HST Images of the Seyfert Galaxy NGC 5929 and Its Companion NGC 5930(1)

Bower, G.A.; Wilson, A.S.; Mulchaey, J.S.; Miley, G.K.; Heckman, T.M.; Krolik, J.H.

4.04

FOS Spectroscopy of the Seyfert 1 Galaxy NGC 5548

D.M. Crenshaw (CSC), A. Boggess (NASA/GSFC), C.-C. Wu (CSC)

Ultraviolet spectra of the Seyfert 1 galaxy NGC 5548 have been obtained with the Faint Object Spectrograph (FOS) on the Hubble Space Telescope. The observations were made at a time when the UV continuum and broad emission lines were at their lowest ever observed level. The high resolution of the spectra (R = 1000), and the low continuum and broad-line flux levels allow for a clean separation of the broad and narrow components of Lα, C IV λ1549, and C III] λ1909. Relative to the other UV narrow lines, C IV is much stronger in NGC 5548 than in Seyfert 2 galaxies observed with IUE, which indicates that the average ionization parameter is higher in the narrow-line region (NLR) of NGC 5548. The narrow component of Mg II λ 2798 is very weak in NGC 5548, which suggests that the NLR clouds are fully ionized and lack substantial "transition zones" that produce the majority of this line in Seyfert 2 galaxies. Thus, it appears the the NLR clouds in NGC 5548 experience a higher level of ionizing flux, on average, than those in Seyfert 2 galaxies.

4.05

10 μm Imaging of NGC 4151 and NGC 1068

M. Meixner, J. R. Graham (UCB), G. W. Hawkins, C. J. Skinner (IGPP), E. Keto (LLNL), J. F. Arens, J. G. Jernigan (SSL)

We have obtained mid infrared images of the nearby Seyfert nuclei NGC 1068 and NGC 4151 to study the spatial distribution of the emission. The data were obtained at UKIRT with the Berkeley mid-IR camera which is supported by IGPP and LEA at Lawrence Livermore National Laboratory. These observations will help distinguish between thermal and non-thermal emission mechanisms, and determine the relative contribution of emission from dust in a molecular torus and the narrow line region.

The images at 8.5 and 12.5 μm both have FWHM of 1.″3 and very high signal to noise (> 300). These data, when combined with an accurate measurement of the point spread function, permit us to constrain the sub–arcsecond structure of the emission. We confirm that the 10 μm emission of NGC 1068 is spatially extended north–south (Becklin et al. 1976 ApJ 186 L69) but these new data show that the emission is very asymmetric. The emission consists of unresolved point source which accounts for $\simeq$ 40% of the flux together with a jet like extended component centered 0.″3 further north. The extended component has a FWHM of 0.″88 in the north-south direction (60 pc at a distance of 13 Mpc), and unresolved (< 0.″1) east-west. The extended component is almost certainly thermal emission from dust. However, since the dust is located about 20 pc from the nucleus, the emission is probably not due to dust that is in thermal equilibrium with the central engine. Rather, the emission is due to dust that is heated locally in circumnuclear star forming regions, stochastically heated small dust grains, or dust heated in the narrow line region by resonantly trapped Lyman α.

4.06

HST Images of the Seyfert Galaxy NGC 5929 and Its Companion NGC 5930[1]

G. A. Bower (STScI), A. S. Wilson, J. S. Mulchaey (STScI/U Md), G. K. Miley (Leiden Observatory), T. M. Heckman (STScI/JHU), J. H. Krolik (JHU)

Images of the Seyfert galaxy NGC 5929 and its interacting companion NGC 5930 have been obtained with HST's Planetary Camera. This interacting pair is also known as Arp 90. Each galaxy was imaged in the wavelength regions of [O III] $\lambda\lambda$ 4959, 5007, Hα+[N II] $\lambda\lambda$ 6548, 6583, and the green and red continua. The nuclei of both galaxies contain emission line gas, enhanced in the images by using the appropriate continuum image to remove the contribution of the continuum light in the on-band images.

Previous ground-based observations of the Seyfert galaxy NGC 5929 include [O III] and Hα+[N II] images, showing that its nucleus contains an elongated region of high-excitation emission line gas. In these HST images, this gas is clearly separated into two distinct regions separated by about 1.″1 (138 h^{-1} pc). The nucleus, as defined by the peak in the continuum, lies halfway between these two distinct emission line regions. The correspondence of this distribution of emission line gas to the published VLA map is examined. The HST continuum images reveal a dust lane lying 0.3 arcsec SE of the nucleus with a length of $\sim$ 1 arcsec and $N_H \approx 4 \times 10^{21}$ cm^{-2}. The implications of these results in the context of "unified models" of Seyfert galaxies, the collimation of ionizing radiation, and the interaction between the radio sources and the ISM are examined.

The nuclear emission line gas in NGC 5930 is concentrated into a ring around the nucleus with a diameter of $\sim 250\,h^{-1}$ pc and L(Hα+[N II]) $\approx 1.6 \times 10^{39}\,h^{-2}$ erg s^{-1}. These observations of Arp 90 present an opportunity to examine the details of the possible role of galaxy interactions in the triggering of an AGN.

[1] Based on observations with the NASA/ESA Hubble Space Telescope, obtained at the Space Telescope Science Institute, which is operated by AURA, Inc., under NASA contract NAS5-26555.

4.07

HST Observations of the Seyfert Nucleus of the Barred Spiral Galaxy NGC 5728

J.A. Braatz (UMd), A.S. Wilson (UMd/STScI)

Both continuum and line emission were observed in the nucleus of the barred Seyfert 2 galaxy NGC 5728 using the WFPC of the Hubble Space Telescope. Integrations of 1200 seconds were taken through the F664N and F492M filters to observe the [NII]+Hα and [OIII] emission, respectively, and 600 second exposures were taken through the F718M and F547M filters to get continuum reference images. The continuum images show interesting structure, including an elliptical ring (8″ × 10″) which surrounds the nucleus and a bar-shaped feature which extends from the ring in towards the nucleus. The line images both reveal a bi-conical emission line region indicative of an anisotropic source of ionizing radiation. The apex of these cones is the most probable location of the central engine, and hence the "true" nucleus. This location of the nucleus is supported by the observation that the ring seen in the continuum images is centered on the apex of the cones, and not on the brightest peak of the optical emission. Only very weak-line and continuum emission is found at the apex, implying the nucleus is blocked from view. Recent observations of other Seyfert 2 nuclei suggest that the ionization cones may be produced by shadowing of the nuclear radiation source by an optically thick molecular torus. The torus blocks the Seyfert 2 nucleus from our view, but nuclear radiation which escapes through the holes of the torus can still be scattered into our line of sight by dust or free electrons. In fact, bright peaks which may result from this scattering appear in the continuum images. The orientation of the cones can be inferred by noting that the ionization cone to the SE of the nucleus has a greater extent and brightness than the NW cone. This difference is probably due to extinction by dust in the outskirts of the torus or in the disk of the galaxy, and in this case the brighter side is the near side. A similar difference in brightness is evident in the two peaks associated with the scattering zones on the continuum images.

4.08

Polarized Continuum Transfer in AGN Accretion Disks

J.C. Liu, G. Lee, G.A. Kriss, A.F. Davidsen (JHU)

We present the preliminary results of a calculation of polarized continuum radiation transfer in the radiation-pressure dominated inner region of the massive thin accretion disks which might exist in Active Galactic Nuclei (AGN). We assume an adiabatic vertical structure for the disk in which the total pressure is a power of the mass density, and then numerically solve the transfer equations for the polarized radiation. Our principle result is the frequency dependence of the continuum polarization. For reasonable model parameters we find low