A quasar possibly ejected from NGC4579

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Abstract With the 2.16 m telescope at Beijing Astronomical Observatory, it is identified that a compact X-ray source detected by ROSAT located in the vicinity of 5′.9 from the LINER galaxy NGC4579 is a quasar with a redshift z = 0.106. A further analysis indicates that this quasar is possibly ejected from NGC4579.

Keywords: quasar-galaxy-redshift.

The phenomenon of the association between high redshift quasars and bright galaxies has been discovered for more than 30 years. Although the debate on the physical nature of such a phenomenon is being continuous, the finding of more and more accumulative examples of such association is an undoubted fact. The gravitational lensing effect taken as an account for such association is preferred by the scholars who support the standard cosmological models. However, the quantitative analysis shows that the gravitation lensing effect can only explain about half excess number of quasars surrounding the galaxies.

The school of thought, which is represented by Arp, Burbidge and Hoyle et al., insists that the redshift of quasars has large non-cosmological components. They firmly believe that some quasars may be ejected from the central active region of galaxies[1]. Many recent new observational results, such as NGC4258[2], NGC1068[3], NGC3516[4] provide a new considerable impetus for this study.

In this note we report a point source located only 5′.9 from NGC4579, which we consider as a quasar with a high redshift z = 0.106. Based on its optical spectrum, it is possibly ejected from the center of NGC4579. NGC4579, i.e. M58, is a member of the Virgo Cluster of galaxies. De Vaucouleurs et al. claimed that it is an SBb galaxy at about 20 h^{-1} Mpc from us and they classified it as an LINER galaxy[5]. In the optical spectrum of NGC 4579 there are strong [OI]λ 6 300 emission lines, and the H_{α} emission shows very broad wings, and the UV emission lines are similar to those of Seyfert galaxies. This active galaxy has thus many notable characters.

Using the ROSAT PSPC observational archives, Radecke[6] and Arp[7] studied the X-ray sources in 1° region around 26 Seyfert galaxies and found a c = 4.4 X-ray source 5′.9 from NGC4579. On the POSS, this source is identified as an E = 18.2 blue point-like object. This means that it is considered as a quasar candidate, its optical position is α_{2000} = 12^{h}37^{m}19.^{s}21, δ_{2000} = +11°49′15.″8 (see fig. 1).

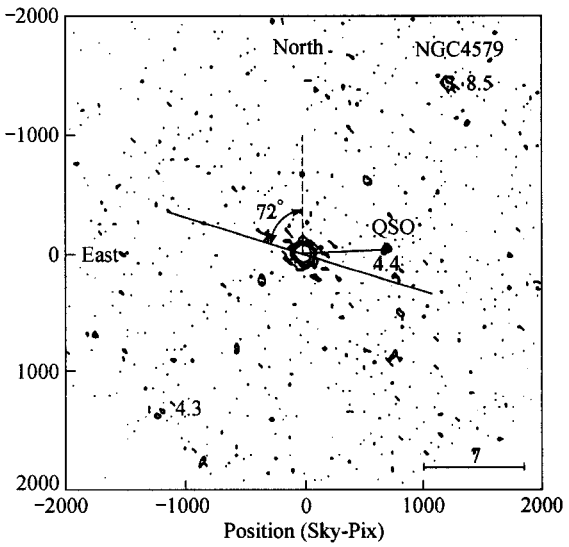

Fig. 1. Finding chart of the quasar.

1 Optical identification

We observed the optical spectrum of this quasar candidate at the 2.16 m telescope of the Xinglong Station, Beijing Astronomical Observatory. An OMR spectrograph was attached at the Cassegrain

Focus with a TEK 1024×1024 CCD serving as a detector at the resolution of 400 nm/mm, the slit width was about 3″ and the integration time 3 600 s. The Fe/Ar lamp and the He/Ar lamp were used for wavelength calibration, the KPNO flux standard stars (Massey et al.)[8] as flux calibration. The data were reduced with IRAF standard packages.

The spectrum in fig. 2 shows its emission lines with typical characters of active galaxy nuclei (AGN). As we all know, at present there is no rigorous standard classification for AGN. Considering that this object has a redshift $z \geqslant 0.1$, we call it a quasar. The emission lines and the corresponding redshifts for this object are listed in table 1.

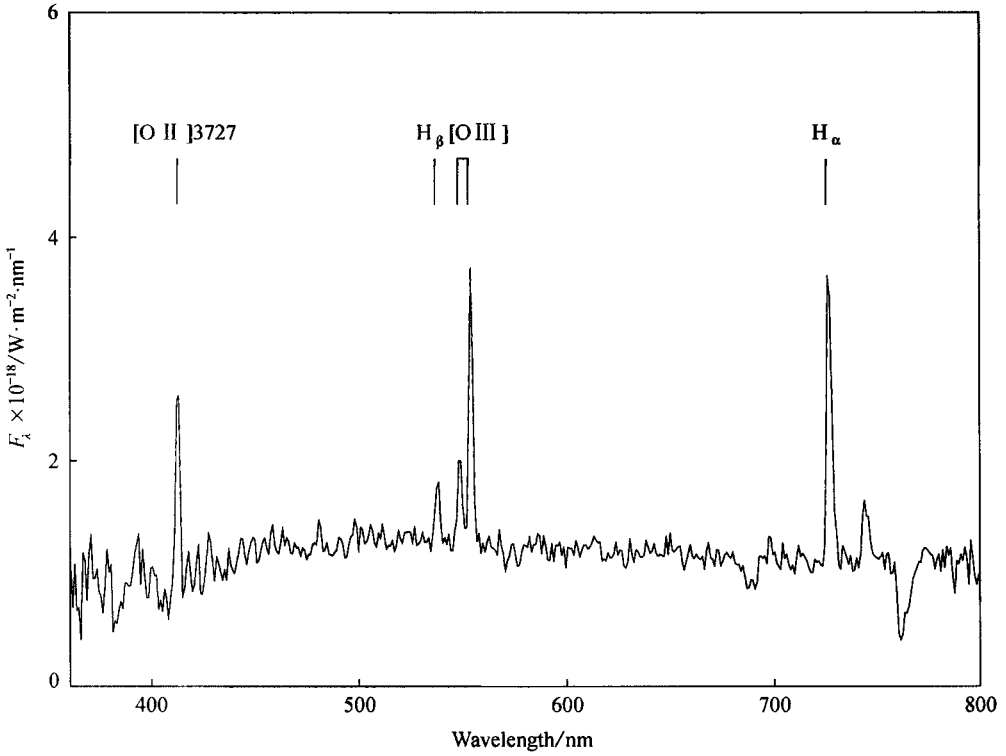

Fig. 2. Optical spectrum of the quasar.

Table 1 Emission lines and redshifts of the quasar

Emission line		Observed wavelength/nm	Redshift z
H_α	6 563	726.3	0.106 6
[OIII]	5 007	554.3	0.107 0
[OIII]	4 959	548.3	0.105 6
H_β	4 861	538.1	0.106 9
[OII]	3 727	412.2	0.105 9

Mean redshift $z = 0.106$.

2 Discussion

(i) In our previous studies we confirmed that in the Virgo Cluster field there is an association between quasars and galaxies in $5' < \theta < 40'$ at highly significant level[9]. In those studies we adopted quasar sample from the LBQS survey, but it did not include the X-ray emitting quasar we identified here. With the help of the cross correlation function we ruled out the possibility that such an association was due to the project effect from the background quasars. Considering that the quasar is a kind of rare objects, from the statistical point of view, the possibility that this new quasar is just due to the

projecteffect located only 5′.9 from NGC4579, a background object, is very low.

On the other hand, there is another known quasar Q1234 + 1217 lying 15′.5 from NGC4579 with a redshift $z = 0.662$ and a magnitude $V = 18.4$[10]. Thus, in the close vicinity of NGC4579, two bright quasars with the similar magnitude of about 18 have been found, it is to reasonably deduce that this new identified X-ray-emitting quasar has some physical relation with the galaxy NGC4579.

(ii) We have noticed that, very similar to NGC4258[2], NGC4579 has also active nuclei and shows considerable evidence of ejection from the center. Using the narrow-band imaging in H_α+[NII] at the 4.2 m WHT telescope and the long-slit spectroscopy at the 2.5 m Isaac Newton Telescope, Delgado and Perez[11] found that in the central region of NGC4579 there is a circumnuclear emission gas which shows radial motion with an extension of 2 kpc from the nucleus to the northeast and with the same distance to the southwest (P. A. = 72°). The H_α equivalent width increases towards the outer part of the nucleus and up to about 1.0 nm at the two ends. The estimated radial velocity could be as high as 400 km/s.

In fig. 1 we see that the new identified quasar lies very near to the ejection direction of the nuclear gas. The direction difference is only 18°. Comparing the cases of NGC4579 and NGC4258, we find them very similar: both have gas ejection with a velocity of about 400—500 km/s in the central region and in both directions of the ejection there exist high redshift quasars. This could also be considered as one of the evidences that the new quasar we identified is probably ejected from the NGC4579.

(iii) Maoz et al. observed the NGC4579 at the UV band (230 nm) using the Hubble Space Telescope and found that besides a central bright nucleus, there is a second slightly extended (~ 0″.1 × 0″.2) source 0″.58 from the center at P. A. = 72° with an about 15% UV flux of the central source, its direction is just opposite (northeast) to that of our new quasar. It looks very like another object ejected from the nucleus.

(iv) The radio observation (Hummel et al.[13]) indicates that the NGC4579 has a compact core and a one-side extended source, its ejection direction is very close to that of the new quasar we found.

3 Conclusion

All the observational results we cited above show that there is a strong ejection activity in the central region of NGC4579. At a distance of about 5′.9 from the center of NGC4579 we find a new quasar with a redshift $z = 0.106$. It is most possibly formed by ejection from the nuclear region of NGC4579. This is another example of the physical association between the two objects with different redshifts.

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