

PHYSICAL CONDITIONS IN ACTIVE GALACTIC NUCLEI

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Self-absorption of synchrotron radiation in compact radio sources gives rise to a low-frequency cutoff in their spectra. To study this effect it is necessary to observe the radio sources at meter wavelengths with angular resolution $< 1''$. Such observations of compact radio sources located in active galactic nuclei lead to estimates of magnetic field strengths and relativistic electron number densities in the AGNs.

Since 1978 investigations of AGNs have been carried out with the Large Phased Array of the Pushchino Radio Astronomy Station of the Lebedev Physical Institute of the Soviet Academy of Sciences. The observations are made by the interplanetary scintillation (IPS) method at a frequency of 102 MHz. The r.m.s. noise level is 0.1 Jy and the angular resolution of the IPS method is $\sim 0''.1$. Some results of the observations are as follows:

1. Physical conditions in the nuclei of giant radio galaxies 3C 236 and DA 240

The scintillating radio source in the nucleus of 3C 236 has an angular diameter $\lesssim 0''.2$, and flux density $S_{102} = 6$ Jy. No scintillating sources have been observed in DA 240 ($S_{102} < 0.5$ Jy) (Artyukh and Hovannissian 1988). Using high frequency observations of the galaxies we have estimated the physical parameters of the compact radio sources in the nuclei of 3C 236 and DA 240 as listed in Table 1. The observational results listed in Table 1 show, in particular, that energy equipartition is not in effect in the nuclei of these two radio galaxies.

Table 1

Physical Conditions in AGNs						
	θ (")	L (pc)	H (gauss)	n_e (cm ⁻³)	E_H (erg)	E_e (erg)
3C 236	$\lesssim 0.2$	340	10^{-2}	10^{-7}	10^{57}	10^{53}
DA 240	0.07	40	$> 10^{-1}$	$< 10^{-7}$	$> 10^{57}$	$< 10^{50}$
θ = angular diameter			n_e = relativistic electron number density			
L = linear diameter			E_H = magnetic field energy			
H = magnetic field			E_e = relativistic electron energy			

2. Correlation between physical conditions in AGNs and morphological types of their host galaxies

IPS observations of quasars and BL Lac sources (which are the nuclei of giant elliptical galaxies), Seyfert galaxies and Markarian galaxies (which are spiral galaxies in the main) have shown that compact radio sources located in quasars and BL Lac objects have radio spectra with cut-offs at meter wavelengths, while such sources in Seyferts and Markarian galaxies have steep spectra (no self-absorption observed at meter wavelengths). This effect has been interpreted as showing that the magnetic field strengths are smaller in the AGNs in spiral galaxies (accordingly the relativistic electron number densities are higher) than in the AGNs in elliptical galaxies (Artyukh 1987).

3. Large-scale inhomogeneity of the distribution of AGNs

Analyses have been made of IPS observations of radio sources in four regions in the sky (each ~ 20 square degrees). These regions are centered on M 31, M 33, 3C 236 and DA 240. A deficit of compact (scintillating) radio sources was found in the field centered on DA 240. The linear scale of this radio void was estimated as $\sim 10^3$ Mpc (Artyukh and Hovannissian 1989).

REFERENCES

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