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The Parsec-Scale Radio Polarization of Three GHz-Peaked–Spectrum Radio Sources

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Abstract. Preliminary results on the parsec-scale polarization properties at 15 GHz of 3 GHz-peaked-spectrum radio sources are presented.

1. Introduction

The GHz-peaked–spectrum (GPS) radio sources have small sizes (in the range 0.002–0.1") and optically thin steep radio spectra turning over at frequencies ranging from about 500 MHz to a few GHz.

Two basic models have been proposed to explain the role of GPS objects among the population of radio loud sources.

The *frustration* model (van Breugel et al. 1984): the radio emitting plasma is strictly confined to the region we now observe by an external medium which is dense enough to prevent the expansion of the radio source. The *youth* model (Fanti et al. 1995; Readhead et al. 1996): based on the idea by Phillips & Mutel (1982), who proposed that the "compact double" radio galaxies are the precursors of the extended FR II radio sources, this model suggests that GPS sources are small because they are young; during their life they will grow large and progressively decrease their radio luminosity by about one order of magnitude. The turnover frequency in the radio spectrum progressively shifts towards lower values as the radio source becomes larger and larger.

The study of the environment is essential to distinguish between the proposed scenarios, and polarization properties of the radio emission can give relevant clues on the density of the region around the radio source.

2. The Radio Polarization and the VLBI Observations

The radio polarization at cm wavelengths is generally low ($< 1\%$, but many upper limits down to 0.1%, Stanghellini et al., in preparation). This is generally interpreted as Faraday depolarization occurring in the radio emitting region, which is consistent with a particularly high density of the medium. Another possibility which can be considered to explain the low fractional polarization is a tangled magnetic field along the line of sight and/or across the instrumental beam. VLBI observations which resolve the structure are then needed to exclude at least beam depolarization as the cause of the total low fractional polarization.

15 GHz observations of a sample of a dozen GPS radio sources have been carried out on April 22-23 1996, with the VLBA recording dual circular polarization. Here we comment on total intensity and polarization images for 3

objects, OQ 208, 0500+019 and 2134+004. The figures below show VLBI images of 0500+019 and 2134+004 with the E-vectors superimposed to the total intensity contour plots. The total intensity image of OQ 208 has been shown in Stanghellini et al. (1997) and the polarization image doesn't show any trace of polarized flux over a 3 sigma level of 2 mJy. The radio source 0500+019 has a hint of polarized flux ($\sim$ 1.4 mJy) in the dominant component corresponding to fractional polarization around or below 0.4%. The radio source 2134+004 has a total polarized emission of $\sim$ 1% at 5 GHz and $\sim$0.5% at 8.4 GHz (Stanghellini et al., in preparation). The 15 GHz VLBI image shows a double morphology with significant polarized emission ($\sim$4%) associated with both components.

These preliminary results suggest that beam depolarization is not the dominant cause for the low fractional polarization observed in GPS radio sources.

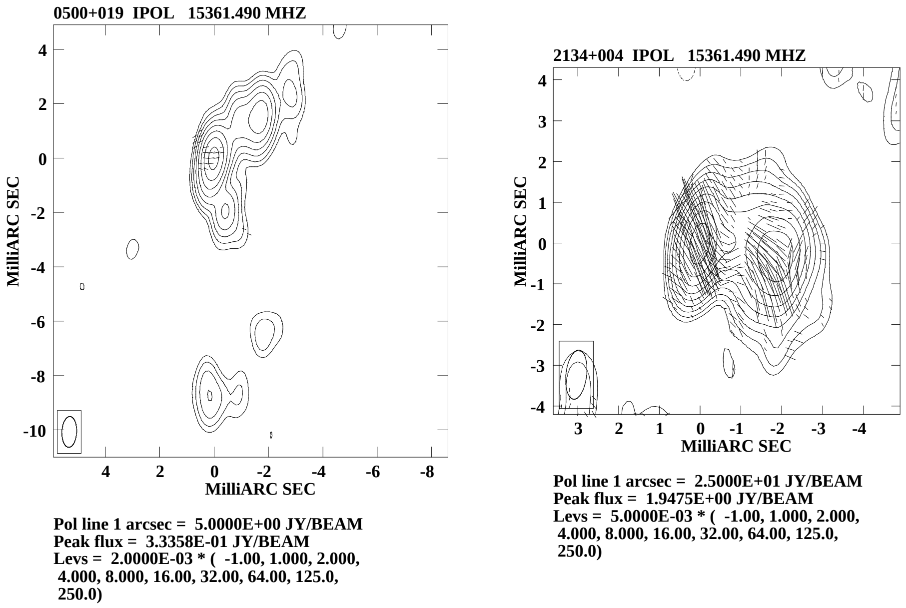

Figure 1. (left) 0500+01 (right) 2134+004.

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