| Active Galaxies Newsletter | *An electronic publication dedicated to the observation and theory of active galaxies* |
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| No. 156 — March 2010 | Editor: Janine van Eymeren (agnews@manchester.ac.uk) |

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# From the Editor

The Active Galaxies Newsletter is produced monthly. The deadline for contributions is the last friday of the month. 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 as editor of the newsletter I am very interested to hear any suggestions or feedback regarding the newsletter. So do not hesitate in emailing me your suggestions.

Many thanks for your continued subscription.

Janine van Eymeren

# Abstracts of recently accepted papers

## Supermassive Black-Hole Growth Over Cosmic Time: Active Galaxy Demography, Physics, and Ecology from Chandra Surveys

**W.N. Brandt[1] and D.M. Alexander[2]**

[1] Department of Astronomy & Astrophysics, The Pennsylvania State University, 525 Davey Lab, University Park, PA 16802, USA
[2] Department of Physics, Durham University, South Road, Durham DH1 3LE, UK

Extragalactic X-ray surveys over the past decade have dramatically improved understanding of the majority populations of active galactic nuclei (AGNs) over most of the history of the Universe. Here we briefly highlight some of the exciting discoveries about AGN demography, physics, and ecology with a focus on results from Chandra. We also discuss some key unresolved questions and future prospects.

To appear in Proceedings of the National Academy of Sciences, invited review from the symposium "Chandra's First Decade of Discovery", September 2009, Boston, Massachusetts

E-mail contact: niel@astro.psu.edu,
Preprint available at http://arxiv.org/abs/1001.5054

## H I 21-cm absorption and unified schemes of active galactic nuclei

**S. J. Curran[1] & M. T. Whiting[2]**

[1]School of Physics, University of New South Wales, Sydney NSW 2052, Australia
[2]CSIRO Australia Telescope National Facility, PO Box 76, Epping NSW 1710, Australia

In a recent study of $z \geq 0.1$ active galactic nuclei (AGN), we found that 21-cm absorption has never been detected in objects in which the ultra-violet luminosity exceeds $L_{\rm UV} \sim 10^{23}$ W Hz$^{-1}$. In this paper, we further explore the implications that this has for the currently popular consensus that it is the orientation of the circumnuclear obscuring torus, invoked by unified schemes of AGN, which determines whether absorption is present along our sight-line. The fact that at $L_{\rm UV} \lesssim 10^{23}$ W Hz$^{-1}$, both type-1 and type-2 objects exhibit a 50% probability of detection, suggests that this is not the case and that the bias against detection of H I absorption in type-1 objects is due purely to the inclusion of the $L_{\rm UV} \gtrsim 10^{23}$ W Hz$^{-1}$ sources. Similarly, the ultra-violet luminosities can also explain why the presence of 21-cm absorption shows a preference for radio galaxies over quasars and the higher detection rate in compact sources, such as CSS or GPS sources, may also be biased by the inclusion of high-luminosity sources. Being comprised of all 21-cm searched sources at $z \geq 0.1$, this is a necessarily heterogeneous sample, the constituents of which have been observed by various instruments. By this same token, however, the dependence on the UV luminosity may be an all encompassing effect, superseding the unified schemes model, although there is the possibility that the exclusive 21-cm non-detections at high UV luminosities could be caused by a bias towards gas-poor ellipticals. Additionally, the high UV fluxes could be sufficiently exciting/ionising the H I above 21-cm detection thresholds, although the extent to which this is related to the neutral gas deficit in ellipticals is currently unclear.

Examining the moderate UV luminosity ($L_{\rm UV} \lesssim 10^{23}$W Hz$^{-1}$) sample further, from the profile widths and offsets from the systemic velocities, we find no discernible differences between the two AGN types. This may suggest that the bulk of the absorption generally occurs in the galactic disk, which must therefore be randomly orientated with respect to the circumnuclear torus. Furthermore, we see no difference in the reddening between the two AGN types, indicating, like the 21-cm absorption, that the orientation of the torus has little bearing on this. We also find a correlation between 21-cm line strength and the optical-near-infrared colour, which suggests that the reddening is caused by dust located in the large-scale, H I absorbing disk which intervenes the sight-line to the AGN.

Accepted by ApJ

E-mail contact: sjc@phys.unsw.edu.au,
preprint available at http://arxiv.org/abs/0902.3493

## High resolution X-ray spectroscopy and imaging of Mrk 573

**Stefano Bianchi**[1], **Marco Chiaberge**[2,3], **Daniel A. Evans**[4], **Matteo Guainazzi**[5], **Ranieri D. Baldi**[6], **Giorgio Matt**[1], **Enrico Piconcelli**[7]

[1] Dipartimento di Fisica, Università degli Studi Roma Tre, via della Vasca Navale 84, 00146 Roma, Italy
[2] Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218
[3] INAF-IRA, Via P. Gobetti 101, I-40129 Bologna, Italy
[4] MIT Kavli Institute for Astrophysics and Space Research / Harvard University
[5] XMM-Newton Science Operations Center, European Space Astronomy Center, ESA, Apartado 50727, E-28080 Madrid, Spain
[6] Università di Torino, via P. Giuria 1, 10125 Torino, Italy
[7] Osservatorio Astronomico di Roma (INAF), Via Frascati 33, I-00040 Monte Porzio Catone, Italy

We present a detailed analysis of the XMM-*Newton* RGS high resolution X-ray spectra of the Seyfert 2 galaxy, Mrk 573. This analysis is complemented by the study of the *Chandra* image, and its comparison to optical (*HST*) and radio (*VLA*) data. The soft X-ray emission is mainly due to gas photoionised by the central AGN, as indicated by the detection of radiative recombination continua from O VII and O VIII, as well as by the prominence of the O VII forbidden line. This result is confirmed by the best fit obtained with a self-consistent CLOUDY photoionisation model. However, a collisionally excited component is also required, in order to reproduce the Fe XVII lines, accounting for about 1/3 of the total luminosity in the 15-26 Å band. Once adopted the same model in the *Chandra* ACIS data, another photoionised component, with higher ionisation parameter, is needed to take into account emission from higher Z metals. The broadband ACIS spectrum also confirms the Compton-thick nature of the source. The imaging analysis shows the close morphological correspondence between the soft X-ray and the [O III] emission. The radio emission appears much more compact, although clearly aligned with the narrow line region. The collisional phase of the soft X-ray emission may be due to starburst, requiring a star formation rate of $\simeq 5 - 9$ M$_\odot$ yr$^{-1}$, but there is no clear evidence of this kind of activity from other wavelengths. On the other hand, it may be related to the radio ejecta, responsible for the heating of the plasma interacting with the outflow, but the estimated pressure of the hot gas is much larger than the pressure of the radio jets, assuming equipartition and under reasonable physical parameters.

Accepted by MNRAS

E-mail contact: bianchi@fis.uniroma3.it,
preprint available at http://arxiv.org/abs/1002.0800

## Investigating the complex X-ray spectrum of a broad-line 2MASS red quasar: XMM-Newton observation of FTM 0830+3759

**Enrico Piconcelli[1], Cristian Vignali[2], Stefano Bianchi[3], Fabrizio Nicastro[1,4,5], Giovanni Miniutti[6] and Fabrizio Fiore[1]**

[1] Osservatorio Astronomico di Roma (INAF), Via Frascati 33, I-00040 Monte Porzio Catone, Italy
[2] Dipartimento di Astronomia, Università di Bologna, Via Ranzani 1, I-40127 Bologna, Italy
[3] Dipartimento di Fisica, Università degli Studi Roma Tre, via della Vasca Navale 84, I–00146 Roma, Italy
[4] IESL, Foundation for Research and Technology, 711 10, Heraklion, Crete, Greece
[5] Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, MS-04, Cambridge, MA 02155, USA
[6] LAEX, Centro de Astrobiologia (CSIC-INTA) LAEFF, PO Box 78, E-28691 Villanueva de la Cañada, Madrid, Spain

We report results from a 50 ks XMM–Newton observation of the dust-reddened broad-line quasar FTM 0830+3759 ($z = 0.413$) selected from the FIRST/2MASS Red Quasar survey. For this AGN, a very short 9 ks Chandra exposure had suggested a feature-rich X-ray spectrum and *HST* images revealed a very disturbed host galaxy morphology. Contrary to classical, optically-selected quasars, the X-ray properties of *red* (i.e. with $J - K_s > 1.7$ and $R - K_s > 4.0$) broad line quasars are still quite unexplored, although there is a growing consensus that, due to moderate obscuration, these objects can offer a unique view of spectral components typically swamped by the AGN light in normal, *blue* quasars. The XMM–Newton observation discussed here has definitely confirmed the complexity of the X-ray spectrum revealing the presence of a cold (or mildly-ionized) absorber with $N_H \approx 10^{22}$ cm$^{-2}$ along the line of sight to the nucleus and a Compton reflection component accompanied by an intense Fe K$\alpha$ emission line in this quasar with a $L_{2-10keV} \approx 5 \times 10^{44}$ erg s$^{-1}$. A *soft-excess* component is also required by the data. The match between the column density derived by our spectral analysis and that expected on the basis of reddening due to the dust suggests the possibility that both absorptions occur in the same medium. FTM 0830+3759 is characterized by an extinction/absorption-corrected X-ray-to-optical flux ratio $\alpha_{ox} = -2.3$, that is steeper than expected on the basis of its UV luminosity. These findings indicate that the X-ray properties of FTM 0830+3759 differs from those typically observed for optically-selected broad line quasars with comparable hard X-ray luminosity.

Accepted by The Astrophysical Journal

E-mail contact: piconcelli@oa-roma.inaf.it,
preprint available at http://arxiv.org/abs/1001.2404

## Intermediate age stars as origin of the low velocity dispersion nuclear ring in Mrk 1066

**Rogemar A. Riffel[1,2], Thaisa Storchi-Bergmann[2], Rogério Riffel[2] and Miriani G. Pastoriza[2]**

[1] Universidade Federal de Santa Maria, Departamento de Física, Centro de Ciências Naturais e Exatas, 97105-900, Santa Maria, RS, Brazi
[2] Universidade Federal do Rio Grande do Sul, Departamento de Astronomia, Instituto de Física, CP 15051, 91501-970, Porto Alegre, RS, Brazi

We report the first two-dimensional stellar population synthesis in the near-infrared of the nuclear region of an active galaxy, namely Mrk 1066. We have used integral field spectroscopy with adaptative optics at the Gemini North Telescope to map the to map the age distribution of the stellar population in the inner 300 pc at a spatial resolution of 35 pc. An old stellar population component (age ¿5 Gyr) is dominant within the inner ≈ 160 pc, which we attribute to the galaxy bulge. Beyond this region, up to the borders of the observation field (∼ 300 pc), intermediate age components (0.3–0.7 Gyr) dominate. We find a spatial correlation between this intermediate age component and a partial ring of low stellar velocity dispersions ($\sigma_*$). Low-$\sigma_*$ nuclear rings have been observed in other active galaxies and our result for Mrk 1066 suggests that they are formed by intermediate age stars. This age is consistent with an origin for the low-$\sigma_*$ rings in a past event which triggered an inflow of gas and formed stars which still keep the colder kinematics (as compared to that of the bulge) of the gas from which they have formed. At the nucleus proper we detect, in addition, two unresolved components: a compact infrared source, consistent with an origin in hot dust with mass $\approx 1.9 \times 10^{-2}$ M$_\odot$, and a blue featureless power-law continuum, which contributes with only ≈15% of the flux at 2.12 $\mu$m.

Accepted by ApJ

E-mail contact: rogemar@smail.ufsm.br,
preprint available at arXiv:1002.2534

## Demystifying the coronal line region of active galactic nuclei: spatially resolved spectroscopy with HST

**Ximena Mazzalay[1,2], Alberto Rodríguez-Ardila[3] and S. Komossa[2]**

[1] Instituto de Astronomía Teórica y Experimental, CONICET-UNC, Laprida 854, X5000BGR, Córdoba, Argentina
[2] Max-Planck-Institut für extraterrestrische Physik, Postfach 1312, 85741 Garching, Germany
[3] Laboratório Nacional de Astrofísica, Rua dos Estados Unidos 154, Bairro das Nacöes, CEP 37500-000, Itajubá, MG, Brazil

We present an analysis of STIS/HST optical spectra of a sample of ten Seyfert galaxies aimed at studying the structure and physical properties of the coronal-line region (CLR). The high-spatial resolution provided by STIS allowed us to resolve the CLR and obtain key information about the kinematics of the coronal-line gas, measure directly its spatial scale, and study the mechanisms that drive the high-ionisation lines. We find CLRs extending from just a few parsecs ($\sim 10$ pc) up to 230 pc in radius, consistent with the bulk of the coronal lines (CLs) originating between the BLR and NLR, and extending into the NLR in the case of [Fe VII] and [Ne V] lines. The CL profiles strongly vary with the distance to the nucleus. We observed line splitting in the core of some of the galaxies. Line peak shifts, both red- and blue-shifts, typically reached 500 km s$^{-1}$, and even higher velocities (1000 km s$^{-1}$) in some of the galaxies. In general, CLs follow the same pattern of rotation curves as low-ionisation lines like [O III]. ¿From a direct comparison between the radio and the CL emission we find that neither the strength nor the kinematics of the CLs scale in any obvious and strong way with the radio jets. Moreover, the similarity of the flux distributions and kinematics of the CLs and low-ionisation lines, the low temperatures derived for the gas, and the success of photoionisation models to reproduce, within a factor of few, the observed line ratios, point towards photoionisation as the main driving mechanism of CLs.

Accepted by MNRAS

E-mail contact: ximena@mpe.mpg.de,
preprint available at http://arxiv.org/abs/1002.3152

## Significant X-ray Line Emission in the 5-6 keV band of NGC 4051

**T.J.Turner[1,2], L.Miller[3], J.N.Reeves[4], A.Lobban[3], V.Braito[5], S.B.Kraemer[6,2] and D.M.Crenshaw[7]**

[1] Department of Physics, University of Maryland Baltimore County, Baltimore, MD 21250
[2] Astrophysics Science Division, NASA/GSFC, Greenbelt, MD 20771, U.S.A
[3] Dept. of Physics, University of Oxford, Denys Wilkinson Building, Keble Road, Oxford OX1 3RH, U.K.
[4] Astrophysics Group, School of Physical and Geographical Sciences, Keele University, Keele, Staffordshire ST5 5BG, U.K
[5] Department of Physics and Astronomy, University of Leicester, University Road, Leicester LE1 7RH, UK
[6] Institute for Astrophysics and Computational Sciences, Department of Physics, The Catholic University of America, Washington, DC 20064
[7] Department of Physics and Astronomy, Georgia State University, Astronomy Offices, One Park Place South SE, Suite 700, Atlanta, GA 30303, USA

A *Suzaku* X-ray observation of NGC 4051 taken during 2005 Nov reveals line emission at 5.44 keV in the rest-frame of the galaxy which does not have an obvious origin in known rest-frame atomic transitions. The improvement to the fit statistic when this line is accounted for establishes its reality at $> 99.9\%$ confidence: we have also verified that the line is detected in the three XIS units independently. Comparison between the data and Monte Carlo simulations shows that the probability of the line being a statistical fluctuation is $p < 3.3 \times 10^{-4}$. Consideration of three independent line detections in *Suzaku* data taken at different epochs yields a probability $p < 3 \times 10^{-11}$ and thus conclusively demonstrates that it cannot be a statistical fluctuation in the data. The new line and a strong component of Fe K$\alpha$ emission from neutral material are prominent when the source flux is low, during 2005. Spectra from 2008 show evidence for a line consistent with having the same flux and energy as that observed during 2005, but inconsistent with having a constant equivalent width against the observed continuum. The stability of the line flux and energy suggests that it may not arise in transient hotspots, as has been suggested for similar lines in other sources, but could arise from a special location in the reprocessor, such as the inner edge of the accretion disk. Alternatively, the line energy may be explained by spallation of Fe into Cr, as discussed in a companion paper.

Accepted by Ap.J

Preprint available as arXiv1002.0082

## Deep GMRT 150 MHz observations of the LBDS-Lynx region: Ultra-Steep Spectrum Radio Sources

**C. H. Ishwara-Chandra[1,2], S. K. Sirothia[1], Y. Wadadekar[1], S. Pal[3], R. Windhorst[4]**

[1]National Centre for Radio Astrophysics, TIFR, Post Bag No. 3., Ganeshkhind, Pune 411007, India

[2]Inter-University Centre for Astronomy and Astrophysics, Post Bag 4, Ganeshkhind, Pune 411007, India
[3]International Centre for Radio Astronomical Research, University of Western Australia, 35 Stirling Highw ay, WA, 6009, Australia
[4]School of Earth & Space Exploration, Arizona State University P.O. Box 871404 Tempe, AZ 85287-1404, USA

It has been known for nearly three decades that high redshift radio galaxies exhibit steep radio spectra, and hence ultra-steep spectrum radio sources provide candidates for high-redshift radio galaxies. Nearly all radio galaxies with $z > 3$ have been found using this redshift-spectral index correlation. We have started a programme with the Giant Metrewave Radio Telescope (GMRT) to exploit this correlation at flux density levels about 10 to 100 times deeper than the known high-redshift radio galaxies which were identified primarily using the already available radio catalogues. In our programme, we have obtained deep, high resolution radio observations at 150 MHz with GMRT for several *'deep'* fields which are well studied at higher radio frequencies and in other bands of the electromagnetic spectrum, with an aim to detect candidate high redshift radio galaxies. In this paper we present results from the deep 150 MHz observations of LBDS-Lynx field, which has been already imaged at 327, 610 and 1412 MHz with the Westerbork Synthesis Radio Telescope (WSRT) and at 1400 and 4860 MHz with the Very Large Array (VLA). The 150 MHz image made with GMRT has a rms noise of $\sim 0.7$ mJy/beam and a resolution of $\sim 19'' \times 15''$. It is the deepest low frequency image of the LBDS-Lynx field. The source catalog of this field at 150 MHz has about 765 sources down to $\sim 20\%$ of the primary beam response, covering an area of about 15 degree$^2$. Spectral index was estimated by cross correlating each source detected at 150 MHz with the available observations at 327, 610, 1400 and 4860 MHz and also using available radio surveys such as WENSS at 327 MHz and NVSS and FIRST at 1400 MHz. We find about 150 radio sources with spectra steeper than 1. About two-third of these are not detected in Sloan Digital Sky Survey, hence are strong candidate high-redshift radio galaxies, which need to be further explored with deep infra-red imaging and spectroscopy to estimate the redshift.

Accepted by MNRAS

E-mail contact: ishwar@ncra.tifr.res.in,
preprint available at arXiv:1002.0691

## A new publicly available code for AGN : TITAN

TITAN is a computer program for calculating the interactions of a dilute medium with electromagnetic radiation. It is specifically designed for warm-hot and thick media emitting and absorbing in the X-ray range.

It includes all atomic processes: absorption, recombination, diffusion, excitation, de-excitation of atoms and ions, heating and cooling, and it solves the radiation transfer in order to obtain the spectra reemitted by the medium. It handles a plane-parallel slab in non LTE steady state, for various physical conditions and incident spectra, valid in many astrophysical situations. The physical parameters, ionisation degrees, temperature, density, and the radiation spectrum, are computed in each point of the slab, by solving simultaneously the ionisation, statistical equilibrium, energy balance equations, eventually the pressure equilibrium equations, and the radiation transfer, using an iteration process (cf. for instance : Dumont A.-M., Abrassart A. & Collin S., 2000, A&A, 357,823, Dumont A.-M. & Collin S., 2001, ASPC..247..231, and Chevallier L. et al., 2006, A&A 449, 493).

The most important features are :

- the radiation transfer equation is solved for the continuum and for the lines (without resorting to escape probabilities), using a competitive method called accelerated lambda iteration (ALI), which essures a very accurate transfer computation inside thick clouds, at the expense of a long computation time;
- the radiation transfer equation is solved for several directions, thus permitting various direction illuminations;
- the whole specific intensity is treated, without distinction between diffuse or reemitted radiation and incident absorbed radiation;
- it solves the full matrix statistical equations, taking into account recombinations onto the excited levels;
- the geometry is plane-parallel.

An "alpha" version of the web interface to the code TITAN is available from internet through the VO application VODesktop from the Astrogrid project (http://www.astrogrid.org). The IVOA ressource name is ivo://obspm.fr/titan. Note that some options in the original code are still not available from internet, in particular the constant pressure option.

A description of the code and of the physical processes as well as a user's guide for the AstroGrid version (Virtual Observatory users Guide) are available at http://titan.obspm.fr

E-mail contact: anne-marie.dumont@obspm.fr

# Meetings

## 460th WE-Heraeus Seminar: Black Holes

Bad Honnef, Germany
June 6-11, 2010

**Webpage:** http://www.xray.mpe.mpg.de/ skomossa/Heraeus460/index.html
**Email:** skomossa@mpe.mpg.de

The last decade has witnessed rapid progress in the astrophysical study of black holes. Observations have shown that many nearby galaxies host supermassive black holes at their centers, and have established an intimate link between the masses of the black holes and the properties of their host galaxies. Measurements in the high-energy X-ray regime have allowed us to study the conditions of matter in the immediate vicinity of black holes, and to probe down to scales very close to the actual event horizon of black holes. Breakthroughs in numerical relativity have made it possible, for the first time, to compute the merging of two supermassive black holes. Within the next ten years, ground-based gravitational wave detectors like LIGO and VIRGO will begin making regular observations of merging stellar-mass black holes out to redshifts of $\sim$0.3. Future space-based observatories like IXO will measure X-rays from the first accreting massive black holes in the Universe, while LISA will detect gravitational waves from coalescing supermassive black hole binaries throughout the Universe. Gravitational wave and electromagnetic astronomy have previously been rather disjoint fields of research. A key goal of this seminar is to bring together researchers in these two fields, and to provide a forum for lively discussions, with an emphasis on the electromagnetic and gravitational wave signatures of strong gravity.

The seminar will focus on the following key topics: (1) Astrophysical observations and physics of black holes, and probes of strong gravity.
(2) Formation and growth of supermassive black holes across cosmic times, co-evolution of galaxies and black holes.
(3) Galaxy mergers, formation and coalescence of binary supermassive black holes.
(4) Gravitational wave emission from compact objects.
(5) Current and future ground- and space-based missions which are devoted to the study of gravitational waves and electromagnetic radiation from (the environment of) black holes.
(6) Electromagnetic signatures of black hole binaries and recoiling black holes.

The seminar will consist of invited review talks (35+5min), contributed talks (15+5 min), and posters. The number of participants is limited to 70. Selection will be made on a “first come, first serve basis. There is no conference fee. Deadline for registration is March 10, 2010.

## 10th EVN Symposium 2010: VLBI and the new generation of radio arrays

Manchester, UK
September 20th-24th, 2010

**Webpage:** http://www.jodrellbank.manchester.ac.uk/meetings/evn2010
**Email:** evnsymp2010@jb.man.ac.uk

SCIENTIFIC RATIONALE: Jodrell Bank Centre for Astrophysics and the University of Manchester, on behalf of the European VLBI Consortium, will host the 10th European VLBI Network Symposium from September 20th to 24th, 2010. The Symposium will be held at the University of Manchester, UK.

At this conference the latest scientific results and technical developments from VLBI and e-VLBI results will be reported. The timing of this meeting coincides with the development of, and first results from a number of new and upgraded radio facilities around the globe, such as e-MERLIN, LOFAR, EVLA, ALMA, and the SKA pathfinders ASKAP and MeerKAT. This meeting will incorporate some of the firs results from these new instruments, in addition to the unique scientific and technical contribution of VLBI in this new era of radio astronomy.

PLANNED SCIENCE SESSIONS will include: Life cycle of matter in stars and galaxies; AGN and cosmic star-formation; Extreme Astrophysics; Astrometry, Geodesy, space and planetary science; and Techniques & developments.

VENUE: The conference will be held in the University of Manchester’s conference venue, the Weston Building, which is situated in city centre of Manchester. Manchester itself is a vibrant city with ample attractions and amenities for all visitors. Block bookings of rooms for the duration of the meeting at the conference venue itself. Further information regarding this conference as well as specific details regarding the venue and accommodation will available shortly on the conference website and in subsequent announcements. This meeting will also incorporate the EVN Users meeting and a trip to Jodrell Bank Observatory.

# Jobs

## Postdoctoral and PhD Research Positions

Instituto de Astrofísica de Andalucía (CSIC), Granada, Spain
22 February 2010

The Relativistic Jets and Blazars group at the Instituto de Astrofísica de Andalucía (CSIC) invites applications for *one two-year postdoctoral research position* and *one four-year PhD position*.

Our research group is focussed on the study of relativistic jets commonly present in active galactic nuclei. In particular we are interested in obtaining a better understanding of the role played by the magnetic field in the jet formation, dynamics, and high energy emission. This research is carried out through observations at multiple wavelengths, from radio -mainly VLBI- to optical, and higher energies. The interpretation of the observational results is performed through comparison with numerical models of the non-thermal emission from these objects.

We are therefore looking for a postdoctoral researcher with experience in either observations or simulations of relativistic jets, mainly in AGN, although experience in other sources of relativistic jets, like GRBs or microquasars, would be also helpful. Our main observational expertise is that of VLBI observations, specially in polarimetric mode and at high frequencies, so any experience in radio interferometry would be highly valuable, but not necessary. Our simulations are aimed to obtain synthetic emission maps/light curves that can be directly compared with observations, so to better constrain the physical properties of the source, specially the magnetic field. Hence, any knowledge of RMHD, synchrotron, and inverse Compton emission would be very useful.

Interested candidates in the postdoctoral position should have (or will shortly satisfy the requirements for) a PhD in Astrophysics or related disciplines. Applicants should send curriculum vita, including complete publication list, a cover letter describing your research interest, and how do you think it suits to our research, and three letters of recommendation to be sent directly to Dr. Gómez (jlgomez@iaa.es).

*Reviewing of both applications will start in late March/April 2010* and will continue until the positions are filled.

For further information please contact Dr. Gómez at jlgomez@iaa.es (http://www.iaa.csic.es/∼jlgomez).