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A New Sample of Candidate GPS Radio Sources with Intermediate Flux Densities

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A new sample of faint Gigahertz Peaked Spectrum (GPS) sources is presented here as an addition to our previous one (Ohanian,1995). Comparison of the results of investigation of these samples with those of previously studied brighter samples (e.g. O'Dea et al. 1991) will delineate the properties of GPS sources over a wide range of luminosity, redshift and rest frame peak frequency. This will give noticeable information relevant to their cosmological evolution and relationship with other classes of extragalactic radio sources.

As the basis for our selection the data of 4 catalogues have been used: Texas survey (UTRAO 365 MHz, Douglas et al. 1980), Arecibo 611 MHz survey for which reliable positions and flux densities were determined with the NRAO 300 ft transit telescope at 4755 MHz (Lawrence et al. 1983), Green Bank 1.4 GHz (White & Becker, 1992) and 4.85 GHz (GB6, Gregory et al. 1995).

The Texas 365 MHz survey $+18^o$ strip and the Arecibo survey overlap from RA 0^h to 12^h and Dec. from 13^o to 19^o. In this range there are 716 Arecibo sources, with $b^{II} > 10^o$. Fifty six sources (8%) were selected with negative spectral indeces ($S \sim \nu^{-\alpha}$) in the range of 365- 611 MHz , and positive in the range 611- 4850 MHz. Since the interferometer used for the Texas survey underestimates flux densities of sources larger than $15''$ and does not detect emission on angular scales $> 2'$, we are excluding all matches in the Texas survey with angular sizes $> 15''$ and matches in GB6 survey which are marked as extended. Besides that, there are 25 Arecibo sources with flux densities $> 5\sigma$, having no matches both in Texas and GB6 surveys. If they are not spurious sources, they can be good candidates for a sharply peaked spectrum, a few examples of which have been reported by O'Dea et al. (1991). High sensitivity multifrequency observations are needed for these sources.

Our sample contains 56 radio sources. The upper limits of flux densities at 365 MHz of 24 sources are less than 250 mJy. The 365 MHz flux densities of the remaining 32 sources lie in the range 163-880 mJy with a median value of $S_{365} = 357mJy$.

We looked for optical identifications on the POSS plates for the sources, which overlap on the Minnesota APS fields (in sum 45 a radio sources). From 45 sources 13 (29%) are identified with galaxies. One source is identified with radio quiet quasar and one with a radio loud quasar, 10 radio sources are identified with stellar objects, which are possible quasars (in the end 12 (27%) are possible quasars). The remaining 20 (44%) radio sources are EF. From 13 identified galaxies 3 are nearby and radio quiet galaxies ($z < 0.1, L_{rad} = 10^{38-40} erg\, sec^{-1}$). All the identified objects among the bright members of GPS sample (e.g. O'Dea et al. 1991) are distant ($z > 0.1$) and luminous. The only exception is Mrk 668, being one of the brightest Sy1 galaxies. From 9 comparatively bright galaxies

($m_r = 9.2^m - 17.6^m$) 6 (60%) have close companions and/or are members of clusters and groups of galaxies. These properties also are typical for bright members of GPS radio galaxies (see e.g. Stanghellini et al. 1993).

In addition to the above mentioned data, we have searched from available literature objects which are identified with GPS radio sources.

First, we have formed a sample of 18 nearby and radio quiet galaxies which are identified with GPS type radio sources or contain a core dominated GPS component. From 18 galaxies 5 are elliptical and the remainder are spirals. Fourteen galaxies from 18 are interacting or pairs of galaxies, and/or members of clusters and/or groups of galaxies. Mrk 231, IIIZw35, Arp 220, which are contained in this sample, are well known galaxies in which extensive bursts of star formation take place. The presence of infrared and HI emission from the remaining galaxies also suggests that in these galaxies are star formation processes.

Second, we have examined the spectra of fainter radio sources ($S_{1.4GHz} < 50mJy$) from the Leiden - Berkeley Deep Survey presented by Oort (1988). Radio sources of this survey are identified with faint ($m_F = 22^m - 24^m$) galaxies. It was found that 12 sources are GPS type objects. From 12 radio sources 8 are identified with blue galaxies. These galaxies which are called blue compact radiogalaxies have optically peculiar morphology. Their radio luminosity is a factor of 10 -100 higher than that of local spirals and is intermediate between that of Seyferts and radio quiet quasars. The blue colour of these galaxies suggests active star formation. From 12 objects 6 are pairs of galaxies or have close companions and/or lie in the direction of clusters of galaxies.

From the data obtained we can conclude that GPS radio sources appear in the inner regions of active galaxies of different Hubble types. The presence of GPS type sources in host galaxies suggests active star formation in them.

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