JETS AND BROAD EMISSION LINE REGIONS

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In recent years an elegant hypothesis for a unified scheme for compact and extended radio sources, and also radio quiet QSOs and radio loud Quasars has been developed (Scheuer & Readhead 1979, Orr & Brown 1982). In this scheme the relative orientation of (relativistic) beam and observer is thought to explain the observed source morphology. We feel that observations suggest examining compact and extended radio sources from still another "angle".

The most significant parameters here to explain differences between types of active galaxies, are the nuclear environment and the duty cycle of the jet.

There are several compelling reasons for considering possible interactions between radio jets and the Broad Line Region (BLR) of active galaxies:

1. VLBIjets and BLRs have similar sizes (1- 10 pc) and energetics (10^{43}-10^{44} erg/sec).
2. Radio jets interact with galactic material on larger scale (kpc):
   *the narrow line region is morphologically related to the radio structure in NGC4151 (Heckman & Balick, 1983) and other Seyferts (Wilson 1983);
   *strong, sharp bending of jets has been observed in high-z quasars with steep-spectrum cores (Barthel & Lonsdale 1983a, 1983b);
   *in ComaA a radio jet interacts with clouds, producing local particle acceleration, photo ionisation as well as jet bending and decollimation (Miley et al., 1981);
   *NeII lines are well correlated with the spiral jet structure in the Galactic Center (Ekers et al., 1983).

With these facts in mind we noted the following properties of various types of active galaxies:

1. Concerning space densities: BLRGs/Syl ∿ Quasars/QSOs ∿ 10^{-1}-10^{-2}
2. BLRGs and Syl are similar in having bright nuclei and strong emission lines; however, FeII/Hβ is weak in BLRGs and strong in Syls (Osterbrock 1982);
3. Radioloud quasars and radio quiet QSOs are similar in having very

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bright nuclei and strong emission lines; however, FeII/Hβ weak in most quasars and strong in QSOs (Osterbrock 1982);
4. The radioloud quasars with strong optical FeII have *compact* radio structure, the extended radio quasars have weak FeII (Miley & Miller 1979).

In other words: in active galaxies possessing extended radio sources the optical FeII is not excited.

From studies of BLR excitation mechanisms (Collin-Souffrin et al., 1980) we know that the BLR is characterized by two distinct ionization systems: a standard photo ionisation region (I), containing Lyα, CIII, HeI, HeII, and a collisionally excited, partially ionized region (II), containing most of the Balmer lines, the optical FeII, MgII and OI. Region II is hot (10^4 K) and dense ($10^{11}cm^{-3}$).

A way to look at the properties just mentioned is to reason that if a radio jet is stopped its energy may dissipate and excite the low ionisation FeII in dense parts of the BLR by collisional heating by turbulent jet velocities. Commonly observed line shifts of $\pm 10^4$ kms^{-1} of these low-ionisation species with respect to the mean redshift (Gaskell 1983) provides evidence for this jet hypothesis.

In summary: although Doppler boosting and aspect angles may play a role in explaining differences between types of active galaxies, the nuclear environment is likely to be an important factor.

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