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Preliminary Results of Galactic Radio Recombination Line Observations using the GMRT

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Abstract. A pilot project to observe recombination lines of hydrogen and carbon from Galactic HII regions near 20cm (n = 168) and 49cm (n = 220) using the 30-station correlator at the Giant Metre-wave Radio Telescope was undertaken. The preliminary results from observations of the HII regions W3 and S106 are presented here.

1. Introduction

Recombination lines (RLs) are a powerful probe of the physical conditions of ionized gas. We imaged W3 and S106 in continuum and searched for recombination line emission. The spectra are presented in this paper.

2. Observations & Preliminary Results

The recombination line observations were conducted using the GMRT in October-November 1999 in the 20 cm and 49 cm bands. We detected H168α and C168α lines from W3A (Fig 1(a)); our 'calibration' lines which is an encouraging result. The 20 cm RLs towards W3A, which were detected earlier, originate in a PIR with T_e = 100 K, n_e = 10cm^{-3} and EM=390$cm^{-6}pc$ (Kantharia et al 1998). The expected strength of H220α line, then, is $\sim$ 18 mJy. However there is no detection down to a 5σ limit of 14 mJy. The electron density in the PIR could be larger than 10 cm^{-3} making the line undetectable at 49 cm due to continuum optical depth effects. However, we need confirmatory observations.

The spectra from S106 at 20 cm and 49 cm are shown in Fig 2. No clear signal is detected in the spectra.

The results of our pilot project of observing recombination lines towards Galactic HII regions are encouraging. We detected the narrow H168α and C168α lines from our 'calibration' source, W3A. Repeat GMRT observations are required for other frequencies and S106.

References

Kantharia, N.G., Anantharamaiah, K.R., Goss, W.M., 1998, ApJ, 504, 375.

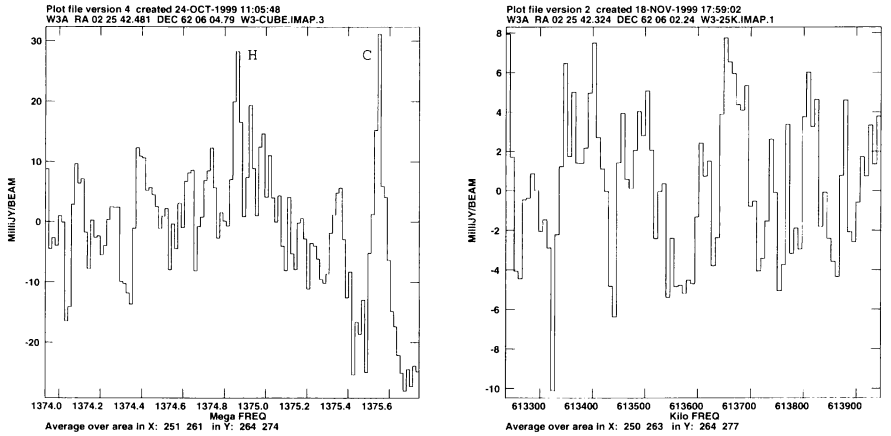

Figure 1. 168α and 220α spectra integrated over W3A. The H and C lines are seen at expected frequencies in 168α spectrum. No line is detected in the 220α spectrum. Both the spectra have an integration time $\sim$ 4 hours.

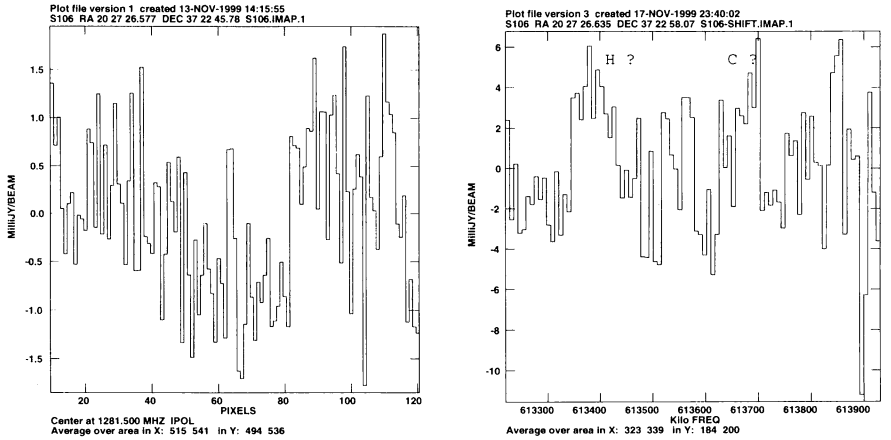

Figure 2. 168α and 220α spectra integrated over S106. No clear line detection. Note that the spectrum at 49 cm has suspect features at two frequencies. Both the spectra have an integration time $\sim$ 4 hours.

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