PKS 0812+020: A QUASAR INTERACTING WITH ITS ENVIRONMENT

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ABSTRACT. Slit spectra have shown optical emission line gas in the vicinity of the radio jet and the north radio lobe of PKS 0812+020. Velocities up to -1000 km/s with respect to the central quasar are seen in the north lobe. The [OII] emission strength becomes comparable to the [OIII] near the north lobe, as would be expected from acceleration by shocks. We suggest this acceleration occurs by interaction with the radio-emitting jet.

1. INTRODUCTION

PKS 0812+020 is a z=0.4 quasar situated in a rich cluster of galaxies. It is the most luminous example of optical emission coincident with a radio hot spot. The optical and radio structure has been discussed by Wyckoff et al. (1983). Recently, better VLA maps at 20cm, 6cm, and 2cm have been obtained. Also, slit spectra were obtained with the KPNO CCD Cryogenic Camera on the 4-m telescope.

2. RADIO RESULTS

A straight jet connects the central QSO to the north radio hot spot. Optical emission ($R=22^m$) is seen in this hot spot on direct photographs. Near the QSO, the jet width is about 2". Beyond about 4" (40 kpc) from the QSO (the limit of the fuzz) the jet widens to 3".5 to 4".5. We suggest that the jet is confined by the interstellar medium in the QSO's host galaxy and flares out upon exiting the galaxy.

The north radio hot spot is embedded in a large diffuse radio lobe with a sharp gradient at the northern edge, consistent with ram pressure confinement by an intracluster medium.

South of the QSO, there is a diffuse lobe with a steep brightness gradient to the SW, and a weak hot spot also coincident with optical emission. At present, it is unclear whether this is the terminus of an invisible jet, or the collision of the slowly expanding radio lobe with a cluster galaxy.

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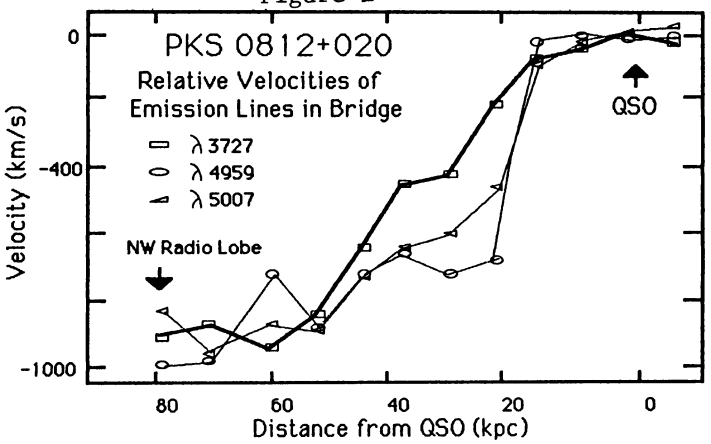
Figure 1



3. SPECTROSCOPIC RESULTS

Velocities in the emission line gas along the jet are plotted in Figure 1. Parallel to the radio jet axis, there is a sharp increase in velocity, reaching almost -1000 km/s with respect to the quasar. This is followed by an abrupt deceleration at the position of the north hot spot (as expected for the radio plasma itself). This behavior is similar to that seen, e.g., in 3C277.3 by van Breugel et al. (1985); it suggests influence of the radio plasma flow on the emission line material.

The apparent excitation conditions change with distance from the nucleus as shown by the [OII] to [OIII] flux ratio changing from about 20 at the QSO to about 1 near the north hot spot.

4. DISCUSSION

There seems to be an abrupt change in conditions at about 4"-5" (or 40 kpc) from the nucleus, i.e., at the limits of the quasar's "host" galaxy. Beyond this interface, the velocities increase, the jet widens, the extended diffuse radio lobe begins, and the [OII] emission strengthens with respect to the [OIII]. At present, we are considering a picture in which most of the emission line material is present throughout the host galaxy, and photoionized by the core. At the transition from the interstellar to intracluster medium, the radio source is perturbed, driving shocks into the thermal material, accelerating it and increasing the [OII] luminosity.

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REFERENCES

van Breugel, W., Miley, G., Heckman, T., Butcher, H., Bridle, A., 1985, U. Cal. Berkeley, preprint.

Wyckoff, S., Johnston, K., Ghigo, F., Rudnick, L., Wehinger, P., Boksenberg, A., 1983, Ap.J., 265, 43.