

# RC J0311+0507: A Candidate to Superpowerful Radio Galaxies with $z = 4.514$

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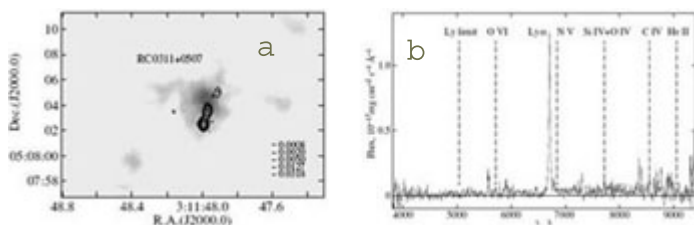
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**Abstract.** The investigations of the ultra steep spectrum radio source RC J0311+0507 (4C+04.11) in radio (RATAN-600, VLA) and optics (6-m telescope SAO RAS) are presented. The identification of a strong line at 6703 Å with Ly $\alpha$  gives a redshift  $z=4.514$ . The object belongs to the group of extremely distant radio galaxies of ultrahigh radio luminosity ( $P_{1400} = 1.3 \times 10^{29} \text{ WHz}^{-1}$ ).

**Keywords.** high-redshift galaxies, cosmological parameters, early universe

The radio source RC J0311+0507 was discovered in 1980-1981 during the first deep survey with RATAN-600 multi-frequency complex. Figure 1a shows the superposition of the 4860-MHz isophotal image of this source on the R-band 6-m telescope (SAO RAS) image of the host galaxy. A strong emission line at 6703 Å has been detected in the optical spectrum for the host galaxy (R = 23.1) with 6-m telescope in 2004 (Fig. 1b). We identified narrow intense line at the center with Ly $\alpha$  at redshift  $z = 4.514$ . The data for known galaxies at  $z > 4$  are given in table 1. Such high power can be provided only by a super massive black hole ( $\sim 10^9 M_{sun}$ ) that formed in a time less than the age of Universe at the observed  $z$  (1.3 Gyr) or had a primordial origin.

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**Table 1.** Data for radio galaxies at  $z > 4$

Name	$z$	$m_{opt}$	$m_k$	$S_{1400}$ , mJy	$\alpha$	LAS	Morphology
TN J0924-2201	5.199	>24	R 21.7	71	1.65	1".2	D
RC J0311+0507	4.514	23.1	R ...	500	1.29	2.8	AD+C
VLA J123642+621331	4.424	24.9	I 21.4	0.5	0.94	0.4	C+E
6C 0140+326	4.413	24	I 20.0	91	1.17	2.6	D
8C 1435+63	4.261	23.6	I 19.5	497	1.37	3.9	D+C
TN J1338-1941	4.11	22.4	R 20.0	121	1.33	5.5	AD+C
TN J1123-2154	4.109	>24.5	R 20.3	49	1.57	0.8	S
7C 1814+670	4.05	24.1	R 19.4	236	1.08	18.	D