a mean right ascension of about 195 deg, consistent with the Coma cluster.[2] If we strobe at +31 deg, which is the declination of the telescope axis, then we obtain the dotted curve shown on Fig. 2(b). We note that here we pick up a multilobed pattern somewhat similar to that obtained for Cygnus XR-1, and we interpret this as evidence that an edge of the Coma cluster source extends to a declination near +31 deg.

The net spectrum from the Coma cluster detected by the proportional counter during a 30-min interval of maximum yield is shown in Fig. 3(c). This corresponds to a net exposure value of 27×10^3 cm^2 sec and exhibits a positive net count of 169 events with an expected statistical standard deviation of 55 counts. A malfunction of the pulse-height analysis for the CsI scintillator channel during the flight of 6 December 1965 prevents an examination of the spectrum much above 30 keV.

The expected total number of events recorded by the proportional counter during a total exposure to the Coma cluster of about two hours was evaluated as 474 ± 113. For comparison, the expected total number of events recorded by the proportional counter during a similar exposure to Cygnus XR-1 was evaluated as 809 ± 121. Since the exposure values for these two sources were essentially the same, this allows us to estimate that the flux from the Coma cluster is comparable to that from Cygnus XR-1 for energies in the vicinity of 25 keV, vix., $\approx10^{-2}$ (cm^2 sec keV)$^{-1}$ at the top of the atmosphere.

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INTERFEROMETRIC STUDY OF COSMIC LINE EMISSION AT OH FREQUENCIES

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The 18-cm Λ-type multiplet of $O^{16}H^1$ in its ground state has been observed in absorption[1] against strong continuum radio sources, with frequencies that agree well with the laboratory-measured values.[2] The emission lines, on the other hand, have been observed only close to H II regions[3-5] with polarization and intensity anomalies that are not yet understood. Single-antenna measurements[6] have shown that the sources are of small angular size, with surface brightnesses that correspond to radiation temperatures two orders of magnitude greater than the apparent kinetic temperatures derived from the observed linewidths. An improvement in angular resolution has been achieved by using the Millstone (84-ft) and Haystack (120-ft) antennas of the MIT Lincoln Laboratory as an interferometer with a base line of approximately 3800λ at 18 cm, along a line nearly 20° east of north. Most of the observations were made with both antennas circularly polarized in the same sense.

The signals from the two antennas were effectively cross-correlated by a phase-switching scheme. The sum and difference of the i.f. outputs from the two receivers were autocorrelated,[7] and the difference between these autocorrelation functions was taken. A common local-oscillator signal was derived from reference signals carried along a transmission line which was servo-controlled to maintain constant electrical length. An i.f. delay for white-fringe compensation was unnecessary since the delays were reconstructed in the autocorrelator.

Fringe amplitude and phase information, as a function of frequency, was extracted from the autocorrelation functions by means of a least-squares-fit technique executed by a digital computer. After calibration of the base-line parameters with continuum radio sources of small diameters and known positions, the positions of the emission lines were obtained from fringe phase as a function of hour angle.

The observations have so far concentrated on the emission region near the continuum radio source W3 (IC 1795). Table I shows, for the five strongest lines at 1665 MHz, the size limits (assuming a uniformly bright circular disk) of the emitting source derived from the observed fringe amplitude. The uncertainty in fringe amplitude represents the peak observed deviations for 15-min integration intervals over all local hour angles. All lines had nearly the same phase which allows us to put an upper limit on the angular separation of the individual lines. No significant resolution of the emitting source could be detected, and all of the radiation appears to originate from the same region. More limited observations of the 1667-MHz lines gave the same position for the lines at −42.2 and −44.7 km/sec within 10 sec of arc subject to a possible lobe ambiguity owing to the small local-hour-angle coverage of the observations at this frequency.

Since all hour angles were covered at 1665 MHz, the position was unambiguously determined from observations made 7 through 19 June to be (epoch 1950.0)

$$\alpha = 02^h 23^m 14.3^s \pm 1.5^s,$$

$$\delta = 61°38'57'' \pm 10''.$$

The dominant contribution to these errors arises from uncertainty in the derived interferometer base line. The rms fluctuations (for a 15-min integration) due to noise in observations of the strongest line (−45.1 km/sec) was 3% in fringe amplitude and 3° in fringe phase.

A search was made in the Palomar Observatory Sky Atlas for possible optical identifications. The observed position falls just within the boundary of a nebulosity, midway between two faint stars, neither of which is within the position uncertainty.

The source of the line emission is clearly of an unusual nature. For example, the observed angular size limit implies a brightness temperature of at least 2×10^6 °K for the line at −45.1 km/sec. The apparent linear dimension of the source, assuming that it is located at the distance of W3 (1700 pc), is less than 0.1 pc.

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Table I. Angular sizes and separations of emission features observed adjacent to W3.

Line velocity[a] (km/sec)	Polarization (IRE convention)	Fringe amplitude	Effective source diameter	Separation from −45.1-km/sec line
−45.1	Right	1.01 ±0.05	<15″	
−43.7	Right	1.0 ±0.1	<20″	<3″
−41.7	Right	1.0 ±0.2	<25″	<3″
−45.4	Left	1.0 ±0.1	<20″	<3″
−46.4	Left	1.0 ±0.1	<20″	<3″

[a]Velocity relative to the local standard of rest assuming rest frequencies to be those of the $2\pi_{3/2}$, $J=\frac{3}{2}$, Λ-doublet of $O^{16}H^1$.

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DIAMETERS AND POSITIONS OF THREE SOURCES OF 18-cm OH EMISSION

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Observations of interstellar OH emission with single-dish antennas have given an upper limit of 5 min of arc to the angular size of the 18-cm line-emission regions.[1] This leads to very high values of brightness temperature. In addition, these objects show linewidths as narrow as 600 Hz, circular polarization as much as 100%, very surprising ratios of line strengths within a multiplet, and, in some cases, variations of flux with time.[2-6]

The purpose of this investigation is the determination of higher accuracy positions and a lower limit to the angular sizes. The instrument used was the pair of 90-ft steerable paraboloids at the Owens Valley Radio Observatory of the California Institute of Technology. The spacings between the antennas may be varied by moving them along tracks in east-west and north-south directions. They were operated at 1600 and 800 ft east-west and 1600 ft north-south in this investigation.

Each individual paraboloid has an equatorial mounting and can track most sources over an hour-angle range of 4 h before and after transit, giving a range of projected spacings as seen from the direction of the sources. The amplitude and phase of the interference fringes at each projected spacing represent two points in the complex two-dimensional Fourier transform of the angular distribution of brightness of the emitting region. A complete grid of projected spacings must be used to enable the reconstruction of the complete brightness distribution in the sky. To measure such a grid would be extremely time-consuming; for this preliminary investigation we chose spacings which we hoped would give significant information and guide further observations.

The horn feeds were parallel with the position angle of the E vector at 0°. Superheterodyne receivers were used with tunnel-diode preamplifiers and image-frequency rejection filters. The common local-oscillator signal was derived from a frequency synthesizer. The synthesizer settings were calculated in advance for all sources, dates, times, and velocities, using the program developed at the Radio Astronomy Laboratory of the University of California.

The intermediate-frequency section available had six channels each with a bandwidth of 6 kHz and each 30 kHz apart. Six local-oscillator settings 5 kHz apart covered a complete spectrum 180 kHz wide. Ten-minute integrations were made at each local-oscillator setting, giving noise fluctuations of 0.5°K antenna temperature.

Barrett and Rogers[6] have resolved line components as narrow as 600 Hz in W3C, with 1.5-kHz separation between features with different polarization. Possible variations of position or size over those ranges of frequency are smoothed out in our observations. On the other hand, we find little variation of position or size over larger ranges of frequency.

The instrumental parameters and locations of OH regions in the sky led us to choose observations of W3C, W49, and NGC 6334 at the strong components at 1665 and 1667 MHz. W3C is at the edge of the emission nebula IC 1795. W49 is associated with a postulated nebula which is completely hidden by intervening dust. Pho-