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Long-Term and Rapid Variability of the Radio Source J1603+1105

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Abstract—We present the long-term light curve of the radio source J1603+1105 and results of the study of its variability on timescales from several days to several weeks. From 2007, a flare with the maximum in 2010 was observed for the object that earlier showed no significant variations of flux density. Three flares with a successively decreasing amplitude were detected at an active phase in the long-term light curve. The characteristic time of the first one was 2.5 yrs. In five sets of daily observations of 95 to 120 days, the flux density variability on scales from 9 to 32 days in 2011, 2012, 2015, and 2016 was detected; in 2015 it was detected at three frequencies simultaneously. In 2011, the variability was found at a single frequency of 4.8 GHz; in 2012—at two frequencies, 4.8 and 7.7 GHz; in 2015—at 4.6, 8.2, and 11.2 GHz. We present instant spectra of the source at different flare phases showing that the dynamics of the flare development is consistent with the model, in which the variability is the result of the shock wave evolution in the radio source jet.

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1. INTRODUCTION

The radio source J1603+1105 was detected in the MGB survey [1]. Its galactic latitude is $|b| = 42°$. From the 13th edition of the catalog of quasars and active nuclei, the source is classified as BL Lac object with a magnitude of $V = 18\overset{\mathrm{m}}{.}3$ and a redshift of $z = 0.143$ [2]. However, the redshift is $z = 0.3855$ from the SDSS[1] catalog with no significant lines in the spectrum. Additional studies are needed to reliably determine the redshift of an object identified with J1603+1105.

In 2005, the source was observed with the VLA in the range of 1.4–22 GHz, where its spectrum was flat [3]. From observations of J1603+1105 at the 40-m Owens Valley telescope 08.2008–04.2009, the flux density was 250–280 mJy at 15 GHz [4]. In 2006–2008, the source was observed at RATAN-600 in the range of 1–21.7 GHz [5]; flux densities from these data are close to those we obtained in corresponding epochs.

We monitored the source at the RATAN-600 radio telescope within the sample of objects with the flux densities $S > 200$ mJy from the GB6 catalog in the declination range of $10°–12°30'$ (J2000) at the right-ascension interval of $0^{\mathrm{h}}–24^{\mathrm{h}}$ from November 2001. Observations were carried out at five frequencies in the range of 2.3–21.7 GHz. We presented the results of studying this sample up to 2010 in papers [6–8].

During seven years, the source J1603+1105 showed no significant variability, its flux density at all frequencies did not exceed 0.25 Jy, and the spectrum was almost flat. From 2008, the flux density began to increase at all frequencies; the maximum of the flare was observed in October 2010, the maximum flux density was 0.6 Jy at 21.7 GHz. A series of flares with successively decreasing amplitude were detected up to 2016.

Variability from several days to a month was studied in daily observing runs up to 105 days. The results obtained are presented in this paper.

2. OBSERVATIONS AND DATA REDUCTION

Observations of the source J1603+1105 were carried out in 2001–2002 and from 2006 at the Northern sector of RATAN-600 simultaneously at frequencies of 2.3, 4.8 GHz (from 2014— 4.6 GHz), 7.7 GHz (from 2013—8.2 GHz), 11.2 and 21.7 GHz. In 2003–2005, we did not observe the source because of technical works at the telescope; furthermore, the matter of priority at that time was the study of the

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