21 CM LINE STUDY OF LARGE SCALE DENSITY FLUCTUATIONS IN THE TAURUS MOLECULAR COMPLEX

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ABSTRACT. 21-cm spectra on a 41 × 31 grid, centered at 1950: RA 04^h30^m; DEC 27^d00^m, at points separated by a true angle of 0.25 degrees, were observed using the Arecibo telescope in October 1985. The identical grid had previously been observed in 13CO by Kleiner and Dickman (1984) with the FCRAO mm wave telescope. In this preliminary analysis we determined autocorrelation functions and power spectra for 21-cm self absorption "intensities", for a cross passing through the central point. Both arms of the cross, aligned parallel to RA and DEC, show a power spectral peak at a frequency of 0.312 reciprocal degrees, corresponding to a period of 3.2 degrees on the sky. Assuming that the Taurus complex is at a distance of 140 pc, this corresponds to a correlation length of 7.8 pc, which is about a factor of two smaller than the value of 14 pc found by Kleiner and Dickman for 13CO.

1. INTRODUCTION

This project was undertaken after the study by Kleiner and Dickman (1984) suggested that the 14 pc correlation length they found for 13CO intensity in the Taurus molecular complex might be a "fossil scale length" originally present in the atomic hydrogen clouds from which the molecular clouds were formed. We intend to do a complete two-dimensional determinations of the 21-cm intensity and velocity correlations, and also cross-correlations, both global and on a cloud-by-cloud basis, with the CO data.

2. OBSERVATIONS AND ANALYSIS

Observations were conducted in October 1985 using the low-sidelobe 21-cm "flat feed" at Arecibo Observatory. The antenna beamwidth was 4 arc min and the receiver system temperature was 60 K. The total number of spectra observed was 1271, each with an integration time of about 20 seconds. Here we present the results of an autocorrelation and power spectral analysis for the central cross of the grid. The data analysed were 41 spectra parallel to Right Ascension, and 31 spectra parallel to Declination, all spaced at a true angle of 1/4 degree. Only self absorption lines between 0 and 8 km/s were selected, and the depth of the self absorption in Kelvins below an interpolating cubic spline curve was

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used as a measure of the "intensity" of 21-cm self absorption. A simple one bit autocorrelation (weak or no line = 0, strong line = 1) gave almost identical results, so the assessment of line intensity, which is difficult as shown by Levinson and Brown (1980), does not affect the autocorrelation function severely. Both power spectra showed a major peak at 0.625 reciprocal degrees, corresponding to a period in the autocorrelation function of 3.20 degrees. This corresponds to a correlation scale length of 7.8 pc.

3. CONCLUDING REMARKS

An analysis of 21-cm self absorption in the Taurus molecular complex indicates that there is a prevailing scale length of 8 pc, quite different from the value of 14 pc found for 13CO. These results, however, are similar to those obtained by Baker (1973) for 21-cm emission from much warmer atomic hydrogen in the anticenter direction, who found a typical scale size of 7 pc.

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STAR FORMATION IN TAURUS, THE IRAS VIEW

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In the course of its short existence the IRAS database has already proved an incredibly powerful tool for studying the classification of sources -both galactic and extragalactic- in a new and very exciting way. For the first time it is now possible to employ selection criteria based purely on the infrared properties of a complete (to very low intensities) and unbiassed infrared sample - thereby eliminating the selection biases which have critically limited any such previous classifications.

The present work describes the application of such a technique to sources believed to represent different stages of star formation within the Taurus region. It involves the selection of sources from the IRAS point source catalogue (in the area RA = 4^h to 5^h; dec = +16° to +31°) on the basis purely of their infrared 'colours'. The technique has already proved very useful in isolating candidate T Tauri stars - a re-

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