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# G0·55–0·85, AN H II REGION–MOLECULAR CLOUD COMPLEX

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SUMMARY

OH, $H_2CO$ and H110$\alpha$ lines have been observed in the direction of G0·55–0·85, an H II region identified with RCW 142. Optical depths in the satellite lines of OH at 1720 and 1612 MHz are unusually high—both are in absorption with about equal intensity, a central velocity of 16·8 km $s^{-1}$, and a half-width of 4·7 km $s^{-1}$. On the other hand, the OH main lines are dominated by a number of narrow emission lines with radial velocities between 6 and 19 km $s^{-1}$. The results are interpreted in terms of a Class I OH source embedded in a dense molecular cloud, probably no more distant than the Sagittarius arm.

## 1. INTRODUCTION

Near the eastern edge of the 5 GHz continuum map of the galactic centre region made by Whiteoak & Gardner (1973) there is a small-diameter source centred at RA (1950) $17^h\ 47^m\ 08^s$, Dec. (1950) $-28°\ 53'{\cdot}1$ ($l = 0°{\cdot}55, b = -0°{\cdot}85$). It has a peak antenna temperature of 1·1 K and a corrected diameter smaller than 3′ arc. An investigation of the source has shown it to be an H II region associated with an OH emission region and a dense molecular cloud.

## 2. RESULTS AND DISCUSSION

The region of the 5 GHz continuum map containing the source G0·55–0·85 is shown in Plate I, superimposed on a ‘ red ’ print of the Palomar Sky Atlas. Contrary to a previous statement of Whiteoak & Gardner (1973), G0·55–0·85 coincides with the small H$\alpha$-emission region RCW 142 (Rodgers *et al.* 1960). The velocity of the H$\alpha$ emission has not been measured, but observations of the H110$\alpha$ recombination line (4874 MHz) yielded a velocity of 13·3 km $s^{-1}$ relative to the local standard of rest; the peak line-to-continuum ratio was 0·07, a value typical of H II regions (Wilson *et al.* 1970).

Fig. 1 shows spectra of the four 18-cm OH transitions observed in the direction quoted earlier. They were obtained with the Parkes 64-m telescope in the manner described by Whiteoak & Gardner (1975a). The resolution in velocity is 0·7 km $s^{-1}$. The satellite lines at 1612 and 1720 MHz are similar—both are in absorption with a peak line temperature of 0·6 K (corresponding to a line-to-continuum ratio of 0·08), a half-width of 4·7 km $s^{-1}$, and a velocity of 16·8 km $s^{-1}$. In contrast, the mainline spectra at 1665 and 1667 MHz are dominated by several narrow emission lines within a velocity range of 6–19 km $s^{-1}$—only one line (at 12·9 km $s^{-1}$) appears to be in common. There is some evidence of absorption at the positive velocity edge of the spectra.

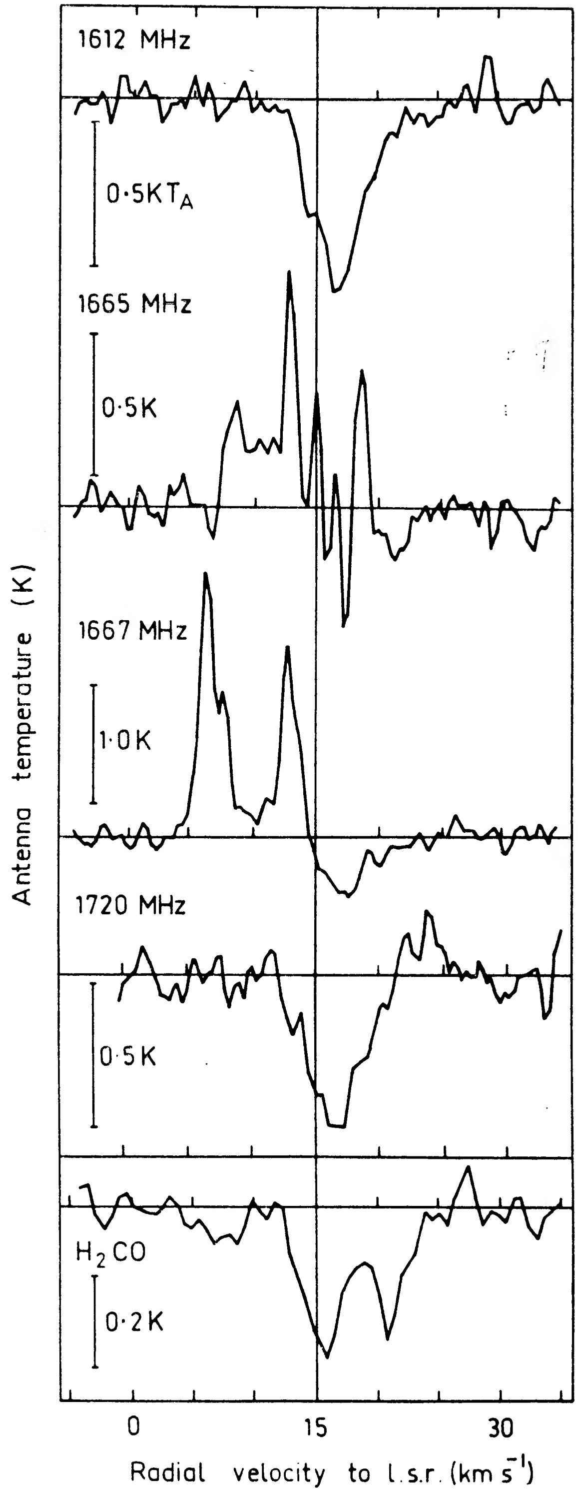


FIG. 1. *Profiles of the ground-state transitions of OH and the absorption of* 4830 *MHz* $H_2CO$ *in the direction of* G0·55–0·85.

Fig. 1 also shows the 4830 MHz $H_2CO$ spectrum for the source, obtained at Parkes. The velocity resolution for the profile is 1·2 km s$^{-1}$. It can be seen that the $H_2CO$ absorption covers a range in velocity similar to that for the satellite OH lines, but there are two distinct dips at 15·6 and 20·8 km s$^{-1}$. The peak absorption is 0·30 K and the corresponding line-to-continuum ratio 0·27.

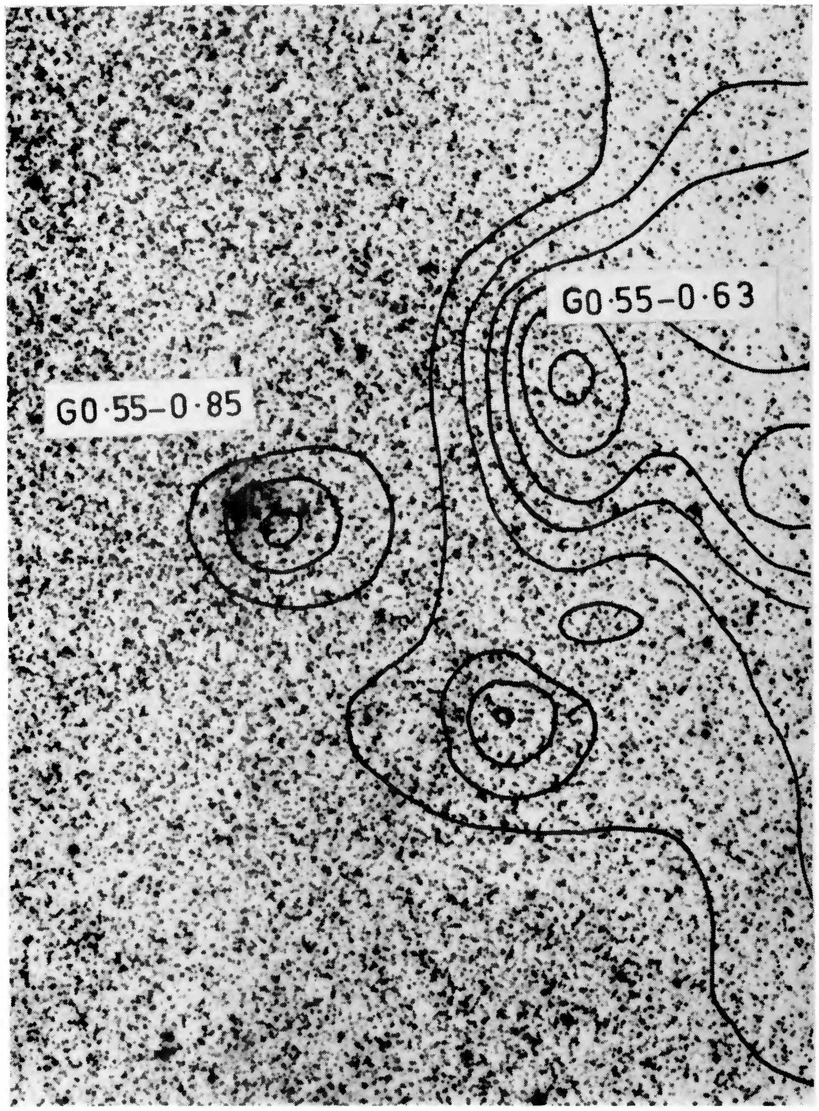


PLATE I. *Part of the* 5 *GHz continuum map of Whiteoak & Gardner* (1973) *superimposed on a ' red ' print of the Palomar Sky Atlas. The lowest contour, and the contour interval, are equivalent to* 0·3 *K in antenna temperature.*

[*facing page* 30P]

The magnitude of the satellite-line absorption and the virtual absence of main-line absorption are unusual features of 18 cm OH spectra of H II regions—outside the galactic centre region the highest line-to-continuum ratio at 1720 MHz listed in the literature is 0·06 (for NGC 2024) (Manchester, Robinson & Goss 1970). For G0·55–0·85 the molecular cloud responsible for the satellite-line absorption must produce considerably greater absorption at the main-line frequencies in accordance with the sum-rule (Rogers & Barrett 1967)—if the cloud were in local thermodynamic equilibrium the absorption at 1667 MHz would be nine times greater. Therefore, in both of the mainline spectra, this absorption must be masked by the narrow emission components, which must originate in some other region where the relative populations of the ground-state energy levels are different. The main-line emission is typical of a Class I OH source and is probably associated with the H II region. This is supported by the absence of main-line emission from the nearby source G0·55–0·63 (see Fig. 1). On the other hand, the 17 km $s^{-1}$ absorbing cloud is considerably extended towards the galactic plane (unpublished $H_2CO$ observations obtained at Parkes). However, an association between this cloud and G0·55–0·85 is also suggested, because the line-to-continuum ratios of the $H_2CO$ and OH absorption are both high (see Whiteoak & Gardner 1975b).

In spite of the small galactic longitude of G0·55–0·85, it is unlikely that it is located near the galactic centre. There are two nearby Hα-emission regions (RCW 137, 141) with measured Hα velocities of 12·2 and 9·6 km $s^{-1}$ (Georgelin & Georgelin 1970). On the Palomar Sky Atlas these regions appear as part of an extended Hα-emission complex partly obscured by dust, which because of its size is probably located no more distant than the Sagittarius spiral arm. Although RCW 142 is small (4′ arc diameter) and apparently discrete, the similarity between its recombination-line velocity and the Hα velocities in RCW 137 and 141 suggests a location in the same spiral arm. In addition, the galactic latitude of the region ($-0^\circ.9$) supports a distance that is not too large.

Further observations are needed to establish the relative position of the H II region and OH-emission source, and to test for circular polarizations of the main-line OH features (the present results were obtained with a linearly-polarized feed).

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