Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
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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. As always, any suggestions or feedback regarding the newsletter are welcome.

Many thanks for your continued subscription.

Megan Argo

Abstracts of recently accepted papers

Half-Megasecond *Chandra* Spectral Imaging of the Hot Circumgalactic Nebula around Quasar Mrk 231

S. Veilleux[1,2], S. H. Teng[3], D. S. N. Rupke[4], R. Maiolino[5,6] and E. Sturm[7]

[1] Department of Astronomy, University of Maryland, College Park, MD 20742 USA
[2] Joint Space-Science Institute, University of Maryland, College Park, MD 20742, USA
[3] Observational Cosmology Laboratory, NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA
[4] Department of Physics, Rhodes College, Memphis, TN 38112, USA
[5] Cavendish Laboratory, University of Cambridge, 19 J.J. Thomson Ave., Cambridge, CB3 0HE, UK
[6] Kavli Institute for Cosmology, Madingley Road, Cambridge, CB3 0HA, UK
[7] Max-Planck-Institut für extraterrestrische Physik, Postfach 1312, D-85741 Garching, Germany

A deep 400-ksec ACIS-S observation of the nearest quasar known, Mrk 231, is combined with archival 120-ksec data to carry out the first ever spatially resolved spectral analysis of a hot X-ray emitting circumgalactic nebula around a quasar. The 65×50 kpc X-ray nebula shares no resemblance with the tidal debris seen at optical wavelengths. One notable exception is the small tidal arc $\sim$3.5 kpc south of the nucleus where excess soft X-ray continuum emission and Si XIII 1.8 keV line emission are detected, consistent with star formation and its associated alpha-element enhancement, respectively. An X-ray shadow is also detected at the location of the 15-kpc northern tidal tail. The hard X-ray continuum emission within $\sim$6 kpc of the center is consistent with being due entirely to the bright central AGN. The soft X-ray spectrum of the outer ($\gtrsim$6 kpc) portion of the nebula is best described as the sum of two thermal components with temperatures $\sim$3 and $\sim$8 million K and spatially uniform super-solar alpha-element abundances, relative to iron. This result implies enhanced star formation activity over $\sim 10^8$ yrs accompanied with redistribution of the metals on large scale. The low-temperature thermal component is not present within $\sim$6 kpc of the nucleus, suggesting extra heating in this region from the circumnuclear starburst, the central quasar, or the optically identified $\gtrsim$3-kpc quasar-driven outflow. The soft X-ray emission is weaker in the western quadrant, coincident with a deficit of Hα and some of the largest columns of neutral gas outflowing from the nucleus. Shocks may heat the gas to high temperatures at this location, consistent with the tentative $\sim$2-sigma detection of extended Fe XXV 6.7-keV line emission.

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E-mail contact: veilleux@astro.umd.edu
Preprint available at http://http://arxiv.org/abs/1405.4833

TANAMI Blazars in the IceCube PeV Neutrino Fields

Felicia Krauß[1,2], Matthias Kadler[2], Karl Mannheim[2], Robert Schulz[1,2], Jonas Trüstedt[1,2], Joern Wilms[1], Roopesh Ojha[3,4,5], Eduardo Ros[6,7,8], Gisela Anton[9], Wayne Baumgartner[3], Tobias Beuchert[1,2], Jay Blanchard[10], Christoph Bürkel[1,2], Bryce Carpenter[5], Thomas Eberl[9], Philip Edwards[11], Dorit Eisenacher[2], Dominik Elsässer[2], Kerstin Fehn[9], Ulf Fritsch[9], Neil Gehrels[3], Christina Gräfe[1,2], Christoph Großberger[12], Hayo Hase[13], Shinji Horiuchi[14], Clancy James[9], Alexander Kappes[2], Uli Katz[9], Annika Kreikenbohm[1,2], Ingo Kreykenbohm[1], Marcus Langejahn[1,2], Katharina Leiter[1,2], Eugenia Litzinger[1,2], James E. Lovell[15], Cornelia Müller[1,2], Chris Phillips[11], Christian Plötz[13], Jonathan Quick[16], Till Steinbring[1,2], Jamie Stevens[11], David J. Thompson[3] and Anastasios Tzioumis[11]

[1] Dr. Remeis Sternwarte & ECAP, Universität Erlangen-Nürnberg, Sternwartstrasse 7, 96049 Bamberg, Germany
[2] Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Emil-Fischer-Str. 31, 97074 Würzburg, Germany
[3] NASA, Goddard Space Flight Center, Greenbelt, MD 20771, USA
[4] University of Maryland, Baltimore County, Baltimore, MD 21250, USA
[5] Catholic University of America, Washington, DC 20064, USA
[6] Max-Planck-Institut für Radioastronomie, Auf dem Hügel 69, 53121 Bonn, Germany
[7] Departament d'Astronomia i Astrofísica, Universitat de València, C/ Dr. Moliner 50, 46100 Burjassot, València, Spain
[8] Observatori Astronòmic, C/ Catedrático José Beltrán no. 2, 46980 Paterna, València, Spain
[9] ECAP, Universität Erlangen-Nürnberg, Erwin-Rommel-Str. 1, 91058 Erlangen, Germany
[10] Departamento de Astronomía, Universidad de Concepción, Casilla 160, Chile
[11] CSIRO Astronomy and Space Science, ATNF, PO Box 76 Epping, NSW 1710, Australia
[12] Max-Planck-Institut für extraterrestrische Physik, Giessenbachstraße 1, 85741 Garching, Germany Bonn, Germany
[13] Bundesamt für Kartographie und Geodäsie, 93444 Bad Kötzting, Germany
[14] CSIRO Astronomy and Space Science, Canberra Deep Space Communications Complex, P.O. Box 1035, Tuggeranong, ACT 2901, Australia
[15] School of Mathematics & Physics, University of Tasmania, Private Bag 37, Hobart, Tasmania 7001, Australia
[16] Hartebeesthoek Radio Astronomy Observatory, Krugersdorp, South Africa

The IceCube Collaboration has announced the discovery of a neutrino flux in excess of the atmospheric background. Due to the steeply falling atmospheric background spectrum, events at PeV energies are most likely of extraterrestrial origin. We present the multiwavelength properties of the six radio brightest blazars positionally coincident with these events using contemporaneous data of the TANAMI blazar sample, including high-resolution images and spectral energy distributions. Assuming the X-ray to γ-ray emission originates in the photoproduction of pions by accelerated protons, the integrated predicted neutrino luminosity of these sources is large enough to explain the two detected PeV events.

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E-mail contact: Felicia.Krauss@fau.de
preprint available at http://arxiv.org/abs/1406.0645

Extreme CII emission in type 2 quasars at z∼2.5: a signature of κ-distributed electron energies?

A. Humphrey[1], L. Binette[2]

[1]Centro de Astrofísica da Universidade do Porto, Rua das Estrelas, 4150-762, Porto, Portugal. andrew.humphrey@astro.up.pt
[2]Instituto de Astronomía, Universidad Nacional Autónoma de México, D.F., Mexico

We investigate the flux ratio between the 1335 Å and 2326 Å lines of singly ionized carbon in the extended narrow line regions of type 2 quasars at z∼2.5. We find the observed CII λ1335 / CII] λ2326 flux ratio, which is not sensitive to the C/H abundance ratio, to be often several times higher than predicted by the canonical AGN photoionization models that use solar metallicity and a Maxwell-Boltzmann electron energy distribution. We study several potential solutions for this discrepancy: low gas metallicity, shock ionization, continuum fluorescence, and κ-distributed electron energies. Although we cannot definitively distinguish between several of the proposed solutions, we argue that a κ distribution gives the more natural explanation. We also provide a grid of AGN photoionization models using κ-distributed electron energies.

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E-mail contact: andrew.humphrey@astro.up.pt
Preprint available at http://arxiv.org/abs/1404.6434

Radio Source Evolution on Galactic Scales

T. Maciel[1] and P. Alexander[1]

[1] Astrophysics Group, Cavendish Laboratory, J. J. Thomson Ave, Cambridge CB3 0HE, UK

There is mounting evidence that mechanical radio source feedback is important in galaxy evolution and in order to quantify this feedback, detailed models of radio source evolution are required. We present an extension to current analytic models that encompasses young radio sources with physical sizes on sub-kiloparsec scales. This work builds on an existing young source dynamical model to include radiative losses in a flat environment, and as such, is the best physically-motivated compact symmetric object model to date. Results predict that young radio sources experience significant radiative loss on length scales and spectral scales consistent with observed compact steep spectrum sources. We include full expressions for the transition to self-similar expansion and present this complete model of radio source evolution from first cocoon formation to end of source lifetime around 10^8 years within the context of a simplified King profile external atmosphere.

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2D stellar population and gas kinematics of the inner kiloparsec of the post-starburst quasar SDSS J0330–0532

David Sanmartim[1], Thaisa Storchi-Bergmann[1] and Michael S. Brotherton[2]

[1] Universidade Federal do Rio Grande do Sul, IF, CP 15051, Porto Alegre 91501-970, RS, Brasil
[2] University of Wyoming, Department of Physics and Astronomy, Laramie, WY, 82071, USA

We have used optical Integral Field Spectroscopy in order to map the star formation history of the inner kiloparsec of the Post-Starburst Quasar (PSQ) J0330–0532 and to map its gas and stellar kinematics as well as the gas excitation. PSQs are hypothesized to represent a stage in the evolution of galaxies in which the star formation has been recently quenched due to the feedback of the nuclear activity, as suggested by the presence of the post-starburst population at the nucleus. We have found that the old stellar population (age ≥ 2.5 Gyr) dominates the flux at 5100 Å in the inner 0.26 kpc, while both the post-starburst (100 Myr $\leq$ age < 2.5 Gyr) and starburst (age < 100 Myr) components dominate the flux in a circumnuclear ring at ≈ 0.5 kpc from the nucleus. With our spatially resolved study we do not have found any post-starburst stellar population in the inner 0.26 kpc. On the other hand, we do see the signature of AGN feedback in this region, which does not reach the circumnuclear ring where the post-starburst population is observed. We thus do not support the quenching scenario for the SDSS J0330–0532. In addition, we have concluded that the strong signature of the post-starburst population in larger aperture spectra (e.g. from Sloan Digital Sky Survey) is partially due to the combination of the young and old age components. Based on the $\mathrm{M_{BH}} - \sigma_{\mathrm{star}}$ relationship and the stellar kinematics we have estimated a mass for the supermassive black hole of $1.48 \pm 0.66 \times 10^7$ $\mathrm{M_\odot}$.

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Theoretical Modeling of Emission-Line galaxies: New Classification Parameters for Mid-Infrared and Optical Spectroscopy

M. Meléndez[1], T. M. Heckman[1], M. Martínez-Paredes[2], S. B. Kraemer[3] and C. Mendoza[4]

[1]Department of Physics and Astronomy, Johns Hopkins University, Baltimore, MD, 21218, USA
[2]Instituto Nacional de Astrofísica, Óptica y Electrónica, Puebla, 72840, Mexico
[3]Department of Physics, The Catholic University of America,Washington, DC 20064, USA
[4]Centro de Física, IVIC, PO Box 20632, Caracas 1020A, Venezuela

We have carried out extensive and detailed photoionization modeling to successfully constrain the locations of different emission-line galaxies in optical and mid-infrared diagnostic diagrams. Our model grids cover a wide range in parameter space for the active galaxy continuum and starburst galaxies with different stellar population laws and metallicities. We compare the predicted AGN and star-formation mid-infrared line ratios [Ne III]15.56μm/[Ne II]12.81μm and [O IV]25.89μm/[Ne III]15.56μm to the observed values, and find that the best fit for the AGN is via a two-zone approximation. This two-zone approximation is a combination of a matter-bounded component, where [Ne III] and [O IV] are emitted efficiently, and a radiation-bounded component that maximizes [Ne II] emission. We overlay the predictions from this two-zone approximation onto the optical [O III]λ5007/Hβ and [N II]λ6583/Hα diagnostic diagram derived from the Sloan Digital Sky Survey, to find that the high-density and low-ionization radiation-bounded component in our two-zone AGN approximation model provides a good lower limit for [N II] emission. This establishes a new theoretical demarcation line for the minimum AGN contribution in this diagram. This new classification results by a factor of ~ 1.4 in a higher AGN population than predictions derived from previous divisions of star-forming galaxies. Similarly, we define a maximum AGN contribution in the [O III]/Hβ and [N II]/Hα diagram by using a two-zone approximation within a parameter range typical of the narrow-line region.

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Iron Kα emission in type-I and type-II Active Galactic Nuclei

C. Ricci[1], Y. Ueda[1], S. Paltani[2], K. Ichikawa[1], P. Gandhi[3], and H. Awaki[4]

[1] Department of Astronomy, Kyoto University, Oiwake-cho, Sakyo-ku, Kyoto 606-8502, Japan
[2] Department of Astronomy, University of Geneva, ch. d'Ecogia 16, 1290 Versoix, Switzerland
[3] Department of Physics, University of Durham, South Road, Durham DH1 3LE, UK
[4] Department of Physics, Ehime University, Matsuyama, 790-8577, Japan

The narrow Fe Kα line is one of the main signatures of the reprocessing of X-ray radiation from the material surrounding supermassive black holes, and it has been found to be omnipresent in the X-ray spectra of active galactic nuclei (AGN). In this work we study the characteristics of the narrow Fe Kα line in different types of AGN. Using the results of a large *Suzaku* study we find that Seyfert 2s have on average lower Fe Kα luminosities than Seyfert 1s for the same 10–50 keV continuum luminosity. Simulating dummy Seyfert 1s and Seyfert 2s populations using physical torus models of X-ray reflected emission, we find that this difference can be explained by means of different average inclination angles with respect to the torus, as predicted by the unified model. Alternative explanations include differences in the intensities of Compton humps, in the photon index distributions or in the average iron abundances. We show that the ratio between the flux of the broad and narrow Fe Kα line in the 6.35–6.45 keV range depends on the torus geometry considered, and is on average $< 25\%$ and $< 15\%$ for type I and type II AGN, respectively. We find evidence of absorption of the narrow Fe Kα line flux in Compton-thick AGN, which suggests that part of the reflecting material is obscured. We estimate that on average in obscured AGN the reflected radiation from neutral material is seen through a column density which is 1/4 of that absorbing the primary X-ray emission. This should be taken into account in synthesis models of the CXB and when studying the luminosity function of heavily obscured AGN. We detect the first evidence of the X-ray Baldwin effect in Seyfert 2s, with the same slope as that found for Seyfert 1s, which suggests that the mechanism responsible for the decrease of the equivalent width with the continuum luminosity is the same in the two classes of objects.

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E-mail contact: ricci@kusastro.kyoto-u.ac.jp
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A large sample of Kohonen-selected SDSS quasars with weak emission lines: selection effects and statistical properties

H. Meusinger[1] and N. Balafkan[2]

[1] Thüringer Landessternwarte Tautenburg, Sternwarte 5, D–07778 Tautenburg, Germany
[2] University Leipzig, Faculty of Physics and Earth Sciences, Linnèstr. 5, 04103 Leipzig, Germany

We performed a search for weak emission line quasars (WLQs) in the spectroscopic data from the Sloan Digital Sky Survey Data Release 7 based on Kohonen self-organising maps for nearly 10^5 quasar spectra. The final sample consists of 365 quasars and includes in particular a subsample of 46 WLQs with low equivalent widths $W(\mathrm{Mg\ II}) < 11$ Å and $W(\mathrm{C\ IV}) < 4.8$ Å. We compared various properties of the WLQs with those of control samples of ordinary quasars. Particular attention was paid to selection effects. The WLQs have, on average, significantly higher luminosities, Eddington ratios, and accretion rates. About half of the excess comes from a selection bias, but an intrinsic excess remains probably caused primarily by higher accretion rates. The spectral energy distribution shows a bluer continuum at rest-frame wavelengths longer than ~ 1500 Å. The variability in the optical and UV is relatively low, even taking the variability-luminosity anti-correlation into account. The percentage of radio detected quasars and of core-dominant radio sources is significantly higher than for the control sample, whereas the mean radio-loudness is lower. We argue that the properties of our WLQ sample can be consistently understood assuming that it consists of a mix of quasars at the beginning of a stage of increased accretion activity and of beamed radio-quiet quasars.

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Molecular line emission in NGC1068 imaged with ALMA. I An AGN-driven outflow in the dense molecular gas

S. García-Burillo[1], F. Combes[2], A. Usero[1], S. Aalto[3], M. Krips[4], S. Viti[5], A. Alonso-Herrero[6], L. K. Hunt[7], E. Schinnerer[8], A. J. Baker[9], F. Boone[10], V. Casasola[11], L. Colina[12], F. Costagliola[13], A. Eckart[14], A. Fuente[1], C. Henkel[15,16], A. Labiano[1,17], S. Martín[4], I. Márquez[13], S. Muller[3], P. Planesas[1], C. Ramos Almeida[18,19], M. Spaans[20], L. J. Tacconi[21] and P. P. van der Werf[22]

[1]Observatorio Astronómico Nacional (OAN)-Observatorio de Madrid, Alfonso XII, 3, 28014-Madrid, Spain
[2]Observatoire de Paris, LERMA, CNRS, 61 Av. de l'Observatoire, 75014-Paris, France
[3]Department of Earth and Space Sciences, Chalmers University of Technology, Onsala Observatory, 439 94-Onsala, Sweden
[4]Institut de Radio Astronomie Millimétrique (IRAM), 300 rue de la Piscine, Domaine Universitaire de Grenoble, 38406-St.Martin d'Hères, France
[5]Department of Physics and Astronomy, UCL, Gower Place, London WC1E 6BT, UK
[6]Instituto de Física de Cantabria, CSIC-UC, E-39005 Santander, Spain. Augusto G. Linares Senior Research Fellow
[7]INAF-Osservatorio Astrofisico di Arcetri, Largo Enrico Fermi 5, 50125-Firenze, Italy
[8]Max-Planck-Institut für Astronomie, Königstuhl, 17, 69117-Heidelberg, Germany
[9]Department of Physics and Astronomy, Rutgers, The State University of New Jersey, Piscataway, NJ 08854, USA
[10]Université de Toulouse, UPS-OMP, IRAP, 31028, Toulouse, France
[11]INAF - Istituto di Radioastronomia, via Gobetti 101, 40129, Bologna, Italy
[12]Centro de Astrobiología (CSIC-INTA), Ctra de Torrejón a Ajalvir, km 4, 28850 Torrejón de Ardoz, Madrid, Spain
[13]Instituto de Astrofísica de Andalucía (CSIC), Apdo 3004, 18080-Granada, Spain
[14]I. Physikalisches Institut, Universität zu Köln, Zülpicher Str. 77, 50937, Köln, Germany
[15]Max-Planck-Institut für Radioastronomie, Auf dem Hügel 69, 53121, Bonn, Germany
[16]Astronomy Department, King Abdulazizi University, P. O. Box 80203, Jeddah 21589, Saudi Arabia
[17]Institute for Astronomy, Department of Physics, ETH Zurich, CH-8093 Zurich, Switzerland
[18]Instituto de Astrofísica de Canarias, Calle Vía Láctea, s/n, E-38205 La Laguna, Tenerife, Spain
[19]Departamento de Astrofísica, Universidad de La Laguna, E-38205, La Laguna, Tenerife, Spain
[20]Kapteyn Astronomical Institute, University of Groningen, PO Box 800, NL-9700 AV Groningen
[21]Max-Planck-Institut für extraterrestrische Physik, Postfach 1312, 85741-Garching, Germany
[22]Leiden Observatory, Leiden University, PO Box 9513, 2300 RA Leiden, Netherlands

We investigate the fueling and the feedback of star formation and nuclear activity in NGC 1068, a nearby (D=14 Mpc) Seyfert 2 barred galaxy, by analyzing the distribution and kinematics of the molecular gas in the disk. We have used ALMA to map the emission of a set of dense molecular gas tracers (CO(3–2), CO(6–5), HCN(4–3), HCO^+(4–3) and CS(7–6)) and their underlying continuum emission in the central $r \sim 2$ kpc of NGC 1068 with spatial resolutions $\sim 0.3" - 0.5"$ ($\sim 20 - 35$ pc). Molecular line and dust continuum emissions are detected from a $r \sim 200$ pc off-centered circumnuclear disk (CND), from the 2.6 kpc-diameter bar region, and from the $r \sim 1.3$ kpc starburst (SB) ring. Most of the emission in HCO^+, HCN and CS stems from the CND. Molecular line ratios show dramatic order-of-magnitude changes inside the CND that are correlated with the UV/X-ray illumination by the AGN, betraying ongoing feedback. The gas kinematics from $r \sim 50$ pc out to $r \sim 400$ pc reveal a massive ($M_{mol} \sim 2.7^{+0.9}_{-1.2}) \times 10^7 M_\odot$) outflow in all molecular tracers. The tight correlation between the ionized gas outflow, the radio jet and the occurrence of outward motions in the disk suggests that the outflow is AGN-driven. The outflow rate estimated in the CND, $dM/dt \sim 63^{+21}_{-37} M_\odot yr^{-1}$, is an order of magnitude higher than the star formation rate at these radii, confirming that the outflow is AGN-driven. The power of the AGN is able to account for the estimated momentum and kinetic luminosity of the outflow. The CND mass load rate of the CND outflow implies a very short gas depletion time scale of ≤ 1 Myr.

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E-mail contact: s.gburillo@oan.es
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Meetings

PhD course: Introduction to sub-mm interferometry and science with ALMA

Place: Dark Cosmology Centre (DARK), Niels Bohr Institute, University of Copenhagen Dates: 13-21 August, 2014

Webpage: http://dark.nbi.ku.dk/calendar/calendar2014/interferometry_science_course/
Email: mcl@dark-cosmology.dk

DARK Associate Professors, Marianne Vestergaard and Lise Christensen, along with Wouter Vlemmings from the Nordic ALMA regional centre (ARC), Chalmers University of Technology and Sé bastien Mü ller (ARC) will provide a 10-day course on research and observations with the Atacama Large Millimeter Array (ALMA) with fellow instructors Ivan Marti-Vidal (ARC) and Matthias Maercker (ARC). Several talks on possible science with ALMA covering many subfields of astronomy will be held by Kirsten Kraiberg Knudsen (Chalmers Technical University, Onsala), and DARK Fellow Julie Wardlow, among others. The interferometry experts will provide background reading and lectures on interferometry. Exercises will include hands-on tutorials and exercises, including introduction to and use of the data manipulation and analysis software CASA, feasibility calculations and technical computations relevant for proposal preparations, hints on proposal writing, and possibly small science projects.

The course will provide 2.5 ETCS points for student not participating in the exercises and the exam and 5 ETCS points for students participating in the exercises//project work. There is no fee for attending the course, but students coming from outside of Copenhagen will have to cover their own transport and housing costs. There is a limited space available; the list of participants will be confirmed later this spring and early summer.