61.05

Two-Epoch VLBI Observations of Three *Very* Weak Nuclei in Lobe-Dominated Radio Quasars

D.H. Hough, T.A. Rector, G.C. Lenz, D.A. Wood (Trinity U.), J.A. Zensus (NRAO), R.C. Vermeulen, A.C.S. Readhead (Caltech/OVRO), R.W. Porcas (MPIfR), A. Rius (NASA-INTA)

Studies of superluminal motion in the nuclei of lobe-dominated radio quasars are of value in testing various unification hypotheses for extragalactic radio sources. One of the unifying themes that has been proposed is relativistic beaming. Simple beaming models invoking a narrow emission cone predict that large superluminal motion (much in excess of 2-3c) should be uncommon in a sample of randomly oriented sources. Thus we have selected two samples of lobe-dominated quasars for which any orientation bias should be minimized, since the lobe emission is presumably unbeamed. One sample is taken from the 3CR survey (Hough and Readhead 1989, *A.J.*, **98**, 1208) and the other from the Jodrell Bank survey (Zensus and Porcas 1987, in *Superluminal Radio Sources*, eds. Zensus and Pearson, Cambridge U. Press, p. 126). We are engaged in two VLBI surveys to measure the distribution of parsec-scale jet velocities in the nuclei of these objects. We are collaborating to measure the speeds in some of the very weak nuclei (down to 15 mJy); these objects are least likely to exhibit large superluminal speeds. Three very weak nuclei - in 3C204, 3C205, and 0839+616 - have now been observed at two epochs - 1988 December and 1991 March. The experiments used Mark III recording with sensitive X-band (3.6 cm) systems at the Effelsberg 100m, Madrid 70m, Haystack 36m, Green Bank 43m, phased VLA, and Goldstone 70m/34m telescopes. All three objects display core-jet structures on the first-epoch maps (Hough *et al.* 1990, *B.A.A.S.*, **22**, 806). A preliminary inspection of the visibility data at the second epoch indicates no major structural changes for any of the three objects; this suggests the absence of large superluminal velocities, which would tend to conform with the simple beaming model. Further analysis to determine component speeds is underway. (D.H.H. acknowledges support from Trinity U., MPIfR, and NRC-NASA and NASA-ASEE programs at JPL).

61.06

De Sitter Redshift in Quasars

J.B. Miller (Princeton), T.E. Miller (Columbia)

The redshift of distant objects is considered as a gravitational effect, the de Sitter redshift, which applies to an isotropic, homogeneous gas of frictionless particles in large-scale equilibrium. In de Sitter spacetime, redshift z can be given as a function of distance r,

$$z = \left(1 - \frac{r^2}{R^2}\right)^{-1/2} - 1 , \qquad (1)$$

where R is the distance to a de Sitter horizon, which depends on mean mass density ρ according to $R^2 = 3/8\pi\rho$. Near a de Sitter horizon, redshift becomes increasingly sensitive to distance: a small increase in distance produces a large increase in redshift. The quasar redshift may be such a de Sitter effect, helping to explain the phenomenon of relatively bright objects with very high redshifts. The expected number of objects at a given redshift, dN/dz, is

$$\frac{dN}{dz} = 4\pi\delta R^3 (z+1)^{-3}\left[1-(z+1)^{-2}\right]^{1/2} , \qquad (2)$$

where δ is the number density of objects. The de Sitter redshift may thereby account for the observed quasar population cut-off near z = 3.

61.07

Fe II Emission from Quasars and AGN

F. Hamann, G. Ferland, A. Pradhan (OSU), and S. Johansson (Lund)

We are conducting a study of Fe II line emission from quasars, active galactic nuclei (AGN), and emission line stars. Our main goal is to test the possibility that photoexcitation by Lyα accounts for the surprising strength of Fe II in AGN and quasar spectra. The total flux from Fe II lines in these objects sometimes rivals the output from all other atoms and ions combined. Existing photoionization models have been unable to account for this phenomenon without artificially bolstering the Fe abundance. In some emission line stars it is known that the Fe II emission is enhanced by resonant absorption of Lyα. This process pumps electron in low lying metastable states into upper Fe II energy levels and leads to a wealth of Fe II cascade (i.e. fluorescence) lines. In this way Lyα photons that are trapped by the very optically thick H I transition can leak out through the various Fe II cascade routes. The net effect is an enhancement of the Fe II flux and an equal depletion of Lyα. The evidence that Lyα photoexcitation actually occurs comes from observations of selected Fe II cascade lines. In this poster we present an early report on the importance of this mechanism in a sample of emission lines stars, and discuss the feasibility of Lyα pumping as a solution to the "Fe II problem" in AGN and quasars.

61.08

Infrared Weak Quasars

J. McDowell (MSFC), M. Elvis, B. J. Wilkes, O. Kuhn (CfA)

Although most quasars emit up to a third of their energy in the infrared region, a subset exhibit anomalously weak IR emission. As part of the Atlas of Quasar Energy Distributions project (Elvis et al 1991 in preparation, Masnou et al 1991), we have studied the properties of several of these infrared-weak quasars. For three objects the IUE data indicate an ultraviolet turnover. We show that in these cases the absence of strong infrared emission shows that the ultraviolet turnover is likely to be intrinsic and not due to internal reddening in the quasar. This allows greater confidence in the relevance of continuum model parameter fits to these objects.

We compare the properties of the weak infrared quasars with those of the weak ultraviolet quasars (McDowell et al 1989), some of which appear to have anomalously luminous host galaxies, and with the mean quasar energy distribution and its dispersion derived from the Atlas study.

McDowell, J. C., et al, 1989 *Ap.J.* **345**, L13
Masnou, J-L., et al, 1991 *Astron. Astrophys.*, in press.

61.09

The Relationship between quasar emission lines and their UV/X-ray continuum properties.

S. Mathur, B. J. Wilkes, M. Elvis (CfA) and Jonathan McDowell (MSFC)

The recent increase in the amount of multi-wavelength quasar data available has at last made it possible to investigate the relation between the strengths and ratios of their broad emission lines and the nature of the ultra-violet(UV)/soft X-ray continuum which is believed to be responsible for their generation. Photoionization models are generally successful in matching the lines of an average quasar using a relatively X-ray bright continuum. Few investigaters (Krolik and Kallman 1988 excepted) have considered the effect of varying the continuum shape and none the full range of UV/soft X-ray properties displayed by the quasar population (Elvis *et al.* 1992). Since photoionization models predict an inti-