

WWW ACCESS TO RADIO MEASUREMENTS OF CLUSTERS OF GALAXIES

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Abstract. Radio measurements of rich Abell clusters of galaxies have been collected both from radio source catalogs and from relevant publications. These data, gathered for all clusters for which they are available and supplemented with optical data, allow one to obtain an overall picture of each cluster and draw samples suitable for statistical studies.

Key words: databases – galaxies: clusters – radio sources

Radio sources in clusters of galaxies provide an important sample that can be used in the studies of the physics of the intracluster medium, its influence on radio sources and the overall evolution of extragalactic radio sources. Numerous cluster observations are available in different spectral ranges, however the relevant data are scattered in hundreds of publications and they are heterogeneous in their quality, sensitivity, angular resolution, availability of an optical identification, etc. They suffer from different selection effects, and only part of them is available in electronic form. This makes it difficult to draw correct astrophysical conclusions from a combination of different radio data.

In order to overcome these difficulties and to allow a more efficient selection of source samples to be used in the solution of astrophysical problems related to cluster radio emission, we

are now developing a database of radio sources in clusters of galaxies. It is based on the CGI interface and HTML forms and is accessible on the WWW server of the Astronomical Institute of the St. Petersburg University (AISPbU) under URL at <http://www.aispbu.spb.su/WWW/Clusters.html>.

We extracted individual source measurements partly from the database of Radio Astronomical Catalogs (RAC) of AISPbU (Gubanov & Titov 1996) and partly from numerous publications dedicated to cluster radio emission. We used a page scanner with the Optical Character Recognition (OCR) software and special proof-reading tools (see Andernach et al. 1997) to convert for the first time dozens of published source tables into electronic form.

We currently include in our service radio and optical data for all 4076 rich clusters in the ACO catalog (Abell et al. 1989). In the future we also plan to include X-ray information and properties of the brightest cluster galaxies. We try to implement the following basic ideas in our information service:

- gather in one place all major information for a given cluster;
- obtain an overall cluster picture based on measurements;
- provide a clear graphic representation of various cluster data;
- allow users to introduce corrections and supply new data;
- provide tools for statistical analysis of cluster data.

At present we have developed the necessary tools for all items except the last one. The URL given above makes it possible to extract and display both radio or optical data for a cluster specified by the user.

The page with *radio data* begins with comments on certain radio sources, e.g. on cluster membership of sources, ambiguities of data interpretation, etc. This is followed by a section on individual radio galaxies in the cluster, including optical identification and radio spectral data sorted by observing frequency and converted where possible to a common absolute flux scale. The last block of the page gives the data *as published* from all relevant references for radio sources within a projected distance of one Abell radius from their centers ($R_a = 3 \text{ Mpc}$ for $H_0 = 50 \text{ km s}^{-1} \text{ Mpc}^{-1}$). More detailed information on these references is available and in the future we plan to provide hyperlinks to abstract services or to electronic journals. Further links make it possible to extract entries from a preliminary source list of the NRAO VLA Sky Survey (NVSS, Condon et al. 1996) and to display the Digitized Sky Survey image of a $500 \times 500 \text{ kpc}^2$ region around a given cluster radio galaxy.

The page with *optical data* lists the basic optical parameters of the cluster, as well as published notes and relevant references. We began to provide links to catalogs of optical objects from APM (Irwin et al. 1994), which may be displayed as PostScript finding charts, currently limited to a maximum field of $30' \times 30'$, i.e. less than $1 R_a$ for nearby clusters. As a more promising tool are Tcl applets, which permit running application software on the user's local computer within the WWW connection. Applets allow one to display the relevant parameters of the objects shown on the computer monitor simply by positioning the cursor on them. They require less disk space than PostScript and allow the user to control the design of the charts. In the future we plan to use Tcl applets to link optical images of objects in a cluster to any relevant information available on them, like radio parameters, spectra, redshifts, etc. We currently use Tcl applets either with the SurfIt! browser (Titov 1997, these proceedings) or with the netscape browser using the "Simple windowing shell" (*wish*) program. These applets will soon operate directly under the netscape browser.

We expect many users to be more familiar with specific sections of data than we are. It is therefore important for improving the quality and completeness of the cluster database that the user is able to introduce corrections or additions to the data in the easiest and most convenient way possible. Rather than having to compose a separate e-mail message, the users may simply prepare revised versions of the data at once without leaving their browsers, using *xedit* (under X-windows) or the *vi* editor (otherwise). Revisions are incorporated into the database after our checking and approval. Depending on the first experience with input from users we can arrange for other editors if needed.

The database is permanently updated with new cluster radio and optical measurements, e.g. from the NRAO VLA Sky Surveys NVSS and FIRST (Becker et al. 1995), or with optical objects from APM, COSMOS (Drinkwater et al. 1995) and APS (cf. Odewahn 1995).

Our service is intended as an open and collaborative enterprise to the benefit of cluster research. We welcome users joining up with our efforts, telling us about their preferences for data to be included into the database and contributing new data sets, especially those not previously available in electronic form.

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