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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.
Rob Beswick

Abstracts of recently accepted papers

Mid-infrared observations of the ultraluminous galaxies IRAS 14348-1447, IRAS 19254-7245, and IRAS 23128-5919

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We present a study of the three ultraluminous infrared galaxies IRAS 14348-1447, IRAS 19254-7245, and IRAS 23128-5919, based on mid-infrared (MIR) spectro-imaging (5–18 μm) observations performed with ISOCAM. We find that the MIR emission from each system, which consists of a pair of interacting late type galaxies, is principally confined to the nuclear regions with diameters of 1–2 kpc and can account for more than 95% of their IRAS 12 μm flux. In each interacting system, the galaxy hosting an active galactic nucleus (AGN) dominates the total spectrum and shows stronger dust continuum (12–16 μm) relative to the Unidentified Infrared Band (UIB) emission (6–9 μm), suggestive of its enhanced radiation field. The MIR dominant galaxy also exhibits elevated 15 μm/Hα and 15 μm/K ratios which trace the high extinction due to the large quantities of molecular gas and dust present in its central regions. Using only diagnostics based on our mid-infrared spectra, we can establish that the Seyfert galaxy IRAS 19254-7245 exhibits MIR spectral features of an AGN while the MIR spectrum of the Seyfert (or LINER) member of IRAS 23128-5919 is characteristic of dust emission principally heated by star forming regions.

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preprint available at http://arXiv.org/abs/astro-ph/0206150

Size and Structure of the Narrow–Line Region of Quasars

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We have observed the narrow–line regions (NLRs) of the seven brightest radio–quiet PG (or BQS) quasars (z < 0.5) with the Wide Field and Planetary Camera 2 on board the Hubble Space Telescope (HST). Linear–ramp filters were used to image the [OIII] λ5007 line emission with $0\farcs0455$–$0\farcs1$ pixel resolution. We find that the NLRs are very compact with typical extents of $2''$–$4''$. Two quasars show compact filamentary structures similar to Seyfert NLRs. They may be related to radio outflows. Most interestingly, when including a sample of Seyfert galaxies observed with HST, we tentatively find that the size of the NLR is proportional to the square root of the [OIII] luminosity. This is comparable to the scaling found for the size of the broad–line region with continuum luminosity, which has been interpreted in terms of a constant photoionization parameter. The relation determined here connects the NLR of radio–quiet quasars and Seyferts over three orders of magnitude in [OIII] luminosity.

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preprint available at http://babbage.sissa.it/abs/astro-ph/0206334

Giant low surface brightness halos in distant radio galaxies: USS0828+193

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We present results on the spectroscopic study of the ionized gas in the high redshift radio galaxy USS0828+193 at z =2.57. Thanks to the high S/N of the emission lines in the Keck spectrum, we have been able to perform a detailed kinematic study by means of the spectral decomposition of the emission line profiles. This study reveals the existence of two types of material in this object: a) a low surface brightness component with apparent quiescent kinematics consistent with gravitational motions and b) a perturbed component with rather extreme kinematics. The quiescent halo seems to extends across the entire object for $\sim$80 kpc. It is enriched with heavy elements and apparently ionized by the continuum from the active nucleus.

The properties of the quiescent halo and its origin are discussed in this paper. We propose that it could be part of a structure that surrounds the entire object, although its nature is not clear (a rotating disc? low surface brightness satellites? a cooling flow nebula? material ejected in galactic winds? other?). A possible link with the following structures is discussed: a) the very extended envelopes found around galaxies of a wide range of morphological types and luminosities based on studies of absorption line systems in the spectra of background quasars, b) the giant Lyα halos associated with some Ly break galaxies, c) the very extended reservoirs (claimed to be discs) of neutral gas associated with some nearby radio galaxies and early type galaxies. All these structures might have a similar origin, related to the formation process of galaxies.

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preprint available at http://babbage.sissa.it/abs/astro-ph/0206118

A Parsec-Scale Study of the 5/15 GHz Spectral Indices of the Compact Radio Sources in M82

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Observations of the starburst galaxy, M82, have been made with the VLA in its A-configuration at 15 GHz and MERLIN at 5 GHz enabling a spectral analysis of the compact radio structure on a scale of $< 0.1''$ (1.6 pc). Crucial to these observations was the inclusion of the Pie Town VLBA antenna, which increased the resolution of the VLA observations by a factor of $\sim$2. A number of the weaker sources are shown to have thermal spectra and are identified as HII regions with emission measures $\sim 10^7$ cm^{-6} pc. Some of the sources appear to be optically thick at 5 GHz implying even higher emission measures of $\sim 10^8$ cm^{-6} pc. The number of compact radio sources in M82 whose origin has been determined is now 46, of which 30 are supernova related and the remaining 16 are HII regions. An additional 15 sources are noted, but have yet to be identified, meaning that the total number of compact sources in M82 is at least 61. Also, it is shown that the distribution of HII regions is correlated with the large-scale ionised gas distribution, but is different from the distribution of supernova remnants. In addition, the brightest HII region at (B1950) 09^h 51^m 42.21^s $+69^\circ$ $54'$ $59.2''$ shows a spectral index gradient across its resolved structure which we attribute to the source becoming optically thick towards its centre.

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Narrow Components within the Fe Kα Profile of NGC 3516: Evidence for the Importance of General Relativistic Effects?

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We present results from a simultaneous *Chandra* HETG and *XMM-Newton* observation of NGC 3516. We find evidence for several narrow components of Fe Kα along with a broad line. We consider the possibility that the lines arise in a blob of material ejected from the nucleus with velocity $\sim$ 0.25c. We also consider an origin in a neutral accretion disk, suffering enhanced illumination at 35 and 175 R_g, perhaps due to magnetic reconnection. The presence of these narrow features indicates there is no Comptonizing region along the line-of-sight to the nucleus. This in turn is compelling support for the hypothesis that broad Fe Kα components are, in general, produced by strong gravity.

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A Spectropolarimetric Atlas of Seyfert 1 Galaxies

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We present optical spectropolarimetry of the nuclei of 36 Seyfert 1 galaxies, obtained with the William Herschel and the Anglo–Australian Telescopes from 1996 to 1999. In 20 of these, the optical emission from the active nucleus is intrinsically polarized. We have measured a significant level of polarization in a further 7 objects but these may be heavily contaminated by Galactic interstellar polarization. The intrinsically polarized Seyfert 1s exhibit a variety of characteristics, with the average polarization ranging from < 0.5 to 5 per cent and many showing variations in both the degree and position angle of polarization across the broad Hα emission line. We identify a small group of Seyfert 1s that exhibit polarization properties similar to those of Seyfert 2 galaxies in which polarized broad-lines have been discovered. These objects represent direct observational evidence that a Seyfert 2-like far-field polar scattering region is also present in Seyfert 1s. Several other objects have features that can be explained in terms of equatorial scattering of line emission from a rotating disk. We propose that much of the diversity in the polarization properties of Seyfert galaxies can be understood in terms of a model involving both equatorial and polar scattering, the relative importance of the two geometries as sources of polarized light being determined principally by the inclination of the system axis to the line-of-sight.

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Thesis Abstracts

Optical Spectropolarimetry and Modelling of Type 1 Seyfert Galaxies

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Spectropolarimetry has proved to be an important tool in the development of the Seyfert unified scheme. Its unique diagnostic strength is that it provides an alternative view into the inner regions of the active nucleus in addition to the direct line-of-sight. This allows us to probe the structure and kinematics of both the polarizing material and the emission source.

The Seyfert unification scheme has been largely based on the spectropolarimetric observations of Seyfert 2 galaxies. Seyfert 1s are less well studied using this technique and the observations are generally inconsistent with scattering from along the poles of the circum-nuclear torus, as invoked for Seyfert 2s. Evidently additional sources of scattered light are required to explain the polarization properties of Seyfert 1s – the nature of which are presently unknown. This thesis describes the largest data set so far accumulated with which the broad Hα emission line polarization in Seyfert 1 galaxies can be investigated. Optical spectropolarimetry was obtained for 36 galaxies and in 20, polarization intrinsic to the Seyfert nucleus has been detected. These objects exhibit a wide range in polarization characteristics, with many showing variations in both the degree and position angle of polarization across the broad Hα emission line.

A Generic Scattering Code was used to investigate the scattering geometries required to reproduce the polarization characteristics of the broad Hα emission line as seen in the data. Ten objects were found to display polarization characteristics, notably large position angle rotations, that are best explained by scattering of broad-line emission originating from a rotating disk, by a scattering region that lies in the equatorial plane of the disk and closely surrounds it. A further three objects were found to display polarization characteristics similar to those Seyfert 2 galaxies in which broad-lines are detected in polarized flux. For these objects it is proposed that the line-of-sight passes through the upper atmosphere of the circum-nuclear torus. Light scattered from the equatorial plane of the line emitting disk suffers extinction allowing far-field polar scattering to dominate the resultant polarization (as in Seyfert 2s). However, the extinction is not such as to render directly viewed broad-line emission unobservable.

The main conclusion of this thesis is that the gross polarization properties of Seyfert 1 nuclei can be accommodated within an orientation sequence which, therefore, reinforces the Seyfert unified scheme.

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