episodes of AGN activity.

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Interstellar Scintillation and the Radio Counterpart of the Fast Radio Burst FRB150418

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Keane et al. (2016) have recently reported the discovery of a new fast radio burst, FRB150418, with a promising radio counterpart at 5.5 and 7.5 GHz – a rapidly decaying source, falling from 200-300 μJy to 100 μJy on timescales of $\sim$6 d. This transient source may be associated with an elliptical galaxy at redshift $z = 0.492$, providing the first firm spectroscopic redshift for a FRB and the ability to estimate the density of baryons in the intergalactic medium via the combination of known redshift and radio dispersion of the FRB. An alternative explanation, first suggested by Williams & Berger (2016), is that the identified counterpart may instead be a compact AGN. The putative counterpart's variation may then instead be extrinsic, caused by refractive scintillation in the ionized interstellar medium of the Milky Way, which would invalidate the association with FRB150418. We examine this latter explanation in detail and show that the reported observations are consistent with scintillating radio emission from the core of a radio-loud active galactic nucleus (AGN) having a brightness temperature $T_{\rm b} > 10^9$ K. Using numerical simulations of the expected scattering for the line of sight to FRB150418, we provide example images and light curves of such an AGN at 5.5 and 7.5 GHz. These results can be compared with continued radio monitoring to conclusively determine the importance of scintillation for the observed radio variability, and they show that scintillation is a critical consideration for continued searches for FRB counterparts at radio wavelengths.

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STUDY OF SWIFT/BAT SELECTED LOW-LUMINOSITY ACTIVE GALACTIC NUCLEI OBSERVED WITH SUZAKU

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We systematically analyze the broadband (0.5–200 keV) X-ray spectra of hard X-ray ($>$ 10 keV) selected local low-luminosity active galactic nuclei (LLAGNs) observed with *Suzaku* and *Swift*/BAT. The sample consists of ten LLAGNs detected with *Swift*/BAT with intrinsic 14–195 keV luminosities smaller than 10^{42} erg s^{-1} available in the *Suzaku* archive, covering a wide range of the Eddington ratio from 10^{-5} to 10^{-2}. The overall spectra can be reproduced with an absorbed cut-off power law, often accompanied by reflection components from distant cold matter, and/or optically-thin thermal emission from the host galaxy. In all objects, relativistic reflection components from the innermost disk are not required. Eight objects show a significant narrow iron-Kα emission line. Comparing their observed equivalent widths with the predictions from the Monte-Carlo based torus model by Ikeda et al. (2009), we constrain the column density in the equatorial plane to be $\log N_{\rm H}^{\rm eq} > 22.7$ or the torus half opening angle $\theta_{\rm oa} < 70^\circ$. We infer that the Eddington ratio ($\lambda_{\rm Edd}$) is a key parameter that determines the torus structure of LLAGNs: the torus becomes large at $\lambda_{\rm Edd} < 2 \times 10^{-4}$, whereas at lower accretion rates it is little developed. The luminosity correlation between the hard X-ray and mid-infrared (MIR) bands of the LLAGNs follows the same one as for more luminous AGNs. This implies that other mechanisms than AGN-heated dust are responsible for the MIR emission in low Eddington ratio LLAGNs.

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Faint COSMOS AGNs at $z \sim 3.3$ - I. Black Hole Properties and Constraints on Early Black Hole Growth

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We present new Keck/MOSFIRE K-band spectroscopy for a sample of 14 faint, X-ray-selected active galactic nuclei (AGNs) in the COSMOS field. The data cover the spectral region surrounding the broad Balmer emission lines, which enables the estimation of black hole masses ($M_{\rm BH}$) and accretion rates (in terms of $L/L_{\rm Edd}$). We focus on 10 AGNs at $z \simeq 3.3$, where we observe the Hβ spectral region, while for the other four $z \simeq 2.4$ sources we use the Hα broad emission line. Compared with previous detailed studies of unobscured AGNs at these high redshifts, our sources are fainter by an order of magnitude, corresponding to number densities of order $\sim 10^{-6} - 10^{-5}\,{\rm Mpc}^{-3}$. The lower AGN luminosities also allow for a robust identification of the host galaxy emission, necessary to obtain reliable intrinsic AGNs luminosities, BH masses and accretion rates. We find the AGNs in our sample to be powered by supermassive black holes (SMBHs) with a typical mass of $M_{\rm BH} \simeq 5 \times 10^8\,M_\odot$ – significantly lower than the higher-luminosity, rarer quasars reported in earlier studies. The accretion rates are in the range $L/L_{\rm Edd} \sim 0.1 - 0.4$, with an evident lack of sources with lower $L/L_{\rm Edd}$ (and higher $M_{\rm BH}$), as found in several studies of faint AGNs at intermediate redshifts. Based on the early growth expected for the SMBHs in our sample, we argue that a significant population of faint $z \sim 5-6$ AGNs, with $M_{\rm BH} \sim 10^6\,M_\odot$, should be detectable in the deepest X-ray surveys available, but this is *not* observed. We discuss several possible explanations for the apparent absence of such a population, concluding that the most probable scenario involves an evolution in source obscuration and/or radiative efficiencies.

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Determining the radio AGN contribution to the radio–FIR correlation using the black hole fundamental plane relation

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We investigate the 1.4 GHz radio properties of 92 nearby ($z < 0.05$) ultra hard X-ray selected Active Galactic Nuclei (AGN) from the Swift Burst Alert Telescope (BAT) sample. Through the ultra hard X-ray selection we minimise the biases against obscured or Compton-thick AGN as well as confusion with emission derived from star formation that typically affect AGN samples selected from the UV, optical and infrared wavelengths. We find that all the objects in our sample of nearby, ultra-hard X-ray selected AGN are radio quiet; 83% of the objects are classed as high-excitation galaxies (HEGs) and 17% as low-excitation galaxies (LEGs). While these low-z BAT sources follow the radio–far-infrared correlation in a similar fashion to star forming galaxies, our analysis finds that there is still significant AGN contribution in the observed radio emission from these radio quiet AGN. In fact, the majority of our BAT sample occupy the same X-ray–radio fundamental plane as have been observed in other samples, which include radio loud AGN —evidence that the observed radio emission (albeit weak) is connected to the AGN accretion mechanism, rather than star formation.

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THE OPTICAL VARIABILITY OF SDSS QUASARS FROM MULTI-EPOCH SPECTROSCOPY. II. COLOR VARIATION

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We investigated the optical/ultraviolet (UV) color variations for a sample of 2169 quasars based on multi-epoch spectroscopy in the Sloan Digital Sky Survey (SDSS) data release seven (DR7) and data release nine (DR9). To correct the systematic difference between DR7 and DR9 due to the different instrumental setup, we produced a correction spectrum by using a sample of F-stars observed both in DR7 and DR9. The correction spectrum was then applied to quasars when comparing the spectra of DR7 with DR9. In each object, the color variation was explored by comparing the spectral index of the continuum power-law fit on the brightest spectrum with the faintest one, and also by the shape of their difference spectrum. In 1876 quasars with consistent color variations from two methods, we found that most sources (1755, $\sim 94\%$) show bluer-when-brighter (BWB) trend, and the redder-when-brighter (RWB) trend is only detected in 121 objects ($\sim 6\%$). The common BWB trend is supported by the bluer composite spectrum constructed from bright spectra than that from faint spectra, and also by the blue composite difference spectrum. The correction spectrum is proved to be highly reliable by comparing the composite spectrum from corrected DR9 and original DR7 spectra. Assuming that the optical/UV variability is triggered by fluctuations, RWB trend can likely be explained if the fluctuations occur firstly at outer disk region, and the inner disk region has not fully responded yet when the fluctuation being propagated inward. In contrast, the common BWB trend implies that the fluctuations are likely more often happening firstly in inner disk region.

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The Optical Variability of SDSS Quasars from Multi-epoch Spectroscopy. III. A Sudden UV Cutoff in Quasar SDSS J2317+0005

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We have collected near-infrared to X-ray data of 20 multi-epoch heavily reddened SDSS quasars to investigate the physical mechanism of reddening. Of these, J2317+0005 is found to be a UV cutoff quasar. Its continuum, which usually appears normal, decreases by a factor 3.5 at 3000Å, compared to its more typical bright state during an interval of 23 days. During this sudden continuum cut-off, the broad emission line fluxes do not change, perhaps due to the large size of the Broad Line Region (BLR), r ¿ 23 / (1+z) days. The UV continuum may have suffered a dramatic drop out. However, there are some difficulties with this explanation. Another possibility is that the intrinsic continuum did not change, but was temporarily blocked out, at least towards our line of sight. As indicated by X-ray observations, the continuum rapidly recovers after 42 days. A comparison of the bright state and dim states would imply an eclipse by a dusty cloud with a reddening curve having a remarkably sharp rise shortward of 3500Å. Under the assumption of being eclipsed by a Keplerian dusty cloud, we characterized the cloud size with our observations, however, which is a little smaller than the 3000Å continuum-emitting size inferred from accretion disk models. Therefore, we speculate this is due to a rapid outflow or inflow with a dusty cloud passing through our line-of-sight to the center.

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The far-infrared emitting region in local galaxies and QSOs: Size and scaling relations

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We use *Herschel* 70 to 160 μm images to study the size of the far-infrared emitting region in about 400 local galaxies and quasar (QSO) hosts. The sample includes normal 'main-sequence' star-forming galaxies, as well as infrared luminous galaxies and Palomar-Green QSOs, with different levels and structures of star formation. Assuming Gaussian spatial distribution of the far-infrared (FIR) emission, the excellent stability of the *Herschel* point spread function (PSF) enables us to measure sizes well below the PSF width, by subtracting widths in quadrature. We derive scalings of FIR size and surface brightness of local galaxies with FIR luminosity, with distance from the star-forming main-sequence, and with FIR color. Luminosities $L_{\rm FIR}{\sim}10^{11}$ L$_\odot$ can be reached with a variety of structures spanning 2 dex in size. Ultraluminous $L_{\rm FIR}{>}{\sim}10^{12}$ L$_\odot$ galaxies far above the main-sequence inevitably have small $R_{\rm e,70}{\sim}0.5$ kpc FIR emitting regions with large surface brightness, and can be close to optically thick in the FIR on average over these regions. Compared to these local relations, first ALMA sizes for the dust emission regions in high redshift galaxies, measured at somewhat longer rest wavelengths, suggest larger sizes at the same IR luminosity. We report a remarkably tight relation with 0.15 dex scatter between FIR surface brightness and the ratio of [CII] 158 μm emission and FIR emission – the so-called [CII]-deficit is more tightly linked to surface brightness than to FIR luminosity or FIR color. Among 33 z$\leq$0.1 PG QSOs with typical $L_{\rm FIR}/L_{\rm Bol,AGN}$ $\approx$0.1, 19 have a measured 70 μm half light radius, with median $R_{\rm e,70}$=1.1 kpc. This is consistent with the FIR size for galaxies with similar $L_{\rm FIR}$ but lacking a QSO, in accordance with a scenario where the rest FIR emission of these types of QSOs is, in most cases, due to host star formation.

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Ionized outflows in luminous type 2 AGNs at $z < 0.6$: no evidence for significant impact on the host galaxies.

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We investigate the presence of extended ionized outflows in 18 luminous type 2 AGNs (11 quasars and 7 high luminosity Seyfert 2s) at 0.3<z<0.6 based on VLT-FORS2 spectroscopy. We infer typical lower limits on the radial sizes of the outflows $R_{\rm o}$ $\geq$several$\times$100 pc and upper limits $R_{\rm o}$ $\leq$1-2 kpc. Our results are inconsistent with related studies which suggest that large scale ($R_{\rm o}$ $\sim$several-15 kpc) are ubiquitous in QSO2. We study the possible causes of discrepancy and propose that seeing smearing is the cause of the large inferred sizes. The implications in our understanding of the feedback phenomenon are important since the mass $M_{\rm o}$ (through the density), mass injection $\dot{M}_{\rm o}$ and energy injection $\dot{E}_{\rm o}$ rates of the outflows become highly uncertain. One conclusion seems unavoidable: $M_{\rm o}$, $\dot{M}_{\rm o}$ and $\dot{E}_{\rm o}$ are modest or low compared with previous estimations. We obtain typically $M_{\rm o}$ $\leq$(0.4-22)$\times$10^6 M$_\odot$ (median 1.1$\times$10^6 M$_\odot$) assuming n =1000 cm^{-3}. These are $\sim$10^2-10^4 times lower than values reported in the literature. Even under the most favorable assumptions, we obtain $\dot{M}_{\rm o}$ $\leq$10 M$_\odot$ yr^{-1} in general, 100-1000 times lower than claimed in related studies. Although the uncertainties are large, it is probable that these are lower than typical star forming rates. In conclusion, no evidence is found supporting that typical outflows can affect the interstellar medium of the host galaxies across spatial scales $\geq$1-2 kpc.

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The Complete Ultraviolet Spectrum of the Archetypal "Wind-Dominated" Quasar Mrk 231: Absorption and Emission from a High-Speed Dusty Nuclear Outflow

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New near- and far-ultraviolet (NUV and FUV) *HST* spectra of Mrk 231, the nearest quasar known, are combined with ground-based optical spectra to study the remarkable dichotomy between the FUV and NUV-optical spectral regions in this object. The FUV emission-line features are faint, broad, and highly blueshifted (up to $\sim$ 7000 km s^{-1}), with no significant accompanying absorption. In contrast, the profiles of the NUV absorption features resemble those of the optical Na I D, He I, and Ca II H and K lines, exhibiting broad blueshifted troughs that overlap in velocity space with the FUV emission-line features and indicate a dusty, high-density and patchy broad absorption line (BAL) screen covering ~90% of the observed continuum source at a distance less than ~2 – 20 pc. The FUV continuum emission does not show the presence of any obvious stellar features and is remarkably flat compared with the steeply declining NUV continuum. The NUV (FUV) features and continuum emission have not varied significantly over the past ~22 (3) years and are unresolved on scales ~40 (170) pc. These results favor an AGN origin for the NUV – FUV line and continuum emission. The observed FUV line emission is produced in the outflowing BAL cloud system, while the Balmer lines arise primarily from the standard broad line region seen through the dusty BAL screen. Our data are inconsistent with the recently proposed binary black hole model. We argue instead that Mrk 231 is the nearest example of weak-lined "wind-dominated" quasars with high Eddington ratios and geometrically thick ("slim") accretion disks; these quasars are likely more common in the early universe.

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Search for Molecular Outflows in Local Volume AGN with *Herschel*-PACS

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We present the results from a systematic search for galactic-scale, molecular (OH 119 μm) outflows in a sample of 52 Local Volume ($d < 50$ Mpc) Burst Alert Telescope detected active galactic nuclei (BAT AGN) with *Herschel*-PACS. We combine the results from our analysis of the BAT AGN with the published *Herschel*/PACS data of 43 nearby ($z < 0.3$) galaxy mergers, mostly ultraluminous infrared galaxies (ULIRGs) and QSOs. The objects in our sample of BAT AGN have, on average, $\sim 10 - 100$ times lower AGN luminosities, star formation rates (SFRs), and stellar masses than those of the ULIRG and QSO sample. OH 119 μm is detected in 42 of our BAT AGN targets. Evidence for molecular outflows (i.e. OH absorption profiles with median velocities more blueshifted than -50 km s^{-1} and/or blueshifted wings with 84-percentile velocities less than -300 km s^{-1}) is seen in only four BAT AGN (NGC 7479 is the most convincing case). Evidence for molecular inflows (i.e. OH absorption profiles with median velocities more redshifted than 50 km s^{-1}) is seen in seven objects, although an inverted P-Cygni profile is detected unambiguously in only one object (Circinus). Our data show that both the starburst and AGN contribute to driving OH outflows, but the fastest OH winds require AGN with quasar-like luminosities. We also confirm that the total absorption strength of OH 119 μm is a good proxy for dust optical depth as it correlates strongly with the 9.7 μm silicate absorption feature, a measure of obscuration originating in both the nuclear torus and host galaxy disk.

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The TANAMI Multiwavelength Program: Dynamic SEDs of Southern Blazars

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Simultaneous broadband spectral and temporal studies of blazars are an important tool for investigating active galactic nuclei (AGN) jet physics.We study the spectral evolution between quiescent and flaring periods of 22 radio-loud AGN through multi-epoch, quasi-simultaneous broadband spectra. For many of these sources these are the first broadband studies. We use a Bayesian block analysis of *Fermi*/LAT light curves in order to determine time ranges of constant flux for constructing quasi-simultaneous SEDs. The shapes of the resulting 81 SEDs are described by two logarithmic parabolas and a blackbody spectrum where needed. For low states the peak frequencies and luminosities agree well with the blazar sequence, higher luminosity implying lower peak frequencies. This is not true for sources in a high state. The γ-ray photon index in *Fermi*/LAT correlates with the synchrotron peak frequency in low and intermediate states. No correlation is present in high states. The black hole mass cannot be determined from the SEDs. Surprisingly, the thermal excess often found in FSRQs at optical/UV wavelengths can be described by blackbody emission and not an accretion disk spectrum.The "harder-when-brighter" trend, typically seen in X-ray spectra of flaring blazars, is visible in the blazar sequence. Our results for low and intermediate states, as well as the Compton dominance, are in agreement with previous results. Black hole mass estimates using the parameters from Bonchi (2013) are in agreement with some of the more direct measurements. For two sources, estimates disagree by more than four orders of magnitude, possibly due to boosting effects. The shapes of the thermal excess seen predominantly in flat spectrum radio quasars are inconsistent with a direct accretion disk origin.

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Special Announcements

Fizeau exchange visitors program - special call for applications

2016-02-10

The Fizeau exchange visitors program in optical interferometry funds (travel and accommodation) visits of researchers to an institute of his/her choice (within the European Community) to perform collaborative work and training on one of the active topics of the European Interferometry Initiative. The visits will typically last for one month, and strengthen the network of astronomers engaged in technical, scientific and training work on optical/infrared interferometry. The program is open for all levels of astronomers (Ph.D. students to tenured staff). non-EU based missions will only be funded if considered essential by the Fizeau Committee. Applicants are strongly encouraged to seek also partial support from their home or host institutions.

The **deadline for applications is June 15**. Fellowships can be awarded for missions carried out until the end of 2016! For missions in 2017 please wait for further announcements!

Further informations and application forms can be found at www.european-interferometry.eu

The program is funded by OPTICON/FP7.

Please distribute this message also to potentially interested colleagues outside of your community!

Looking forward to your applications,
Josef Hron & Laszlo Mosoni
(for the European Interferometry Initiative)

E-mail contact: fizeau@european-interferometry.eu

Meetings

Interdisciplinary Workshop on Time Series Analysis

Paris, France
June 17, 2016

Webpage: `https://indico.in2p3.fr/event/13186`
Email: `beckmann@apc.in2p3.fr`

Modern day research has entered an age where, as experiments grow larger and more complex, the amount of recorded data is increasing exponentially. The analysis of the time-series data associated with these experiments is now beginning to push both computational power and resources to their limit. In order to analyse data from current and future experiments, new technology, and the development of more efficient and smarter algorithms, are required.

This workshop, supported by the Mastodons TimeClean proposal, brings together data analysts from the fields of astrophysics, biology, computing science and engineering, and will focus on advances in both academia and industry in both algorithmic development and computing technology in the area of time-series analysis.

Organizing Committee:
C. Cavet, E. Porter (APC), S. Bernard, T. Palpanas (University Paris Descartes), D. Horan (LLR), S. Juneau (CEA), V. Beckmann (CNRS / IN2P3)

Invited Speakers:
Anthony Bagnall (University of East Anglia), Dimitrios Emmanoulopoulos (University of Southampton), Uri Hasson (University of Trento), Dohy Hong (Safran Tech), Eric Chassande-Mottin (APC Paris), Themis Palpanas (University Paris Descartes)

Registration is free but mandatory