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Research Note

Discovery of six bright low-redshift quasars from the RASS sources

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Abstract. We are carrying out a program on the identifications and follow-up observations of the x-ray sources selected from the ROSAT All-Sky Survey Bright Source Catalogue with the 2.16m telecope and 60cm telescope at Beijing Astronomical Observatory. After the first run observation, six bright low-redshift quasars have been discovered. They are 1RXS J002811.6+310342 (V=15.42, z=0.500), 1RXS J012556.6+351039
(V=16.42, z=0.312), 1RXS J080132.3+473618 (V=15.73, z=0.1583), 1RXS J221537.8+290239 (V=16.50, z=0.2288), 1RXS J231456.0+224325 (V=16.30, z=0.1692) and 1RXS J234734.6+271910 (V=16.06, z=0.646).

Key words: quasars: general – surveys – X-rays: galaxies

1. Introduction

Most of the sources in the ROSAT All-Sky Survey(RASS) Bright Source Catalogue(Voges et al. 1996) were first detected at x-ray band. About 60 percent of the sources have not been identified. It is very important to make optical identifications and follow-up observations of the RASS sources. We are carrying out a project to observe unidentified RASS sources with E magnitude between 13.5 and 16.5. In this letter we report the discovery of six bright low-redshift quasars with V magnitude equal to or less than 16.5.

In the second section of this letter, the selection of sources and observations are introduced. Then we report the observations which led to the discovery of the six quasars in the third section. In the final section, we present discussions about the six quasars individually.

2. Optical identifications and follow-up observations

In this program, we selected sources from the RASS Bright Source Catalogue with the following steps: 1. Select sources in the northern hemisphere with high galactic latitude. In practice we chose $\delta \geq 3^o$ and $|b| \geq 20^o$. 2. Exclude sources with optical counterparts in the catalogues of bright stars,white dwarfs,cataclysmic variables,NGC and AGNs. 3. Search for optical counterparts within a circle with a radius D=D1+D2, in which D1 is the ROSAT x-ray position error given by Voges et al.(1996) and D2 was taken as 5 arcseconds. It should be noted here that about 15 percent of the quasars would been excluded outside the cross radius. 4. Select the objects with E magnitudes between 13.5 and 16.5, in which the E magnitudes were measured using DSS(Cao et al. 1997). 5. Exclude the sources whose nature is known in SIMBAD or NASA Extragalactic Database.

The spectra were obtained by using the 2.16m telescope at Xinglong station, Beijing Astronomical Observatory. A JENA ZEISS UNIVERSAL spectrograph or OMR spectrograph were attached at the Cassegrain focus, and a TEK1024*1024 CCD camera was employed as the detector with a resolution of 200Åmm^{-1} or 400Åmm^{-1}. The observing log was listed in table 1. KPNO standard stars were observed on the same nights for flux calibration. Flat-field correction, wavelength calibration, and flux calibration were done as usual per manual.

The photometric data have been obtained using 60cm telescope at Xinglong station. At the prime focus the telecope is equipped with a TI215 (Japan) CCD camera and standard Johnson filters. The observations were done on Dec. 10, 1996. M67 was observed on the same night, and photometric data of M67 published by Montgomery(1993) were used for system calibration and correction of atmospheric extinction. The photometric error (r.m.s.) are 0.06 for V and 0.07 for B respectively. Spectroscopic and photometric observation data were reduced using the IRAF package.

3. Results

Some parameters of the six bright low-redshift quasars are listed in the table 2. Their optical coordinates are listed in the second and third column. The optical coordinates were measured from DSS with the reference frame of the stars from the NASA Guiding Stars Catalog. The average redshifts were derived from 2 or

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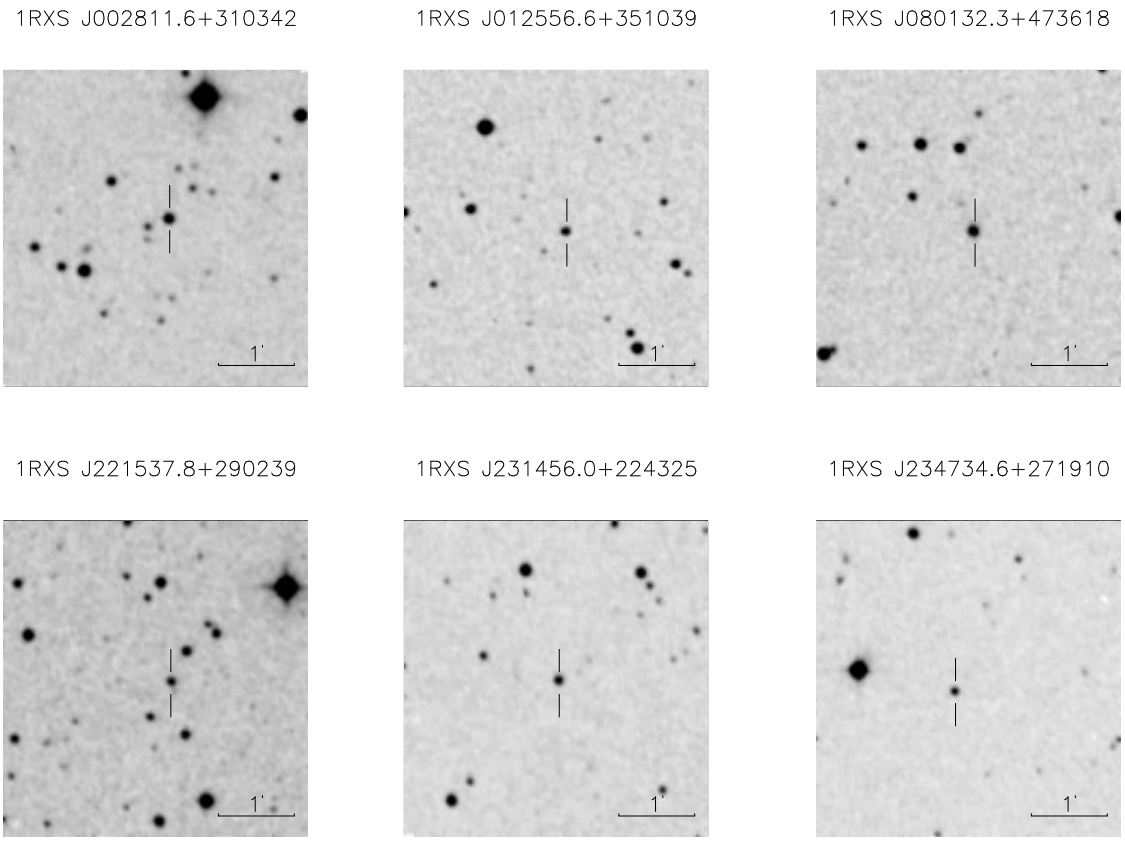

Fig. 1. The finding charts of the six quasars. North is up, and east is at the left.

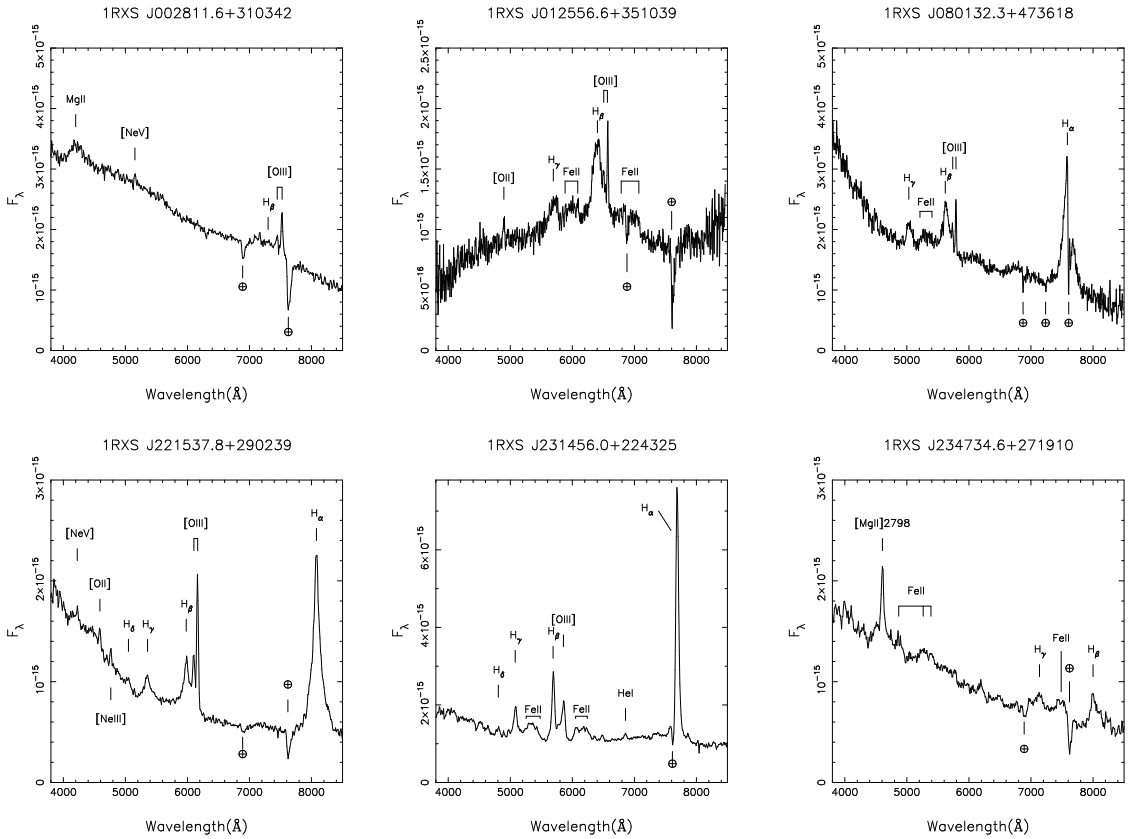

Fig. 2. The spectra of the six quasars

Table 1. The observing log

source name	date	UT	exp.time	spectrograph	grating	wavel.range	airmass
1RXS J002811.6+310342	01.12.96	14h11m	5min	OMR	400A/mm	3800-8000A	1.149
1RXS J012556.6+351039	15.01.96	11h06m	40min	JZU	200A/mm	3800-8000A	1.006
1RXS J080132.3+473618	23.12.95	17h31m	60min	JZU	200A/mm	3800-8000A	1.052
1RXS J221537.8+290239	02.11.96	12h34m	10min	OMR	400A/mm	3800-8000A	1.046
1RXS J231456.0+224325	01.11.96	13h19m	10min	OMR	400A/mm	3800-8000A	1.064
1RXS J234734.6+271910	30.11.96	12h15m	15min	OMR	400A/mm	3800-8000A	1.055

Table 2. Parameters of the quasars

source name	RA	Dec.(2000)	V	B-V	z	M_B
1RXS J002811.6+310342	00:28:10.7	31:03:50	15.42	0.37	0.500±0.001	-26.7
1RXS J012556.6+351039	01:25:56.0	35:10:38	16.42	0.86	0.312±0.001	-24.2
1RXS J080132.3+473618	08:01:31.9	47:36:17	15.73	0.37	0.1583±0.0007	-23.8
1RXS J221537.8+290239	22:15:36.8	29:02:37	16.50	0.25	0.2288±0.0004	-24.0
1RXS J231456.0+224325	23:14:55.7	22:43:25	16.30	0.59	0.1692±0.0005	-23.2
1RXS J234734.6+271910	23:47:35.3	27:19:00	16.06	0.35	0.646±0.003	-26.7

more emission lines. The absolute B magnitudes were calculated by the same formula used by Veron-Cetty and Veron(1995) under the assumption of Ho=50kms^{-1}Mpc^{-1} and q_0=0. The formula is defined as

$M = m + 5 - 5\log D - k + \Delta m(z)$

where k is the k correction and $\Delta m(z)$ is a correction to k. The finding charts and spectra are showed in Fig. 1 and Fig. 2 respectively. The six quasars are described individually in the following:

1RXS J002811.6+310342: It is the brightest one of the six quasars. Its B magnitude is 15.7, brighter than the limiting magnitude of the Palomar Bright Quasar Survey(BQS)(Green, Schmidt and Liebert,1986). It has a galactic latitude of b= 31.5, in the area of BQS. But it is just at the boundary of field of view of the survey plates(Green 1996). Its spectrum shows that this quasar has blue continuum. The broad MgII emission line and narrow forbidden lines of [NeV] and [OIII] can be identified. But the broad H_β emission line is remarkably weak.

1RXS J012556.6+351039: From the dropping of its spectrum at the blue end and the colour B-V=0.86, it can be seen that it is a red quasar. The broad H_β and H_γ emission lines and narrow [OII] and [OIII] emission lines can be identified. There are also obvious FeII emission lines.

1RXS J080132.3+473618: This object was offered to us by Dr. W. Brinkmann before we began our program. This quasar has a B mgnitude of 16.10, but it is a little fainter than the limiting magnitude of the BQS in this field(Green, Schmidt, and Liebert, 1986). The spectrum shows a blue continuum. The broad Balmer (H_α, H_β and H_γ), HeI and FeII emission lines and narrow [OIII] emission lines can be identified. The H_α emission line, which has not been corrected, is seriously affected by the atmospheric absorption A-band at 7594Å.

1RXS J221537.8+290239: Its spectrum shows blue continuum. Actually this quasar, with B-V=0.25, is the bluest one of the all six quasars. The broad Balmer emission lines can be identified. And the narrow [NeV],[OII],[NeIII] and [OIII] emission lines are also very obvious.

1RXS J231456.0+224325: It has an absolute B magnitude of -23.2, the faintest of the six quasars. Its Balmer lines are narrower than the other 5 quasars. All these make it look like a Seyfert nucleus. It is remarkable that this quasar has very strong FeII emission. The H_α emission line is affected by the atmospheric absorption A-band. And HeI5786 fills the atmospheric absorption B-band at 6867Å, which makes it is hard to find the B-band absorption line from the non-corrected spectrum.

1RXS J234734.6+271910: Its spectrum shows very weak [OIII]4959/5007 lines compared to a spectrum of a normal quasar. The MgII2798 line is narrower than normal quasars. However, it seems that the MgII line also has a broad component. There are also strong FeII emission lines.

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