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TESTING THE CONNECTIONS IN THE BH-DISK-JET SYSTEM

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To study physical relations between the central nucleus, the broad line region and the parsec-scale jet we combined data available from the optical spectroscopy and VLBI imaging of ∼ 120 radio-loud (RL) AGN from the 2 cm and MOJAVE[4] VLBA surveys. Here, we present some preliminary relations found between the mass of the black hole ($M_{\rm BH}$) and properties of parsec-scale radio jets for 41 AGN selected from the presence of Hβ broad emission line in their spectra.

The sample, observations, reduction, as well as the emission line (Hβ and [OIII]) and continuum luminosity (at 5100 Å, L_{5100}) measurements are described in Arshakian et al. (2005). The majority of these RL AGN have redshifts between 0.5 to 1.5.

BH masses of RL AGN determined by means of reverberation mapping are overestimated because of beamed continuum emission coming from the relativistic jet (Wu et al. 2004). We expect that the luminosity of the Hβ emission line is not enhanced by the jet emission. To test this, we calculated $M_{\rm BH}$ with two different relations, one based on the radius of the broad-line region, $R_{\rm BLR}$, and Hβ luminosity, $R_{\rm BLR} - L_{\rm H\beta}$, and one based on $R_{\rm BLR} - L_{5100}$ (Kaspi et al. 2005).

We found that $R_{\rm BLR} - L_{5100}$ relation gave smaller values of $\rm M_{BH}$ than those computed with L_{5100} and hence that indeed $L_{\rm H\beta}$ is a more accurate indicator of photoionizing luminosity. The $M_{\rm BH}$ estimated for 25 RL AGN lie in the range from $2 \times 10^6\, M_\odot$ to $2 \times 10^9\, M_\odot$.

For the same sample, we found a correlation between L_{5100} and luminosity of the parsec-scale jet at 15 GHz ($L_{5100} \propto L_{jet}{}^{0.72\pm0.08}$) with a correlation coefficient $r = 0.8$. Since the production of radio emission in compact jets is due to synchrotron mechanism, positive correlation between radio and optical emission suggests that the beamed optical continuum emission may originate in the jet on scales of tens to hundreds of parsecs.

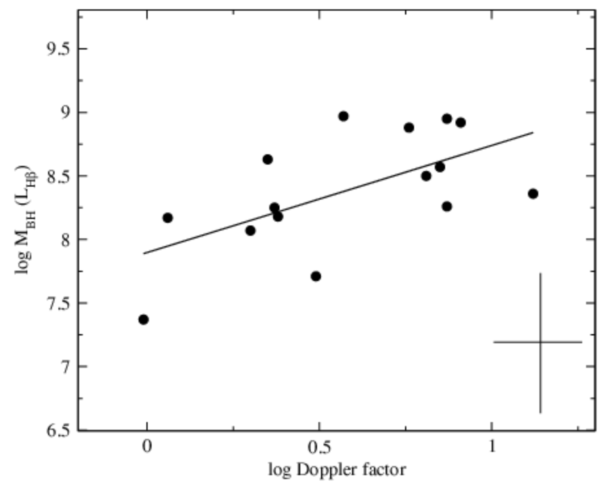

Fig. 1. $\rm M_{BH}$ vs. Doppler factor for 15 RL AGN, the error bars represent the standard deviation of individual errors.

The intrinsic parameters of the jet (jet speed and its inclination angle) can be determined from the observable quantities, the apparent superluminal speed (β_{app}) and Doppler factor (δ) of the jet. Arshakian et al. (2005) reported preliminary results about correlations between the BH mass and the compact radio jets. They found a positive correlation between $M_{\rm BH}$ and δ of the jet for a sample of 11 RL AGN. Using the Doppler factors estimated by Lähteenmäki & Valtaoja (1999) we confirm the moderate positive correlation ($M_{\rm BH} \propto \delta_{\rm var}{}^{0.84\pm0.30}$, $r = 0.6$) for 15 AGN having Hβ broad emission line (see Figure 1). If this correlation is confirmed for a larger sample of AGN then this suggests that *more massive central nuclei produce jets having higher Lorentz factors.*

We plan to test these correlations and to study new connections between the BH, BLR and the jet for a enlarged sample of ∼ 120 RL AGN with Hβ, MgII and CIV broad emission lines.

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