LETTERS TO THE EDITOR

ASTRONOMY

Observations of Quasars using Interferometer Baselines up to 3,074 km

IT has previously been demonstrated by the Jodrell Bank–Malvern interferometer that some quasars have angular diameters less than 0·025 sec of arc. These measurements were made with a baseline of 120 km at a wavelength of 6 cm (ref. 1).

It is not only desirable to improve still further the resolving power at centimetre wavelengths but, in view of existing theories which predict that the observed diameter of a quasar should increase with wavelength, it is important to achieve comparable resolution at longer wavelengths. This implies the use of very long baselines. With conventional interferometers using land lines or microwave links, it is difficult to preserve the phase of the signals for distances greater than a few hundred kilometres. Furthermore, it is difficult to compensate for the large and variable time delay between reception of the signals at the two telescopes. These difficulties have been overcome by the use of wide-band magnetic tape recorders and independent local oscillators controlled by rubidium frequency standards[2].

With an interferometer of this type we have observed the quasar *3C 273B* at a frequency of 448 Mc/s with a baseline of 3,074 km ($4{\cdot}6 \times 10^6\lambda$). Assuming a Gaussian source model the visibility of the fringes indicates that the diameter of this source is less than 0·02 sec of arc at this frequency.

Observations at 448 Mc/s have also been made at a baseline of 183 km ($2{\cdot}7 \times 10^5\lambda$) and fringes of high visibility observed for the sources *3C* 273, *3C* 286, *3C* 287, *3C* 309·1, *3C* 345, *NRAO* 530, *3C* 446 and *CTA* 102. The maximum angular diameter of these sources is therefore about 0·3 sec of arc. Fringes of low visibility were observed for the quasar *3C* 454·3.

Although some sources showed large amplitude scintillations, the fringes for all sources were extremely regular, indicating that phase scintillation was small.

The instruments used for these observations were the 46 m telescope of the Algonquin Radio Observatory, the 25·6 m telescope of the Dominion Radio Astrophysical Observatory and the 18·3 m antenna of the Defence Research Telecommunications Establishment, near Ottawa. We thank the Defence Research Telecommunications Establishment for making available the 18·3 m antenna for some of these observations.

Note added in proof. Subsequently, fringes were also observed from *3C* 345 using the 3,074 km baseline.

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A Strong X-ray Source in the Vicinity of the Constellation Crux

THIS communication presents a preliminary report of the detection of a strong source of X-rays in the vicinity of the constellation Crux.

Two identical X-ray detection systems were included in the payloads of two Skylark rockets flown from Woomera, Australia (lat. = 30·9° S., long. = 136·5° E.), at 0032 U.T. on April 4, 1967 (Skylark *SL* 426), and at 2236 U.T. on April 20, 1967 (Skylark *SL* 425). The X-ray experiments on both flights operated successfully from ignition to re-entry 400 sec later. The data considered here will be those obtained when the rockets were at altitudes in excess of 100 km, because below this altitude the atmosphere is opaque to celestial X-rays in the energy range of interest.

The X-ray detection system on each rocket consisted of four LND proportional counters containing a xenon–methane (90 per cent to 10 per cent) mixture at 1 atm. The X-ray window of each counter was 12 cm², and consisted of 14 mg/cm² (0·003 in.) of beryllium. The counters were calculated to have an efficiency which varied from 40 per cent at 2 keV to 98 per cent at 8 keV. The counters possessed energy resolutions of about 25 per cent full width half maximum (FWHM) when newly filled. The resolutions of some of the counters deteriorated with time, however, possibly as a result of contamination of the filling gas with electronegative material, and in the worst case were 70 per cent immediately before the flight (*SL* 426). Two counters used on *SL* 425 possessed the best energy resolution immediately before flight (~30 per cent) and for the purposes of this communication have been used to investigate photon energy spectra.

On each rocket, the counters were divided into two groups of two, each pair "looking" in one direction and having its pulse outputs combined through an equalizing network. The resultant pulse train was analysed by a two window pulse height analyser, with windows set at 2–5 keV and 5–8 keV. These windows were calibrated using the 5·9 keV X-rays from a source of iron-55. The counting rate data from the two energy windows corresponding to each pair of counters were telemetered to ground, as were the temperatures of various components. The geometrical configuration of the counters was such that about 75 per cent of the pulses due to relativistic cosmic rays were equivalent to greater than 8 keV energy deposition, and thus were rejected.

Collimators were placed in front of each of the counters to define its field of view, the angular resolutions being 10·5° FWHM in the direction of rocket spin and 35° FWHM in the plane containing the spin axis. The attitude of the rocket spin axis, and the phase of the rocket spin, were determined using optical, magnetic, and rate gyro data provided by the standard Skylark instrumentation unit. Four independent crossed-slit Sun sensors provided the angle between the solar and spin vectors, while a three-axis magnetometer permitted calculation of the angle between the magnetic and spin vectors; the two angles

Table 1. SUMMARY OF RESULTS FOR "CRUX" OBJECT

	SCO XR-1	"CRUX"
Intensity*		
SL 425: 2–5 keV (c.p.s.)	269 ± 8	160 ± 7
5–8 keV (c.p.s.)	98 ± 5	33 ± 3
2–8 keV		
ratio $\frac{\text{"CRUX"}}{\textit{SCO XR}\text{-1}}$	0·52 ± 0·04	
Spectra		
SL 425: ratio $\frac{5\text{–}8\ \text{keV}}{2\text{–}5\ \text{keV}}$	0·36 ± 0·03	0·20 ± 0·03
Position†		
SL 425: Right ascension	16·2 h	13·7 h
Declination	−15°	−62°
SL 426: Right ascension	16·3 h	13·5 h
Declination	−16°	−66°

* No corrections have been applied for the efficiency of the counters. Absolute photon fluxes should not be computed from these counting rates until such corrections have been applied. (Errors shown are statistical).

† The position of *SCO XR*-1 is 16·28 h, 15·5 degrees (ref. 3).