TABLE 1

KENDALL'S τ CORRELATION ANALYSIS BETWEEN RADIO AND OPTICAL LUMINOSITIES[a]

			All		Quasars		BL Lac	
A1	A2	A3	τ	P	τ	P	τ	P
L_{5100}	$L_{\rm VLBA}$	z	**0.259**	**3.95E-14**	**0.237**	**7.67E-10**	0.140	0.173
L_{5100}	$L_{\rm un}$	z	**0.242**	**6.14E-12**	**0.198**	**9.02E-07**	0.150	0.149
L_{5100}	$L_{\rm jet}$	z	**0.246**	**2.07E-12**	**0.218**	**6.53E-08**	**0.389**	**9E-04**

[a]The columns are arranged as follows: A1 and A2 are the independent variables for which the Kendall's τ correlation analysis is performed, and A3 is the dependent variable, in this case the redshift, "All" refers to the 233 sources in the sample, also were analyzed separately 181 quasars and 31 BL Lacs, τ is the correlation coefficient, and P is the probability of a chance correlation. The correlations considered to be significant are marked in bold face.

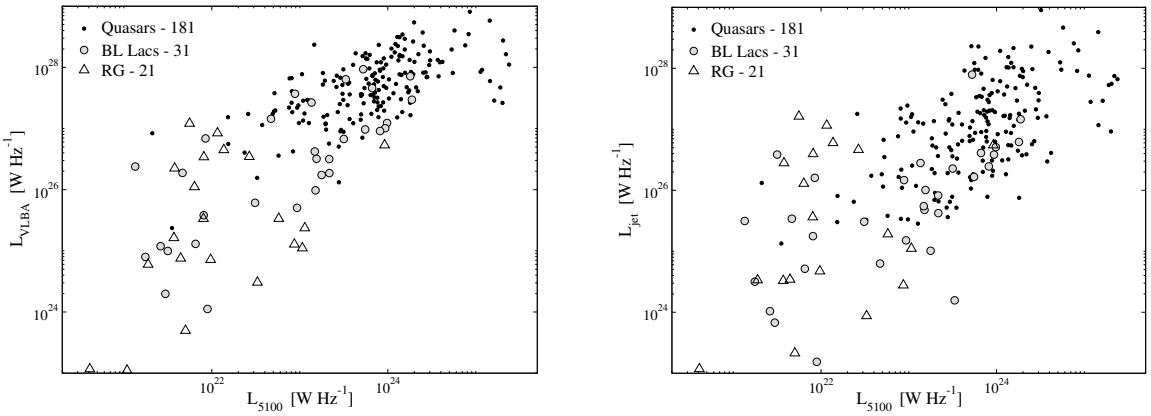

Fig. 1. The total radio luminosity of the VLBA jet at 15 GHz against optical continuum luminosity at 5100 Å, (left panel), and radio luminosity of the jet (unresolved core subtracted) against optical continuum luminosity at 5100 Å (right panel) for quasars, BL Lacs and radio galaxies.

jet and the optical nuclear luminosity. We consider the correlations to be significant for the samples of all 233 AGN and 181 quasars if the chance probability of the correlation $P < 0.02$ (or confidence level $> 98\%$), and $P < 0.05$ (or confidence level $> 95\%$) for the sample of 31 BL Lacs. The outcome of the statistical analysis is summarized in Table 1 and they are in agreement with the results reported in A10. There is a significant positive correlation for 233 AGN between optical nuclear emission and radio emission originated in the jet at milliarcseconds scales (Figure 1; Table 1). For quasars, correlations hold also between optical nuclear luminosity and radio luminosities of the unresolved core (at sub-milliarcseconds scales) and the whole jet. For BL Lacs, the optical luminosity correlates positively only with the jet luminosity at the high confidence level of $\sim$99.9% (Figure 1). The dispersion of the radio-optical correlation can be caused by non-simultaneous observations, distributions of intrinsic luminosities, and Doppler factors. The larger dispersion for BL Lacs could be a result of stronger variability in the radio and optical bands as well as a wider range of intrinsic luminosities, while for radio galaxies the deeming of optical continuum emission by an obscuring dusty torus can vary significantly.

Our results, together with the apparent speed – optical luminosity diagram and the aspect curves derived from the relativistic beaming theory (see Figure 9 of A10), support the idea that the optical emission is generated in the relativistic jet. In particular, the optical emission in quasars with superluminal jets originates in the innermost part of the jet at sub-parsec scales, while in the BL Lacs it is generated in the parsec-scale jet.

REFERENCES

Akritas, M. G., & Siebert, J. 1996, MNRAS, 278, 919
Arshakian, T. G., et al. 2010, A&A, 520, 62
Kovalev, Y. Y., et al. 2005, AJ, 130, 2473
Lister, M. L., et al. 2009, AJ, 138, 1874