Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
No. 7 — April 1997	Editor: Anthony Holloway (ajh@ast.man.ac.uk)

Abstracts - Thesis Abstracts - Jobs - Meetings

From the Editor

Thanks to everyone again for sending in their abstracts. Submissions for the next issue will have a deadline of 31st May. Cheers, Ant.

Abstracts of recently accepted papers

The Temperature of Extended Gas in Active Galaxies – Evidence for Matter-Bounded Clouds

A. S. Wilson[1], L. Binette[2] and T. Storchi-Bergmann[3]

[1] Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218
[2] European Southern Observatory, Casilla 19001, Santiago 19, Chile
[3] Instituto de Fisica, UFRGS, Campus do Vale, CxP 15051, 91501-970 Porto Alegre - RS, Brazil

We report measurements of the electron temperature at about a dozen locations in the extended emission-line regions of five active (Seyfert and radio) galaxies. Temperatures ($T_{[OIII]}$ and $T_{[NII]}$) have been determined from both the I([OIII]λ4363)/I([OIII]λ5007) and I([NII]λ5755)/I[NII]λ6583) ratios. $T_{[OIII]}$ lies in the range (1.0 – 1.7) $\times$ 10^4K. We find a strong trend for $T_{[OIII]}$ to be higher than $T_{[NII]}$, with the difference typically being $\approx$ 5,000K. Because the critical density for collisional de-excitation of the $^1D_2$ level in NII is lower than that of the same level in OIII, the deviations of the measured intensity ratios from those expected for $T_{[OIII]} = T_{[NII]}$ in the low density limit are unlikely to result from collisional de-excitation. The measured values of $T_{[OIII]}$ and the differences between $T_{[OIII]}$ and $T_{[NII]}$ are very similar to those found in Galactic planetary nebulae. It is argued that the dominant form of energy input to the clouds is photoionization, but detailed modelling indicates that the temperature difference is too large to be accounted for in terms of photoionization of ionization-bounded clouds. We propose instead that both matter- and ionization-bounded clouds are present in the extended emission-line regions, with most of the [OIII] emission originating from a hot zone in the matter-bounded clouds and essentially all of the [NII] from the ionization-bounded clouds.

To be published in the Astrophysical Journal (Letters) June 20 1997 issue, Volume 482

E-mail contact: wilson@astro.umd.edu, preprint available at http://xxx.lanl.gov/archive/astro-ph/9704022

Inverse Compton X–rays from strong FRII radio–galaxies

Gianfranco Brunetti1, 2, **Giancarlo Setti[1,2] and Andrea Comastri[3]**

[1] Dipartimento di Astronomia, via Zamboni 33, I–40126 Bologna, Italy
[2] Istituto di Radioastronomia del CNR, via Gobetti 101, I–40126 Bologna, Italy
[3] Osservatorio Astronomico di Bologna, via Zamboni 33, I–40126 Bologna, Italy

In the framework of the quasars–radio galaxies unification the radio–emitting lobes of FRII radio galaxies are pervaded by an intense quasar radiation field. Inverse Compton (IC) scattering between the relativistic electrons and the IR–optical photons from a hidden quasar may provide an important contribution to the X–ray emission of these radio galaxies. The soft X–ray emission properties of six strong, high redshift FRIIs (3C 277.2, 280, 294, 324, 356, 368) are compared with our model expectations, taking into account also the contribution from the IC scattering of the CMB photons with the radio electrons. We find that the soft X–ray luminosities and spectra of five out of six sources can be satisfactorily explained by our model with the exception of 3C 324 whose X–ray emission is probably dwarfed by that of the galaxies' cluster of which this source is a member. One important effect is the prediction that the observed X–ray emission associated with the two radio lobes would be asymmetric if the radio axis is inclined with respect to the plane of the sky, the far-away lobe being the more luminous. The ratio between the X–ray luminosities of the two lobes is derived for several values of the inclination of the radio axis. However, the predicted angular sizes of these distant radio galaxies are small and difficult to be resolved with present X–ray facilities.

To appear in Astronomy & Astrophysics

E-mail contact: gbrunetti@astbo1.bo.cnr.it, Postscript files of figures, tables and text available at
http://www.bo.astro.it/bap/BAPhome.html/bap97-08-*.ps or via anonymous ftp at boas3.bo.astro.it/bap/files/bap97-08-*.ps

A Neutral Hydrogen study of the Seyfert Galaxy NGC 5033

A.H.C. Thean[1], C.G. Mundell[1], A. Pedlar[1] and R.A. Nicholson[1]

[1] University of Manchester, Nuffield Radio Astronomy Laboratories, Jodrell Bank, Macclesfield, Cheshire SK11 9DL

Neutral hydrogen observations of $22.7'' \times 18.5''$ resolution are presented for the Seyfert type 1 galaxy NGC 5033. Our measurements show that the total HI mass of the galaxy is 6.8×10^9 $M_\odot$ and that it is receding at 870 km s^{-1}. The column density map features prominent HI spiral arms and an asymmetric plume of HI which extends $\sim$ 6 kpc south of the galaxy. We find a well ordered velocity field and the large-scale kinematical warp in the galactic disc has been modelled. The inner region of the velocity field is well fitted by a flat, inclined disc with inclination 68° and position angle 352° but due to warping these fall to 64° and 342° respectively at large radii.

Attention is paid to factors which may be related to Seyfert activity in the nucleus and we find some evidence for a previous tidal encounter but little evidence for a bar, or significant non-circular motions in the central regions. Large concentrations of HI at the galactic centre appear to show no evidence of interaction with the active nucleus.

Accepted by MNRAS

E-mail contact: ahct@jb.man.ac.uk, preprint available at http://www.jb.man.ac.uk/∼ahct

A Search for "Dwarf" Seyfert Nuclei. III. Spectroscopic Parameters and Properties of the Host Galaxies

Luis C. Ho[1], Alexei V. Filippenko[2] and Wallace W. L. Sargent[3]

[1] Harvard-Smithsonian Center for Astrophysics, 60 Garden St., Cambridge, MA 02138
[2] Astronomy Department, University of California, Berkeley, CA 94720-3411
[3] Palomar Observatory, 105-24 Caltech, Pasadena, CA 91125

We have completed an optical spectroscopic survey of the nuclear regions ($r < 200$ pc) of a large sample of nearby galaxies. Although the main objectives of the survey are to search for low-luminosity active galactic nuclei and to quantify their luminosity function, the database can be used for a variety of other purposes. This paper presents measurements of the spectroscopic parameters for the 418 emission-line nuclei, along with a compilation of the global properties of all 486 galaxies in the survey. Stellar absorption generally poses a serious obstacle to obtaining accurate measurement of emission lines in nearby galactic nuclei. We describe a procedure for removing the starlight from the observed spectra in an efficient and objective manner. The main parameters of the emission lines (intensity ratios, fluxes, profile widths, equivalent widths) are measured and tabulated, as are several stellar absorption-line and continuum indices useful for studying the stellar population. Using standard nebular diagnostics, we determine the probable ionization mechanisms of the emission-line objects. The resulting spectral classifications provide extensive information on the demographics of emission-line nuclei in the local universe. This new catalog contains over 200 objects showing spectroscopic evidence for recent star formation and an equally large number of active galactic nuclei, including 46 which show broad Hα emission. These samples will serve as the basis of future studies of nuclear activity in nearby galaxies.

To appear in *The Astrophysical Journal Supplement Series.*

E-mail contact: lho@cfa.harvard.edu

A Search for "Dwarf" Seyfert Nuclei. IV. Nuclei with Broad Hα Emission

Luis C. Ho[1], Alexei V. Filippenko[2], Wallace W. L. Sargent[3] and Chien Y. Peng[2]

[1] Harvard-Smithsonian Center for Astrophysics, 60 Garden St., Cambridge, MA 02138
[2] Astronomy Department, University of California, Berkeley, CA 94720-3411
[3] Palomar Observatory, 105-24 Caltech, Pasadena, CA 91125

We present the results of an optical spectroscopic survey designed to search for low-luminosity, "dwarf" Seyfert nuclei in a magnitude-limited sample of 486 bright, northern galaxies. Moderate-resolution spectra of exceptionally high quality were obtained in part to detect broad Hα emission, similar in character to, but much weaker than, the broad permitted lines that define type 1 Seyfert nuclei. One of the primary goals of the survey is to better quantify the faint end of the luminosity function of active galactic nuclei. This paper describes the subset of nuclei showing definite or probable evidence of broad Hα emission. We outline the procedures for determining the presence of this elusive spectral feature, steps for its quantitative measurement, and the associated systematic errors. Of the 211 emission-line galaxies classified as having Seyfert or LINER nuclei in our survey, the broad Hα line was detected with confidence in 34 objects, and with less certainty in another 12. Most of the detections are reported for the first time, and the detection rate represents a lower limit to the true incidence of active nuclei harboring a broad emission-line region. These statistics imply that broad-lined active nuclei are much more common than previously believed: they exist in at least 20% of all galaxies spectroscopically classified as "active" and in more than 10% of all luminous galaxies at the current epoch.

To appear in *The Astrophysical Journal Supplement Series.*

E-mail contact: lho@cfa.harvard.edu

A Search for "Dwarf" Seyfert Nuclei. V. Demographics of Nuclear Activity in Nearby Galaxies

Luis C. Ho[1], Alexei V. Filippenko[2] and Wallace W. L. Sargent[3]

[1] Harvard-Smithsonian Center for Astrophysics, 60 Garden St., Cambridge, MA 02138
[2] Astronomy Department, University of California, Berkeley, CA 94720-3411
[3] Palomar Observatory, 105-24 Caltech, Pasadena, CA 91125

We use the sample of emission-line nuclei derived from a recently completed optical spectroscopic survey of nearby galaxies to quantify the incidence of local ($z = 0$) nuclear activity. Consistent with previous studies, we find detectable amounts of ionized gas in the central few hundred parsecs of most (86%) galaxies. Half of the objects can be classified as H II or star-forming nuclei and the other half as some form of AGN, of which we distinguish three classes — Seyfert nuclei, LINERs, and transition objects. The population of AGNs consequently is very large; approximately 43% of the galaxies in our survey can be regarded as "active." Most of the objects have much lower luminosities than AGNs commonly studied; the median luminosity of the narrow Hα line, after correcting for extinction, is only 2×10^{39} erg s^{-1}. Our sample therefore occupies the extreme faint end of the AGN luminosity function. We detect signatures of a broad-line region, as revealed by visible broad Hα emission, in ~20% of the AGN sample. Seyfert nuclei, both type 1 and type 2, reside in ~10% of all galaxies. LINERs make up the bulk (1/2–3/4) of the AGN population and a significant fraction (1/5–1/3) of all galaxies. A nonnegligible subset of LINERs emit broad Hα emission, furnishing direct evidence that at least some LINERs are indeed related physically to the AGN phenomenon. The dominant ionization mechanism of the nuclear emission depends strongly on the morphological type and luminosity of the host galaxy. AGNs are found predominantly in luminous, early-type (E to Sbc) galaxies, while H II nuclei prefer less luminous, late-type (Sbc and later) systems. The various AGN subclasses have broadly similar host galaxies.

To appear in *The Astrophysical Journal.*

E-mail contact: lho@cfa.harvard.edu

The Influence of Bars on Nuclear Activity

Luis C. Ho[1], Alexei V. Filippenko[2] and Wallace W. L. Sargent[3]

[1] Harvard-Smithsonian Center for Astrophysics, 60 Garden St., Cambridge, MA 02138
[2] Astronomy Department, University of California, Berkeley, CA 94720-3411
[3] Palomar Observatory, 105-24 Caltech, Pasadena, CA 91125

We test ideas on fueling of galactic nuclei by bar-driven inflow by comparing the detection rate and intensity of nuclear

H II regions and AGNs among barred and unbarred galaxies in a sample of over 300 spirals selected from our recent optical spectroscopic survey of nearby galaxies. Among late-type spirals (Sc–Sm), but not early-type (S0/a–Sbc), we observe in the barred group a very marginal increase in the detection rate of H II nuclei and a corresponding decrease in the incidence of AGNs. The minor differences in the detection rates, however, are statistically insignificant, most likely stemming from selection effects and not from a genuine influence from the bar. The presence of a bar seems to have no noticeable impact on the likelihood of a galaxy to host either nuclear star formation or an AGN. The nuclei of early-type barred spirals do exhibit measurably higher star-formation rates than their unbarred counterparts, as indicated by either the luminosity or the equivalent width of Hα emission. By contrast, late-type spirals do not show such an effect. Bars have a negligible effect on the strength of the AGNs in our sample, regardless of the Hubble type of the host galaxy. This result confirms similar conclusions reached by other studies based on much smaller samples.

To appear in *The Astrophysical Journal.*

E-mail contact: lho@cfa.harvard.edu

Properties of H II Regions in the Centers of Nearby Galaxies

Luis C. Ho[1], Alexei V. Filippenko[2] and Wallace W. L. Sargent[3]

[1] Harvard-Smithsonian Center for Astrophysics, 60 Garden St., Cambridge, MA 02138
[2] Astronomy Department, University of California, Berkeley, CA 94720-3411
[3] Palomar Observatory, 105-24 Caltech, Pasadena, CA 91125

As part of an optical spectroscopic survey of nearby, bright galaxies, we have identified a sample of over 200 emission-line nuclei having optical spectra resembling those of giant extragalactic H II regions. Such "H II nuclei," powered by young, massive stars, are found in a substantial fraction of nearby galaxies, especially those of late Hubble type. This paper summarizes the observational characteristics of H II nuclei, contrasts the variation of their properties with Hubble type, and compares the nuclear H II regions with those found in galaxy disks. Similarities and differences between H II nuclei and luminous starburst nuclei are additionally noted.

To appear in *The Astrophysical Journal.*

E-mail contact: lho@cfa.harvard.edu

The Active Galaxies Newsletter is available on the World Wide Web. You can access it via the University of Manchester home page :- http://axp2.ast.man.ac.uk:8000/~ajh/agn/