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"TEMPORARY GPS/HFP" RADIO SOURCES

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Abstract. For investigation of the nature of GPS/HFP ('gigahertz peaked-spectrum / high-frequency peakers', possible young developing radio sources) it is important to construct robust, representative flux-density-limited samples. To look for spectra of the GPS/HFP type, we have used our RATAN-600 instantaneous broad-band 1–22 GHz spectra measurements of about 2000 compact extragalactic radio sources done in 1997–2003. We have found that some objects from published GPS/HFP samples change their spectra in time becoming non-GPS/HFP sources. We call such objects "temporary GPS/HFP" and suggest to use them cautiously. GPS/HFP-like type of spectrum can often be produced by an AGN during early stages of strong radio flares, and usually such a spectrum evolves to a flat one. A GPS-type spectrum could also be observed during a quiescent state of a relativistic jet when emission of an extended, slowly variable component of the source dominates. Some new GPS candidates are also found.

Key words: galaxies: active, compact – radio continuum: galaxies

1. INTRODUCTION

We investigate 'gigahertz peaked-spectrum' (GPS) radio sources characterized by a simple convex spectrum which peaks in a range of about a decade around 1 GHz. We also consider sources with spectra peaking at frequencies above a few GHz and call them 'high frequency peakers' (HFP) following Dallacasa et al. (2000).

To investigate the nature of GPS/HFP sources, which possibly are young developing radio sources, it is of great importance to construct a robust, representative flux density-limited sample. Some results of sample selections were published recently (see, e.g., Stanghellini et al. 1998; Marecki et al. 1999; Dallacasa et al. 2000; Snellen et al. 2002).

We have used our RATAN-600 instantaneous broad-band 1–22 GHz spectra measurements of extragalactic radio sources done in 1997–2003 in the framework of our ongoing long-term monitoring and survey program (Kovalev et al. 1999) to analyze a possible variability of spectral shapes of the sources selected as GPS/HFP.

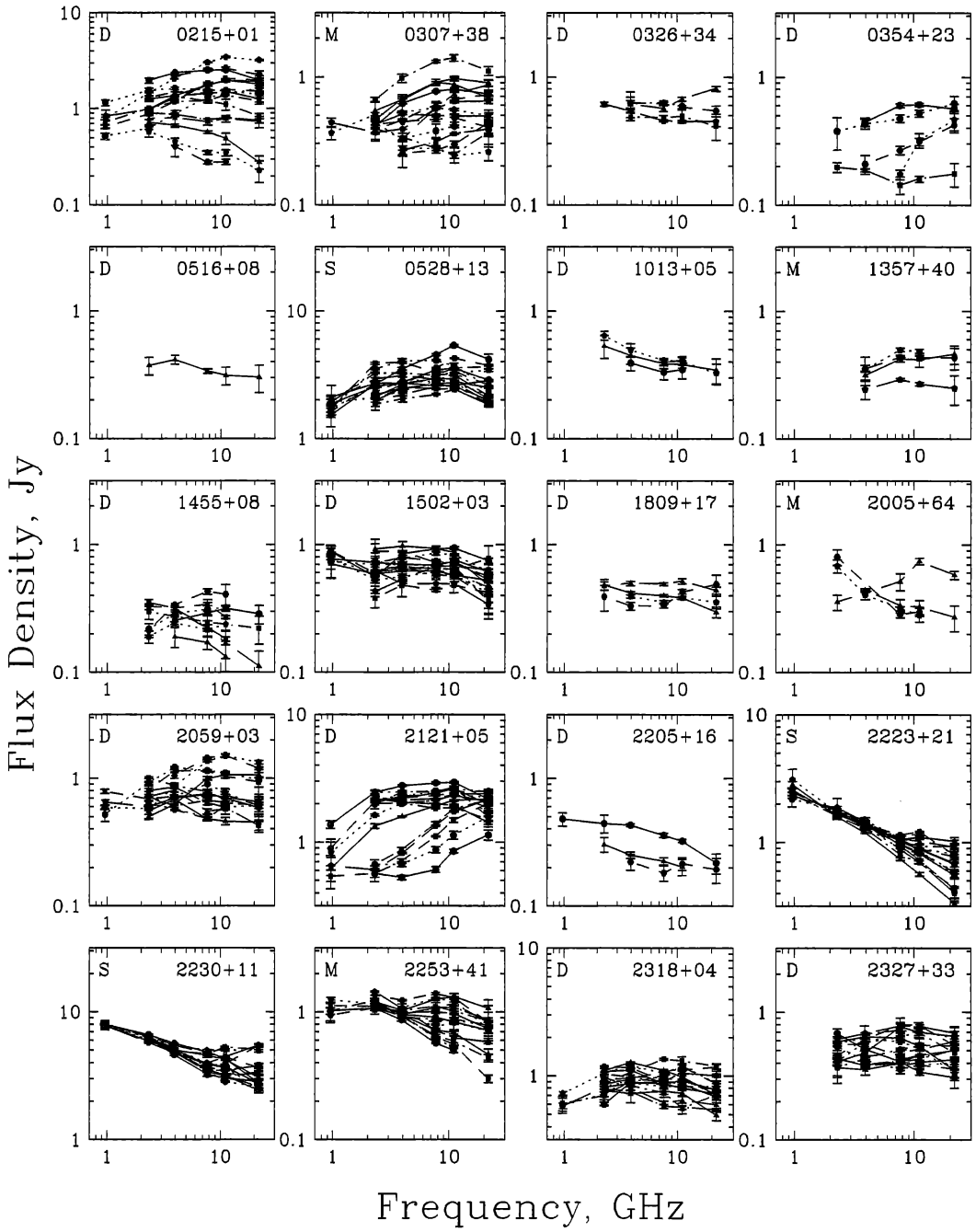

Fig. 1. RATAN-600 radio spectra observed in 1997–2003 for selected "temporary GPS/HFP" radio sources. We mark sources from the Stanghellini et al. (1998) sample as 'S', from Marecki et al. (1999) as 'M', and from Dallacasa et al. (2000) as 'D'.

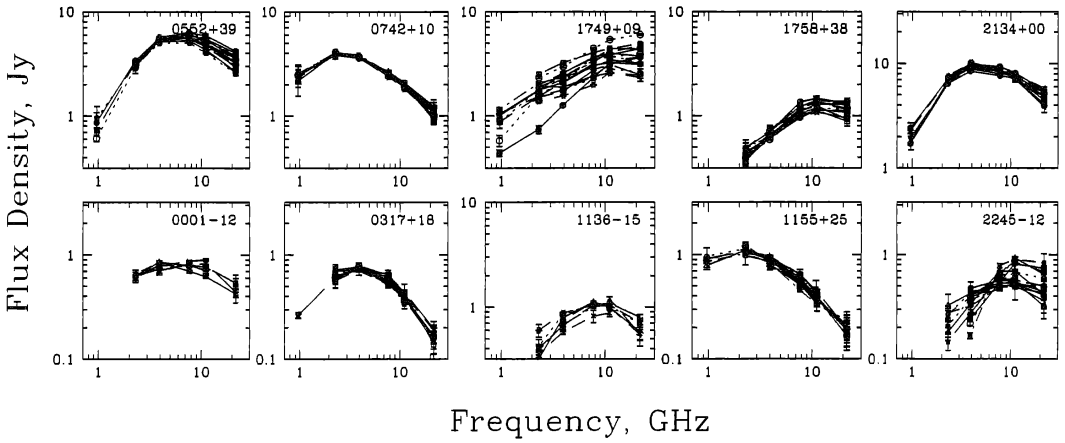

Fig. 2. Examples of RATAN-600 spectra observed in 1997–2003 of the confirmed GPS/HFP radio sources as well as of the new GPS/HFP candidates.

2. OBSERVATIONAL DATA

Broad-band spectra observations were made in 1997–2003 with the 600 m ring radio telescope RATAN-600 at 31, 13, 7.7, 3.9, 2.7 and 1.4 cm, simultaneously in all frequencies. The description of the method of observations and data processing, the list of sources selected for monitoring and the first results are presented in Kovalev et al. (1999). The horizontal localization of the stationary antenna horns allows broad-band spectral responses to be obtained at all observed frequencies during a time interval of 1–2 min in the transit mode of meridional observations.

3. RESULTS

We have analyzed all sources from the GPS/HFP samples published recently by Stanghellini et al. (1998), Marecki et al. (1999), Dallacasa et al. (2000), Snellen et al. (2002) and found that some objects change their spectral shape in time becoming the non-GPS/HFP sources (see Figure 1). We call such objects "temporary GPS/HFP" and suggest to use them cautiously in studies of the GPS/HFP sample. None of the Snellen et al. objects was found by us to be of the "temporary" type.

GPS-like type of the spectrum can often be produced by an AGN during the early stages of strong radio flares, and usually such spectrum evolves to a flat one (see, e.g., Figure 1 and modeling made by Valtaoja et al. 1988; Nesterov et al. 1994 and Kovalev et al. 2002).

Another reason for a confusion can be the following. Kovalev et al. (2002) have shown that generally broad-band spectra of extragalactic sources can be modeled as a sum of two components. One of them represents a compact relativistic jet, another one – a slowly variable extended component. If the source is observed during the quiescent stage, the jet contribution could become very low and the spectrum (corresponding to the extended component alone) can look like a GPS (see, e.g., the spectrum variability of 2230+11 or 2253+41, Figure 1).

In Figure 2 we present examples of long-term broad-band spectra monitoring for a few confirmed GPS sources and new GPS candidates which we picked out using results of our RATAN-600 program. The "temporary GPS/HFP" sources

from Figure 1 obviously exhibit a different behavior of spectra in time, and thus they should be distinguished from the genuine GPS/HFP sources.

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