A POSSIBLE REASON OF FORMING THE VARIOUS TYPE OF SPECTRA IN EXTRAGALACTIC OBJECTS

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ABSTRACT. An analysis of multifrequency observations of 1,300 instantaneous spectra at cantimeter–decimeter waves during 7 sets for a sample of up to 200 VLBI–compact objects gives a strong experimental evidence to an old hypothesis, that a VLBI–compact jet of relativistic particles from an object's nucleus is a main reason of forming the various type of spectra in extragalactic objects. It is enough to explain all main known spectra types (steep, flattened, inverted) by *two spectra components only* - of a quasi stationary jet in a longitudinal magnetic field and an optically thin cloud or envelope, resulted by the jet. A combination of these two components gives also complex shapes in a case of a nonstationary phase of the jet.

Key words: galaxies: compact — galaxies: active — quasars: general.

Introduction

An idea that a typical extragalactic radio source consists on 2–3 main components (a nucleus, a compact jet and/or a cloud) had been discussed during last 20 years on various initial bases by many authors (see, an example, Kellermann and Pauliny-Toth, 1981; Kovalev, 1983; Amirkhanyan, 1985). Nevertheless, a typical situation was also, when many separate components was suggested to explain complex spectra and VLBI–structure of extragalactic sources. In opposite to the majority of discussions, we use practically instantaneous 1–22 GHz spectra, measured during several minutes of the each. It is important because the sources are *variable*, as a rule.

Observations and Analysis

The preliminary results of instantaneous multi frequency spectra observations at the wavelengths of 31, 13, 7.6, 3.9, 2.7 and 1.4 cm, carried out at the RATAN–600 during last 7 sets in July, August, October, December of 1995 and March, June, July of 1996, are used. As an example, about 500 spectra, including 400 last spectra, have been presented in Appendix to the poster. All data are planned to be published by Kovalev et al., 1997. Main observed types of these spectra are summarized on the Figure 1. They cover known spectra types.

It had been studied about 1,300 instantaneous spectra for a sample of up to 200 sources with declination $-30^\circ \div +43^\circ$. 146 of these objects form the full sample with correlated flux density more than 0.5 Jy at 2.3 GHz in the VLBI–servey by Preston et al. (1985).

The main our aim here is to answer on the question, is it possible to explain the presented main types of spectra as a combination of two components only? The answer is positive. The analysis includes a model analysis like in Nesterov et al. (1994).

Results and Discussion

1. We did not obtain any exotic or too complex spectra type, and belive that this is a positive result of using the practically instantaneous spectra measurements.

2. *Only two main components are enough* to explain all spectra types on the Figure 1: a quasi stationary continuos flow of relativistic plasma from a nucleus (as a source of relativistic matter) and an optically thin cloud (as "a receiver" of the matter flow).

3. We think, that the main variability of spectra may fully depends on a temporal variability of the matter flow from the object's nucleus in a longitudinal magnetic field. The jet may be unvisible on scales of more than milli–arcsecond scale, because of a known effect of an evolution of electron pitch–angles along the magnetic field, until a strong curvature of magnetic field lines is absent.

4. A theoretical synchrotron spectrum of a such *stationary* jet has a flattened part, the slope of which depends on a power γ in an electron energy distribution, and the width of which depends on the

angle ϑ between the jet and the direction to an observer. The spectra maximum and the frequency of it depend on physical conditions in a jet.

5. Observations are in agreement with a morfology of an object like a nucleus–jet–cloud (or envelope as a result of a temporal evolution of the cloud). As a rule, the radio emission of the nucleus can be neglected, and the envelope is optically thin in the 1–22 GHz band. Varying a relative contribution of the emission from the jet and the envelope to the integral spectrum, we can simulate all observed types of instantaneous spectra. Such formal varying is equal to varying the above physical conditions in jets — first of all, ϑ, γ, the magnetic field and the age of an object. The age can also influence on forming the envelope from "a jung cloud" by the continious pumping the matter from the jet. So, the older an object the more a contribution of the envelope to the integral spectrum.

6. From this point of view, several observed bright VLBI–components, have to be "hot spots" of a continious nonstationary jet, as a matter of fact, rather than separate independent components or the nucleus of an object. This conclusion is supported by a simulation of VLBI–maps of various such jets in Kovalev (1995).

7. These results explain also a known observational fact that sources with flat spectra are variable, as a rule. Really, flat spectrum is a sign of a such jet. Any jet is potencially nonstationary. So, a variability in the flow of relativistic plasma gives the observed spectra variability (see details of this effect in Kovalev and Larionov, 1994). Moreover, because the used sample of compact objects is complete, *any extragalactic object with VLBI–compact components* can show a spectra variability, if our conclusions are true.

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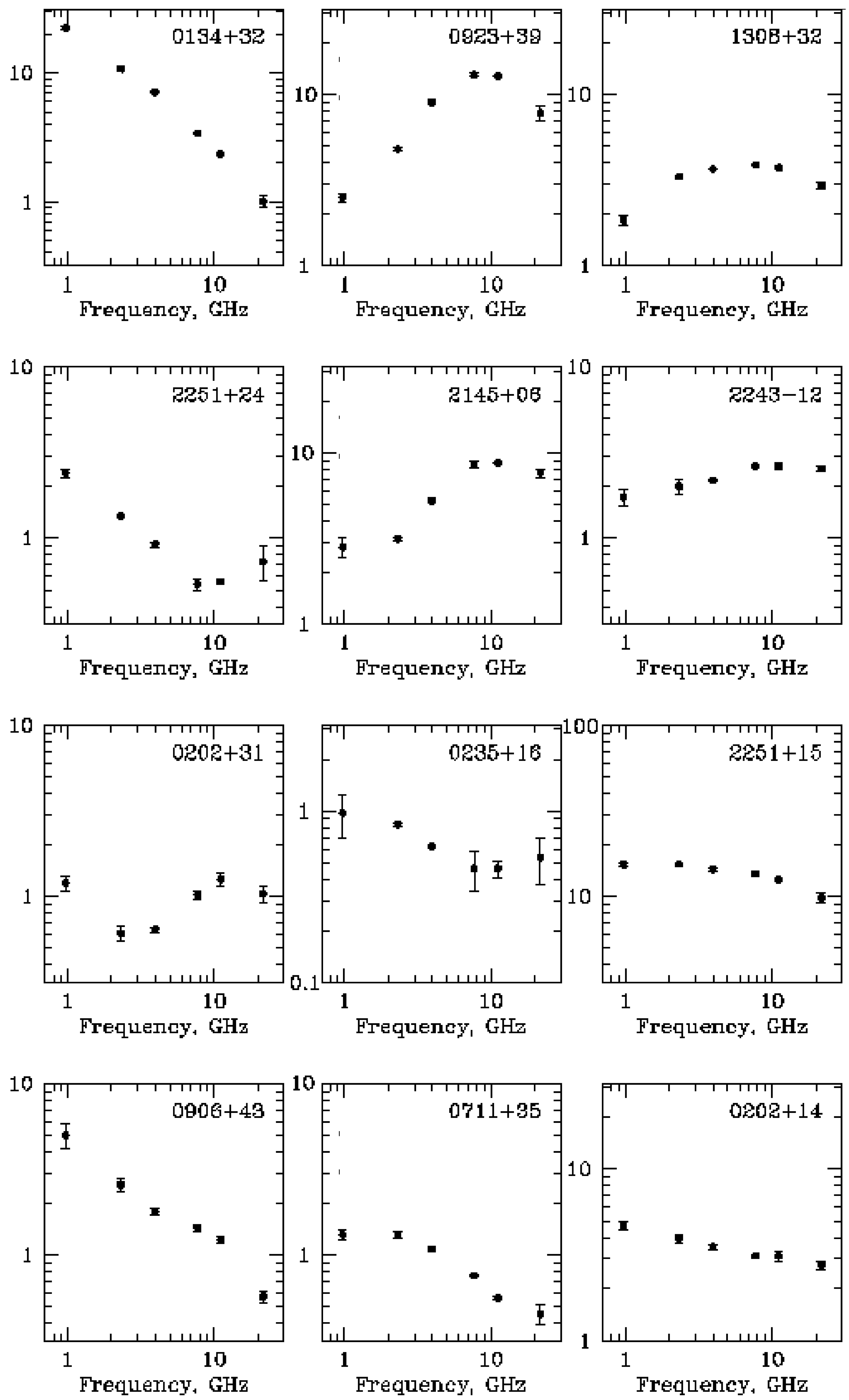

Figure 1. Main spectra types and their combinations on the examples, extracted from 1,300 instantaneous spectra, measured during 7 sets from June, 1995, to July, 1996, for a sample of 200 compact objects: steep (left column), inverted (middle column), and flattened (right column). The ordinate is the flux density in Jy.