



A search for compact fading radio-loud AGNs

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ABSTRACT

Evidence has been mounting recently that activity in some radio-loud AGNs can cease shortly after ignition and that perhaps even a majority of very compact sources may be short-lived phenomena because of a lack of stable fuelling from the black hole. Thus, they can fade out before having evolved to large, extended objects. However re-ignition of the activity in such sources is also possible. Based on the discovery of very strong candidates for young compact faders some aspects of the above scenario are discussed.

INTRODUCTION

The Gigahertz-Peaked Spectrum (GPS) and Compact Steep Spectrum (CSS) sources make a significant fraction of radio-loud AGNs. Their projected linear sizes are less than 20 kpc ($H_0=100 \text{ km s}^{-1} \text{ Mpc}^{-1}$ and $q_0=0.5$) and can be explained by the evolution theory. According to it [6, 7], the CSS sources are precursors of older Large Symmetric Objects (LSO) and GPS sources may be earlier stages of CSS objects. However, it has been suggested that the activity of extragalactic radio sources is intermittent on the timescales of $\sim 10^4$ - 10^5 years [8], which means that some small scale objects will never reach the LSO stage. As a result we should observe a large number of fading compact CSS/GPS objects or those showing a restarted activity [5, 3].

OBSERVATIONS

A sample of 60 candidates which could be weak Compact Steep Spectrum sources was selected from the VLA FIRST catalogue [9]. All these sources were initially observed with MERLIN at 5 GHz and the results of these observations led to the selection of several groups of objects for further study with MERLIN, VLA and VLBA. The observations were made in a snapshot mode with phase referencing in 2002-2004.

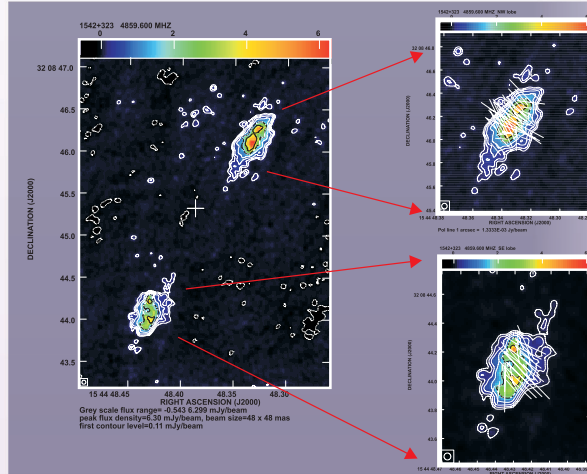


Fig. 1. The 4.9 GHz MERLIN map (12-h observations) of the overall structure of 1542+323 and the individual lobes including polarisation vectors. Cross indicates the position of an optical object found using SDSS.

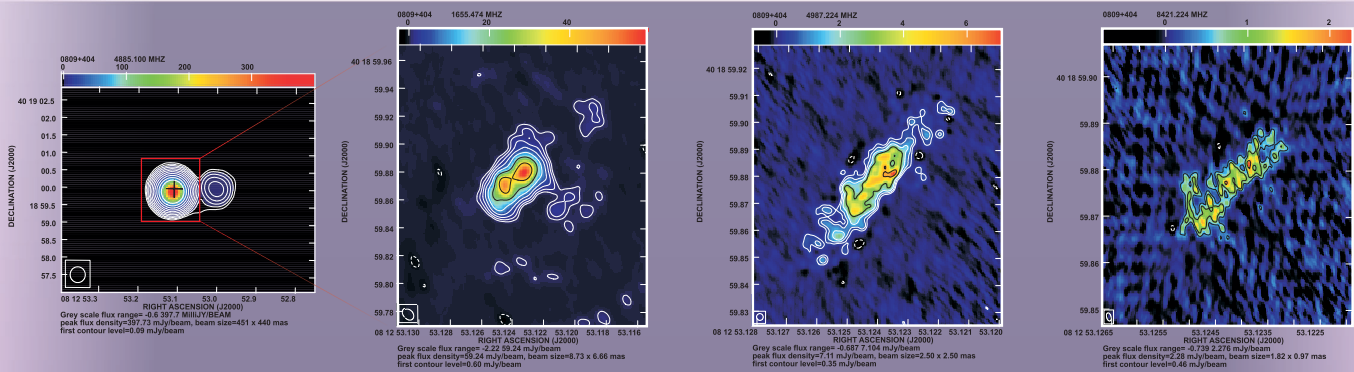


Fig. 2. The 4.9 GHz VLA map of 0809+404 [1] and our VLBA observations at 1.7, 5 and 8.4 GHz. Cross indicates the position of an optical object found using SDSS. There is no trace of this source in 15 GHz VLBA observations. 0809+404 is a type II quasar and its largest linear size at VLA resolution is equal to 4.5 kpc ($z=0.551$).

RESULTS

The first set of observations were made using MERLIN at 1.7 and 4.9 GHz and VLA at 4.9 GHz and revealed one strong candidate for compact fader - 1542+323 [2]. A full-track MERLIN observations at 4.9 GHz (Fig.1) of 1542+323 shows two radio lobes without visible hotspots and without a core. Also, there is no change in the direction of the polarisation vectors in the regions of maximum intensity which one might expect if they were active hotspots.

The observations of the second group of objects were performed using VLBA at 1.6, 5, 8.4 and 15 GHz [3]. One of the sources studied, 0809+404 (Fig.2), is dominated by a compact component but also has diffuse, arcsecond-scale emission visible in VLA images [1]. The VLBI observations of the "core" structure have revealed that this is also diffuse and fading away at higher frequencies. The above result is an indication that

the activity of the host galaxy of 0809+404 may be intermittent. Previous observations obtained from the literature and those presented here indicate that activity had ceased once in the past, then restarted, and has recently switched off again.

The third set of observations were made using VLBA at 1.7, 5 and 8.4 GHz [4]. One of the sources studied, 1045+352 (Fig.3), is known as a high radio and infrared luminous broad absorption line (BAL) quasar. Our multifrequency high resolution observations make this source to be a BAL quasar with the best known radio structure so far. It is a young CSS object whose slightly asymmetric two-sided structure on a scale of several hundred pc extended in two different directions may suggest an intermittent activity. One possible explanation of the structure of 1045+352 is a binary BH scenario leading to a fast precession of the jets.

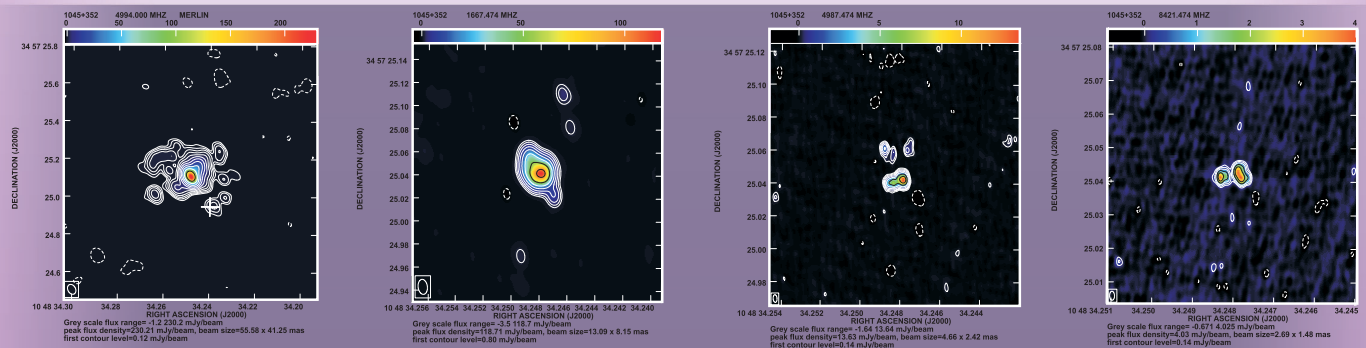


Fig. 3. The MERLIN 5 GHz and VLBA 1.7, 5 and 8.4 GHz maps of 1045+352. Cross indicates the position of an optical object found using SDSS. 1045+352 is a BAL quasar and hyperluminous infrared object. Its largest linear size at MERLIN resolution is equal to 1.3 kpc ($z=1.604$).

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