curve into the contributions of bulge, disk and halo component. Combining these results with existing HI data, the extension of the halo component and its contribution to the total galaxy mass can be calculated. For instance, in the case of NGC 5084, a massiv halo is required to explain the M/L profile. This is found to vary from about 19 $M_\odot/L_\odot$ (H_0=100 Mpc km s^{-1}) in the inner regions increasing outwards to 45 $M_\odot/L_\odot$, with a possible central peak of > 30 $M_\odot/L_\odot$. Following the model, a total mass of 7.28×10^{11} $M_\odot$ (R < 30 kpc), 80% of which contained in the halo component, is derived. The presence of the massive halo could also explain the tilted lane observed in this galaxy in terms of a stabilized warped disk (Binney, 1978).

NGC 5084 is an S0 galaxy, but nevertheless has an enormous quantity of gas. This observed gas can hardly derive from a single accretion event, since such a large mass would probably leave the gas in an inclined configuration due to the effect of self-gravitation (Sparke and Casertano, 1988), but this configuration is not observed. If the picture of the external origin of the gaseous material should still hold, one has to assume that the time scale of the accretion process is very short with respect to the life time of the galaxy.

A possible picture for the formation of SDGs is then that they are the result of a series of accretion events, possibly induced also by the progressive deepening of the galaxy potential well.

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On the Origin of the Continuum Radiation at Optical and Ultraviolet Wavelengths in AGN/Quasars

M.-H. ULRICH, ESO

It is generally proposed that the energy source in quasars and Seyfert galaxies is accretion onto a massive object. Since angular momentum appears in most astrophysical situations, it has been further proposed that the accreted gas is assembled in a disk (Lynden-Bell, 1969; Shields, 1978; for reviews see Pringle, 1981; Collin-Souffrin and Lasota, 1988). For a given model, the spectrum of the radiation emitted by a pure viscous flow can be calculated. Comparison of this continuum spectrum with the observed optical/UV/soft X-ray spectrum can, in principle, give the mass of the central object M_{BH} and the accretion rate $\dot{M}$ (e.g. Sun and Malkan, 1989). However, not only are the models still uncertain but also, as we shall see below, the rapid variations of the UV and optical continuum of AGN suggest that the origin of this continuum is more complex than previously realized.

Let us examine the flux variations data available for one of the best studied AGNs: NGC 4151 (Ulrich et al., 1990).

NGC 4151 has been observed with IUE on 125 days mostly grouped in campaigns of typically 20 to 40 days, the interval between observations being 4 to 5 days. No ground-based optical observations were systematically done simultaneously with the UV observations but we have at our disposal the flux measured with the fine error sensor (FES) on-board IUE before each spectral exposure. The optical FES flux, which is recorded with an S20 photocathode, is contributed by variable components (broad emission lines + continuum) and a nonvariable component including stellar light and narrow emission lines.

The contribution of the Balmer continuum in the FES band is negligible. That of the broad emission lines is estimated to be < 20% of the total flux.

Figures 1 and 2 show that the optical (FES) and UV fluxes undergo variations which are simultaneous within our time

TABLE 1: *NGC 4151 = Selected episodes: observing dates*

1983	IUE EXOSAT	October 30; November 4, 7, 11, 15, 19 November 7, 11, 15, 19
1984	IUE EXOSAT	December 16, 19, 24, 28 December 16, 20, 22, 24, 28
1985	IUE EXOSAT	January 2, 8, 14 January 2
1988	IUE	November 29 December 10, 14, 20, 24, 28, 31
1989	IUE	January 5, 9, 13, 17, 21, 25, 30
1990	IUE	February 25 March 1, 5, 9, 13, 17, 21 April 1, 12, 17

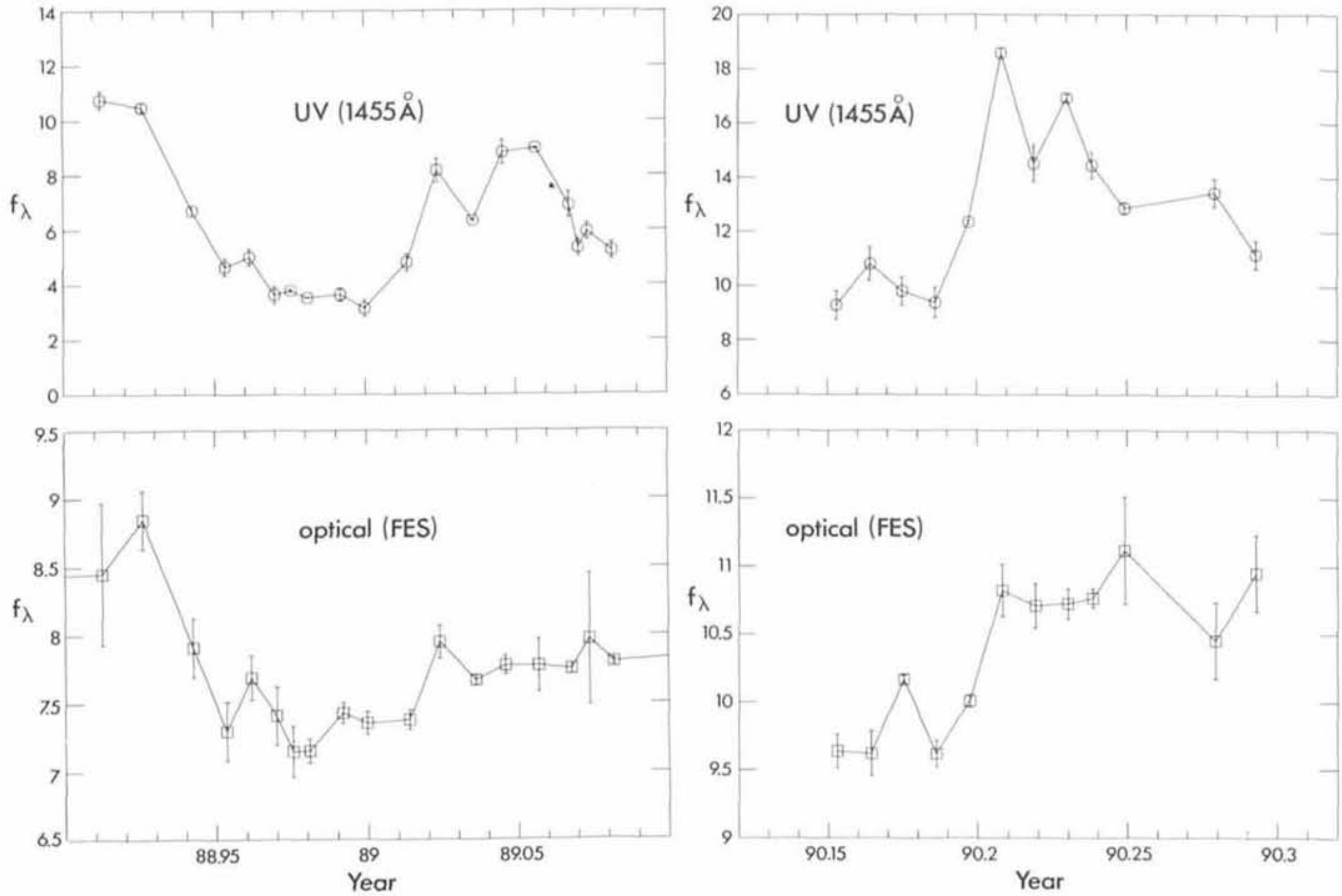

Figure 1: *UV/optical flux variations in NGC 4151: The flux at 1455Å and in the FES for 2 episodes, November 29, 1988 – January 30, 1989, and February 25 – April 17, 1990. Ordinates in 10^{-14} erg cm^{-2} s^{-1} $Å^{-1}$. Abscissae, year minus 1900.*

sampling. The data taken as an example are those of the 2 most recent campaigns of observations, November 1988 – January 1989 and February–April 1990. The maximum delay between the UV and the optical variations is < 2 days in either direction as compared to a viscous time scale of a few years. Moreover the time scale of the continuum variations is of the order of days. This rules out the possibility that the observed continuum variations are due to variations of the accretion rate (Pringle, 1981; Clarke, 1988).

We propose two processes for the rapid and simultaneous optical and UV continuum variations (Ulrich et al., 1990):

1. The variations are due to local instabilities in the inner part of the disk which produce small hot regions emitting mostly in the far UV but which contribute to the optical flux through the low energy tail of their spectrum. This results in a nearly perfect modulation of the UV and optical flux. The time scale and the amplitude of the variations at different wavelengths have the potential to give strong constraints on the dimensions, temperature and location of these instabilities.

2. Alternatively, the UV/optical variations could be due to irradiation of the disk by a central variable X-ray source. Such a model has been proposed by Czerny, Czerny and Grindlay (1986) for low mass binaries. The irradiation heats the disk surface which then emits a spectrum different (hotter) from that of a pure accretion flow. The modulation of the UV and optical fluxes is caused by the X-ray variations. In this case, one expects the UV/optical variations to be correlated with the X-rays variations.

Our simultaneous IUE/EXOSAT observations of NGC 4151 (Fig. 2) of 7–19 November 1983 and 16 December 1984 – 2 January 1985 (Perola et al., 1986) give results consistent with irradiation: There is an excellent linéar correlation (probability of 2.5×10^{-6} of being due to chance) between the 2–10 keV flux and the continuum at 1455Å during the 2 periods of simultaneous observations.

Figure 3 shows the correlation between the X-ray flux in the ME range and the UV flux at 1455Å (same data as Fig. 2). We note that each value of the ME flux is the average of the flux measured during an EXOSAT observation. During each observation (which lasted several hours) the flux drifted smoothly by about $\pm 15\%$ around the mean for this observation. The extremely good correlation of Figure 3 suggests that similar variations must have occurred in the UV range but the timing of our IUE observations (2 consecutive spectra within 2 hours, every 4 to 5 days) is not adequate to verify this point.

We stress that at other isolated dates of simultaneous UV/X-ray or optical/X-ray observations, the UV (or optical) and X-ray fluxes do not follow this correlation but scatter at larger values of the UV (or optical) flux and lower values of the X-ray flux. See, for example, the point representing the simultaneous IUE/Einstein observations of 19–21 May 1979 which falls on the right hand side of Figure 3 (Perola et al., 1986; Penston, 1986). We suggest that in November 7–19, 1983 and December 16, 1984 – January 2, 1985, the X-ray variations overrode and masked the effects of the inner disk instabilities; the latter are, in general, the dominant process producing the UV/optical variations when the X-ray source is not particularly strong.

The determination of M_{BH} and $\dot{M}$ from fitting of the UV/optical spectra with theoretical models of an accretion disk spectrum have not so far included the effect of irradiation or of the instabilities discussed here. Further modelling in-

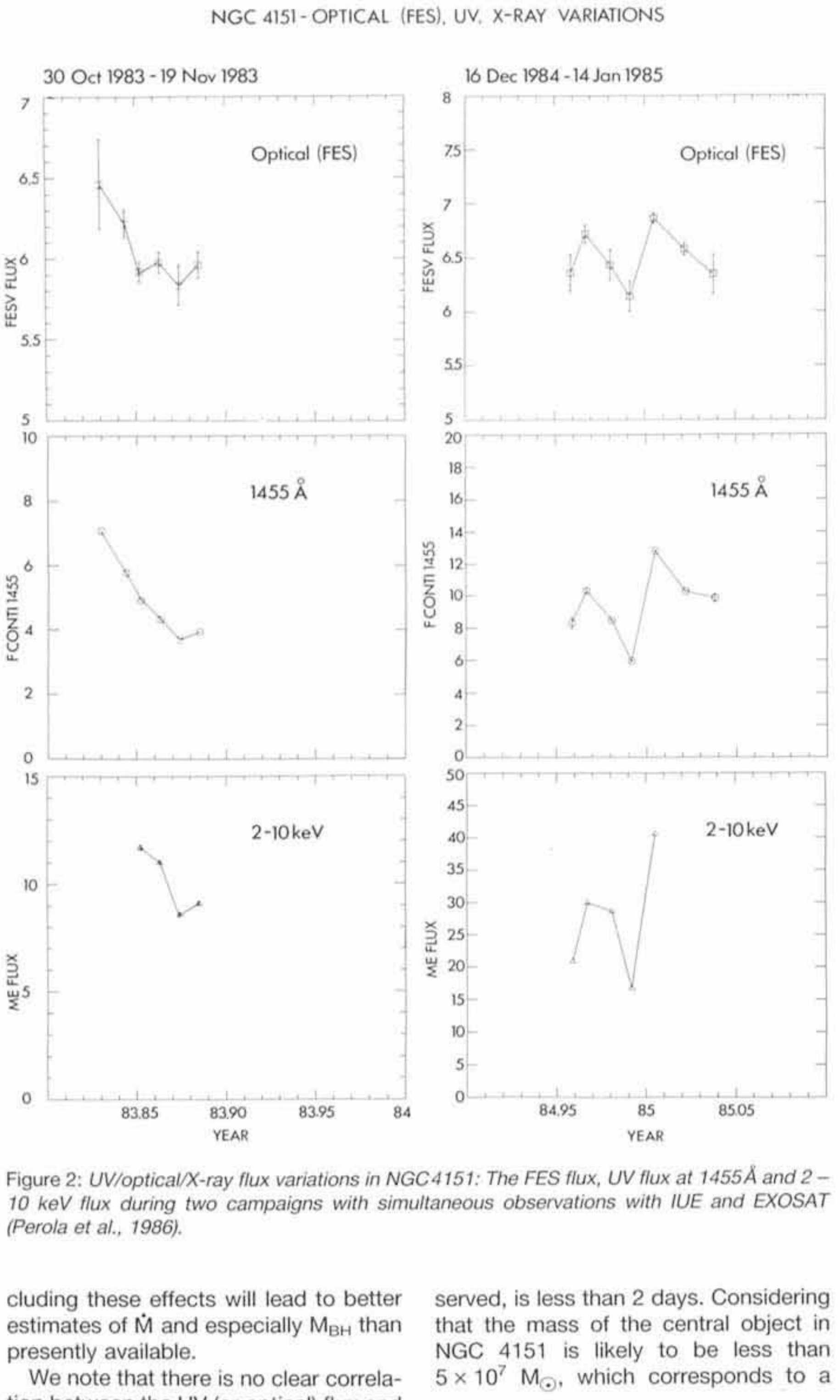

Figure 2: *UV/optical/X-ray flux variations in NGC 4151: The FES flux, UV flux at 1455 Å and 2 – 10 keV flux during two campaigns with simultaneous observations with IUE and EXOSAT (Perola et al., 1986).*

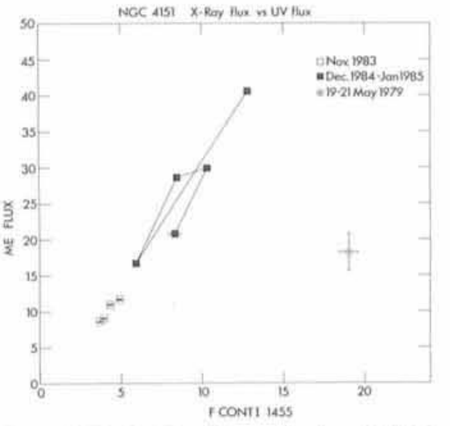

Figure 3: *The 2 – 10 keV flux vs the flux at 1455 Å for the dates of Figure 2, plus the point representing the X-ray and UV flux on May 19 – 21, 1979. The optical/X-ray data taken at isolated dates do not follow the correlation X-ray vs UV flux or X-ray vs optical flux defined by the November 1983 and December 1984 – January 1985 data. Altogether the data suggest that irradiation by the X-ray source produces the quasi simultaneous optical/UV flux variations at some epochs. But in general, it is the instabilities in the inner disk which modulate simultaneously the optical and UV fluxes.*

cluding these effects will lead to better estimates of $\dot{M}$ and especially M_{BH} than presently available.

We note that there is no clear correlation between the UV (or optical) flux and the X-ray flux in other AGN/quasars which have been adequately observed in different energy bands (NGC 4051: Done et al., 1990; 3C 273: Courvoisier et al., 1990). The good UV/X-ray correlation observed in NGC 4151 in November 1983 and December 1984 – January 1985 is exceptional for NGC 4151 as well as among the other AGN/quasars.

Evidently, a good estimate of the time delay between UV and X-ray variations provides constraints on the relative location of the different emission regions. This time delay in NGC 4151, at the epochs when the correlation was observed, is less than 2 days. Considering that the mass of the central object in NGC 4151 is likely to be less than $5 \times 10^7\ M_\odot$, which corresponds to a Schwarzschild radius $r_s \leq 2 \times 10^{13}$ cm, the upper limit on the time delay available now is not very constraining.

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A New Jet in M 87?

B.J. JARVIS, ESO

The giant elliptical galaxy M 87 (NGC 4486) has been the subject of intense study over the past two decades for a number of reasons. Firstly, it is large and bright, centrally placed in the Virgo cluster and also because of its bright optical synchrotron and radio jet emanating from the nucleus. The jet has been studied at all wavelengths from X-ray to radio. An understanding of these jets is important for probing the physical processes in active nuclei and their interac-