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Study of some morphological features of extragalactic radio sources of FRI and FRII types

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Abstract. It was used the date of more than 650 extragalactic radio sources for the study of distribution of spectral indexes and elongation for the radio sources of different Fanaroff Riley (FR) classes. It was shown, that no large differences are observed in the distribution of spectral indexes in radio sources FRI and FRII classes. From the study of distribution of the elongation of extragalactic radio sources it was found the following basic morphological differences for the objects of different FR classes:
a) the radio images of extragalactic radio sources FRII type in the average are more elongated than the radio images of extragalactic radio sources FRI type:
b) the extragalactic radio sources FRI type can be divided on two subtypes with two function of distribution of the elongation parameter K having different maximums. These two subtypes of radio sources of FRI class, in besides of different average elongation of radio images, probably must have also differences in the orientations of these elongation directions relative to the direction of rotation axes of parent optical galaxies that in most cases are coincide with the minor optical axes of galaxies.

Keywords. radio galaxies, FRI, FRII, morphology

We have suggested a mechanism of the formation and evolution of extragalactic radio sources (Andreasyan 1984) in framework of the cosmological concept of V. Ambartsumian (Ambartsumian 1966). It was concluded that the magnetic field of the host galaxy or AGN has a dipole configuration, with dipole axes parallel to the rotation axes or minor axes of host galaxy. Extragalactic radio sources are formed from relativistic plasma clouds, ejected from the central part of the optical galaxy and moving in its large-scale dipole magnetic field. The behaviors of relativistic plasma cloud ejected in the direction of the dipole axis, depends on the ratio Q of the kinetic energy density of the plasma to the magnetic field energy density. In the frame of suggested mechanism the known Fanaroff-Ryley (FR) dichotomy and many other morphological fetchers finds a very simple physical explanation.

Here parallel to the Fanaroff-Riley classification we bring a simple classification of extragalactic radio sources by the elongation parameter K (K is the ratio of the largest dimension of the radio image to the dimension of image in perpendicular direction). For the study we have used data for 267 nearby radio galaxies (sample1) (Andreasyan & Sol, 1999), and 280 extragalactic radio sources (sample 2) from (Andreasyan *et al.*., 2002). Sample 1 and 2 are brought in Andreasyan (2012). We use also the data of 859 extragalactic radio sources (sample 3) from the CoNFIG catalogue (Combined NVSS-FIRST Galaxy catalogue) (Gendre, Best and Wall, 2010). We bring the distribution

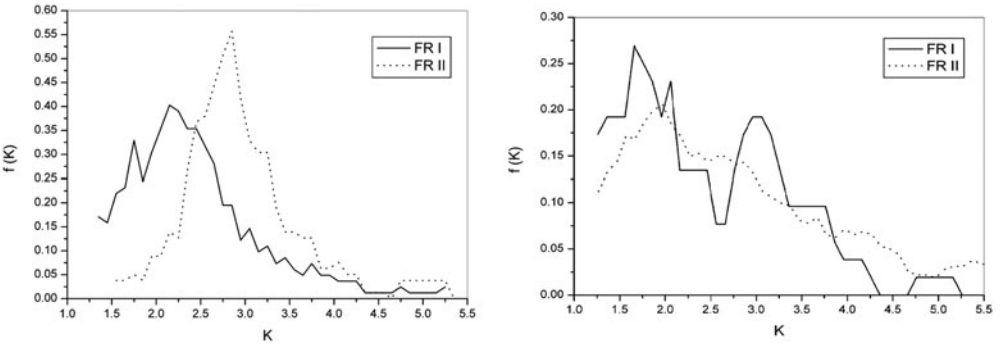

Figure 1. Distribution function of radio sources by the parameter K for different FR types (Sample1- left, and Sample3-right)

function f(K) of the elongation parameter for different FR types of extragalactic radio sources.

The main conclusion is that the radio sources of FRII type are more homogeneous objects and their distribution by the elongation parameter K probably can be explained by their spatial orientation. But the distribution of radio sources of FRI type shows two maximums, and, probably, in these objects there are radio sources of two different natures. These radio sources are less elongated relatively older Van Allen belts type sources, with the axes perpendicular to the dipole axes, and the younger, more elongated jet like radio sources. So, the results, obtained above from the analyses of observational data are in good agreement with the suggested mechanism of formation and evolution of extragalactic radio sources. Almost all main properties of extragalactic radio sources can be qualitatively explained in terms of mentioned scenario, varying the parameter Q and the environment of radio sources.

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