Bull. Astr. Soc. India (2002) 30, 747–748

GMRT detection of H I absorption in the high-redshift red quasar 3C 190

C. H. Ishwara-Chandra[1]*, K. R. Anantharamaiah[2†] and K. S. Dwarakanath[2]
[1] *Space Astronomy and Instrumentation Division, ISRO Satellite Center, Bangalore 560 017*
[2] *Raman Research Institute, Sadashivanagar, Bangalore 560 080*

Abstract. We report the GMRT detection of H I absorption in the high-redshift red quasar 3C 190 at a redshift of 1.1946. The most interesting result is that the peak of the H I absorption is blueshifted by $\sim$ 250 kms^{-1} with respect to the optical emission lines. The H I absorption profile indicates the presence of multiple components and the peak absorption is at 647.728 MHz. The FWHM of this absorption feature is 185 $\pm$7 kms^{-1}and the peak optical depth is 0.012. The corresponding atomic hydrogen column density is 3.98 $\times$ 10^{20} (T_s/100K) cm^{-2}.

Keywords : galaxies: active - quasars: absorption lines - radio lines: galaxies

1. Introduction

Recently, the red or obscured quasars have generated interest since the work of Webster et al. (1995) claiming that a large fraction ($\sim$ 80%) of quasars could be missed in optical surveys due to dust extinction. Carilli et al. (1998) have searched for H I absorption in a red quasar subsample at a moderate redshift ($z \sim 0.7$) and showed that the success rate for detecting H I absorption in red quasars is much higher (80%). We have started a program to search for H I absorption in a sample of high-redshift ($z > 1$) red quasars with the GMRT. In this paper, we present the detection of H I absorption from the red quasar 3C190 at z= 1.1946. The observations were carried out with the GMRT in the following settings: (i) One observation with a bandwidth of 4 MHz centered at 647.7 MHz and (ii) Two observations each with a bandwidth of 8 MHz centered at 646.7 MHz and 648.7

*email: ishwax@yahoo.com
†Deceased

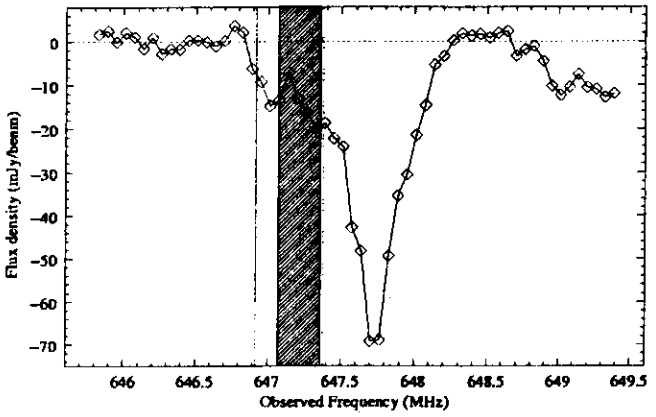

Figure 1. H I absorption profile toward the red quasar 3C 190 from the GMRT. The spectra from the two 8 MHz bandwidth and one 4 MHz bandwidth observations have been averaged. The hashed region from 647.08 to 647.375 MHz corresponds to the redshift obtained from the optical emission lines. The dotted vertical line at 646.918 MHz corresponds to the Mg II absorption line. The uncertainty in the redshift determined from Mg II absorption line is 10 times smaller than that of optical emission lines. The peak of the H I absorption is at 647.728 MHz with an optical depth of $\sim$ 0.012.

MHz respectively. The corresponding velocity resolutions are 29 and 14.5 kms^{-1} for the bandwidths of 8 MHz and 4 MHz.

2. Results and Discussion

The most important finding from our observations is that the H I absorption is blue shifted by $\sim$ 250 kms^{-1} with respect to the redshift obtained from optical emission lines (Stockton et al 2001). The absorption appears to be occurring in the range $\sim$ 646.9 MHz to $\sim$ 648.1 MHz. There is evidence for multiple components in the absorption profile. 3C 190 is a compact steep-spectrum source and is unresolved by the GMRT. The main absorption line is centered at 647.728 MHz with a FWHM of 185 $\pm$ 7 kms^{-1}. The peak optical depth is $\sim$ 0.012 and the corresponding H I column density is $\sim$ 3.98 $\times$ 10^{20} (T_s/100K) cm^{-2}. A more detailed interpretation of the various possible components in the line and the origin of the blue shift of the H I absorption will be discussed elsewhere.

References

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