Research Note

A Search for Extended Radio Emission Around the Nearby X-ray QSO 0241 + 622

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Summary. No extended radio emission was detected from the nearby X-ray QSO 0241 + 622.

Key words: X-ray QSO – extended radio emission

The X-ray QSO 0241 + 622 with a redshift of 0.0438 is the nearest quasar known (Apparao et al., 1968; Margon and Kwitter, 1978). Its radio emission has been studied by the VLA (Apparao et al., 1978), with radio link interferometry (Tzanetakis et al., 1978) and with VLBI (Geldzahler and Shaffer, 1979). The structure consists of a flat spectrum core whose size is smaller than 0′′00055 and a 1′ steep spectrum component located 3′9 away. Since these measurements were all made with high angular resolution, they are relatively insensitive to structures larger than a few seconds of arc. At the QSO 1′′ ~ 760 pc, it was possible that an extended component of size ≥ 100 kpc such as is present in many quasars (e.g. Miley and Hartsuyker, 1978) might have been missed. Moreover, this QSO has been reported to have an optical nebosity extending by at least 10′ (Ford, 1978). At 610 MHz the Westerbork Synthesis Radio Telescope (WSRT) is an ideal instrument to search for weak extended non-thermal radio emission. We have therefore used the WSRT at 610 MHz to map the region near 0241 + 622.

The source was observed for 12 ten-minute periods at equally spaced hour angles during 6th to 14th November 1978. A 512 by 512 array corresponding to a 3′ by 3′ region around the quasar was Fourier transformed and the central 256 by 256 array was cleaned and restored with an elliptical Gaussian beam of half widths 50′′ (RA) by 57′′ (Dec).

The resultant completeness level in the map uncorrected for primary beam is ~ 20 mJy. Including the QSO, nine sources were detected above this 20 mJy map flux limit. These are listed in Table 1. The pointlike quasar was detected with a flux density of 300 ± 18 mJy and the other sources are believed to be background sources unconnected with the quasar.

No extended emission was detected above a brightness level of 30 mJy per beam area close to the QSO. This corresponds to a luminosity limit of ≤ 1×10²³ W Hz⁻¹ per 38 by 43 kpc and is more than two orders of magnitude below the extended luminosities observed in some quasars.

1 \( H = 75 \text{ km s}^{-1} \text{ Mpc}^{-1} \)

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Table 1. Sources in 1.5′ × 1.7′ field around QSO 0241 + 622

<table>
<thead>
<tr>
<th>Ser. no.</th>
<th>Right ascension (1950)</th>
<th>Declination (1950)</th>
<th>Corrected 610 MHz Flux density (mJy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>02 38 24.2</td>
<td>+62 41 05</td>
<td>55</td>
</tr>
<tr>
<td>2</td>
<td>02 38 43.2</td>
<td>+62 46 40</td>
<td>313</td>
</tr>
<tr>
<td>3</td>
<td>02 39 14.4</td>
<td>+62 36 26</td>
<td>182</td>
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<tr>
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<td>02 39 40.8</td>
<td>+61 43 12</td>
<td>327</td>
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<td>02 41 00.7</td>
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</tr>
<tr>
<td>9</td>
<td>02 45 25.4</td>
<td>+62 33 45</td>
<td>80</td>
</tr>
</tbody>
</table>

Notes:

a. Flux densities are corrected for attenuation by primary beam
b. Uncertainties are ~ ±0.15 in r.a., ~ ±2′′ in dec, ~ ±7% in flux density
c. QSO is source 5
d. No source is significantly resolved (≥ 35′′ × 40′′) with the exception of source 6 which has a faint extension in p.a. ~ 60°
e. Includes all sources with mapflux > 30 mJy.

This completeness level does not include primary beam attenuation. Near QSO attenuation is negligible. Thus here any extended structure has brightness < 30 mJy beam⁻¹

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References