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IPS Observations at Miyun Station, BAO

X.Z. Zhang and J.H. Wu

Beijing Astronomical Observatory, CAS, Beijing 100012, China & National Astronomical Observatories, CAS, Beijing 100012, China

Abstract. IPS observations have recently begun at Miyun Station, Beijing Astronomical Observatory. This paper briefly describes the radio telescope at Miyun Station, discusses the observation and the data reduction procedures and presents the preliminary results of observations on IPS source 3C48.

1. Introduction

The radio wave from distant radio sources will be scattered by the irregular structures of the solar wind plasma when propagating through the interplanetary space, resulting into a randomly fluctuating pattern of the radio wave in observation. This pattern is called interplanetary scintillation, or IPS. Observation on IPS can give information of the solar wind speed and irregular structures in solar wind plasma. It also provides the unique way currently available to study the sub-arcsec structure of distant weak radio sources.

In addition to IPS observations, solar wind study can also be carried out by spacecraft. But the spacecraft can only do the 'thin sampling' of the solar wind in the ecliptic plane. In comparison, IPS observations can detect 3-D structures of solar wind within solar elongation range $0° \sim 90°$. It can also act as routine observations to do the long-term monitoring of the solar wind.

The IPS observations began at Miyun Station, Beijing Astronomical Observatory from the late half of 1999. This paper describes the Miyun IPS telescope in section 2, gives the IPS observations and data analysis procedures in section 3, and presents some observation examples on IPS source 3C48 in secton 4.

2. The Telescope

The Miyun Synthesis Radio Telescope (MSRT)(Wang 1987) is an array consisted of 28 paraboloid antennae, each has a diameter of 9 m. The antennae are aligned in east-west direction with a longest base-line of about 1.2 km. They are divided into A and B array. The A array consists of 16 elements with separations of 72 m between each two, while the B array consists of 12 elements, 6 elements locate at the east of the A array and the other 6 at the west. The separation between each two elements is 12 m in

B array. The total collecting area of the MSRT is about 1,600 m^2, similar to the collecting area of a 47 m single-dish telescope. The effective area is about 900 m^2 when the telescope is used as an IPS telescope.Table 1 summarizes the parameters related to the observations and the telescope.The working frequency is 232 MHz.

Table 1. The Parameters for MSRT

observing frequency	232 MHz
antenna	9 m parabolic
number of antennas	28
primary beam	$10^o \times 12^o$
baseline	1164 m E-W
spacing interval	6 m
number of baseline	192
min. and max. baseline	18m — 1164 m
synthesis beam	$3.8' \times 3.8' csc\delta$
trans. frontend noise	$100K(232MHz)$
band width	1.5 MHz
sampling interval	10 sec.
path compensation	digital
correlator	96

The MSRT, as it's name suggests, was originally designed as an aperture synthesized system. When it is used in IPS observations, the signals collected by the antennae are simply added in A and B array, separately. Then the A array signal and B array signal are correlated and recorded by computer.

3. Observations

The IPS observations began at Miyun Station, BAO at the late half of 1999. Since the collecting area of MSRT is limited, several strong IPS sources were chosen for the initial observations, such as 3C273, 3C279, 3C48.

After doing the gain and phase calibration (by pointing the telescope at Cyg A), the telescope is pointed at an IPS source and a $\sim$ 30 minutes of source-on observation is made. Then the telescope is moved slight away from the source and a $\sim$ 10 minutes source-off observation is made. The sample rate is 20 ms using a time constant of 60 ms.

Since there is no delay compensation system on MSRT, the IPS observations can only be made when the source locates within half an hour before or after the meridian. Description of the data analysis can be found in the paper of Wu,Zhang, & Zheng (2000) because of the page limit.

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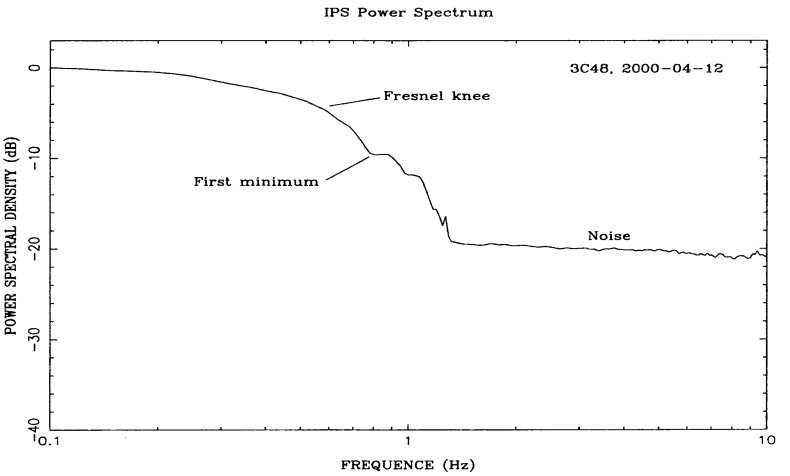

Figure 1. power spectrum of 3c48 obtained with MSRT, BAO

4. Preliminary results on 3C48

We did some observations of 3C48 recently. Fig. 1 gives the power spectra of IPS on April 12, 2000..

The Fresnel knees and the first minima are very clear in the spectra, corresponding to solar wind speeds of about 420 $\mathrm{km\,s^{-1}}$. Since the collecting area of MSRT is limited, the system noise is relatively high and dominates the high-frequency parts of the spectra.

The Miyun IPS observation and data reduction procedures are still under developing and will soon be completed. The observation will be a routine observation and covers as large an area as possible in the future.

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