

Amateur Pulsar Detection Project with EME Communication System in Japan

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Pulsars are faint radio sources requiring large antennas, complex receivers and data processing to detect them. Therefore, it has long been believed that pulsar detection by amateur radio-astronomers is extremely difficult. Recent advancement in Information and communications technology (ICT) has enabled to observe pulsars with a small parabola or an array of high gain Yagi antennas. In the past decade, some amateur radio astronomers achieved detection of pulsars using Software Defined Radio (SDR) receivers [1].

We've initiated a project to make radio astronomical observatories with Earth-Moon-Earth (EME) communication system as a collaborative activity between the amateur radio and radio astronomy communities in Japan. We are aiming to detect the brightest radio pulsar visible in the northern sky (PSR B0329 + 54) using an EME system which is located at Nagano prefecture, Japan. The EME instrument is an array of eight high-gain Yagi antennas in the 420-440 MHz with a combined gain of around 23 dBi (Figure 1) .

RFI monitoring results have found that the RFI from a mobile base station next to the EME system is one of the main interference sources. In fact, large saturating signals between 700 to 1000MHz causes in-band noise modulations that impacts on the system performance. Therefore, the RF signal from the antenna is pre-filtered by a Low Pass Filter (LPF) to suppress the signals out of the operating band. After passing through a Low-Noise Amplifier (LNA), the incoming signal from the antenna passes through Band Pass Filter (BPF) and is sampled by an SDR receiver.

We will report the progress of this project and the results of some astronomical observations.



Figure 1. EME system: Array of eight high-gain Yagi antennas in the 420-440 MHz

References

- [1] R. McKnight and F. van Graas, "Radio-frequency pulsar observation using small-aperture antennas," *Proceedings of the 2022 International Technical Meeting of The Institute of Navigation*, 2022, pp. 856-866, doi.org/10.33012/2022.18259

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