# RADIO OBSERVATIONS AT 1.4 GHz OF ABELL CLUSTERS

C.Fanti, R.Fanti, L.Feretti, A.Ficarra, I.M.Gioia,
G.Giovannini, L.Gregorini, F.Mantovani, B.Marano*,
L.Padrielli, P.Parma, P.Tomasi, G.Vettolani
Istituto di Radioastronomia, via Irnerio 46, Bologna, Italy
*Istituto di Astronomia, via Zamboni 33, Bologna, Italy

We have observed with the Westerbork Synthesis Radio Telescope (WSRT) at 1.4 GHz the Abell clusters included in the HEAO-2 satellite observing program, for which radio information was not available. In practice we excluded the clusters south of 15°, in order to ensure an adequate angular resolution in declination; moreover we did not observe distance class (d.c.) 6 clusters for which better resolution and sensitivity would be necessary. The final list includes 61 clusters. These have been observed to a limiting peak flux density of about 5 mJy, corresponding to average minimum radio powers ranging from $\sim 5 \times 10^{21}$ to $\sim 2 \times 10^{23}$ W/Hz for d.c. 1 to 5. By adding the present data to those already available in the literature, we have radio information about all the clusters of d.c. 1 and 2, north of 15°, except A1185. The sample of d.c. 3 clusters contains 60% of the clusters of this class, but seems unbiased both for richness criteria and for radio characteristics; therefore it is useful for statistical studies. The observed clusters of d.c. 4 and 5, instead, are richer than average. The list of the observed clusters is presented in table 1: the Abell name is given in column 1, the d.c. in column 2, the richness class in column 3, the number of radio detected cluster galaxies in column 4 (in parentheses the number of galaxies for which the membership of the cluster is doubtful or the radio identification is not certain is given). The identification of the radio sources with the cluster galaxies of d.c. 5 is still in progress. While a more complete discussion of the properties of radio sources in clusters will be performed later, using the data about all the clusters of the sample, here we summarize the results of the discussion on d.c. 1 and 2 clusters.

The bivariate radio luminosity function (RLF) of the cluster galaxies has been derived for the morphological types E, SO and S+Irr, dividing these into 3 different classes of absolute optical magnitude. The RLFs of E and SO galaxies in the present clusters do not differ from the corresponding ones for clusters of higher richness. There is a marginal evidence that S+Irr galaxies in cluster have a lower probability of being radio sources than field ones. The RLF of the E + SO first cluster members with absolute optical luminosity less than -20 has been computed using all the d.c. 0, 1, 2 Abell clusters with $\delta < 15°$, except A407 and



*D. S. Heeschen and C. M. Wade (eds.), Extragalactic Radio Sources, 91–92.*

A1185. There is an indication at 1.5 r.m.s. level that first cluster members have a higher probability of being radio sources than the other galaxies of the same optical luminosity range.

The proportion of resolved to unresolved sources in the present sample is similar to that of the WSRT survey of rich clusters. A plot of the maximum linear size as a function of the total radio power shows a clear trend indicating that more powerful radio sources have larger sizes. This size-power distribution does not differ from the corresponding distribution for low luminosity radio galaxies not belonging to rich clusters. Among the resolved sources, 3 show head-tail or wide-angle-tail type radio structure: one in A569, another in A576, the last in A2162. This is an indication of the presence of a dense intracluster medium (in the case of A576 at the periphery of the cluster).

Table 1

| Name | D | R | N | Name | D | R | N |
|---|---|---|---|---|---|---|---|
| A71 | 3 | 0 | 0 | A1569 | 5 | 0 | - |
| A98 | 5 | 3 | - | A1589 | 5 | 0 | - |
| A154 | 3 | 1 | 1+(1) | A1654 | 5 | 0 | - |
| A160 | 4 | 0 | 1 | A1674 | 5 | 3 | - |
| A179 | 3 | 0 | 1 | A1760 | 5 | 3 | - |
| A195 | 3 | 0 | 1 | A1767 | 4 | 1 | 1 |
| A262 | 1 | 0 | 8 | A1781 | 3 | 0 | 1 |
| A272 | 5 | 1 | 2 | A1800 | 3 | 0 | 2 |
| A278 | 3 | 0 | 2 | A1831 | 3 | 1 | 2 |
| A347 | 1 | 0 | 1 | A1913 | 4 | 1 | 1+(1) |
| A397 | 3 | 0 | 1 | A1927 | 4 | 1 | 1+(2) |
| A568 | 3 | 0 | 2+(1) | A1939 | 5 | 1 | - |
| A569 | 1 | 0 | 2 | A1940 | 5 | 3 | - |
| A576 | 2 | 1 | 2 | A1983 | 3 | 1 | 1 |
| A608 | 5 | 1 | - | A1990 | 5 | 3 | - |
| A646 | 5 | 0 | - | A1991 | 3 | 1 | 2 |
| A655 | 5 | 3 | - | A2065 | 3 | 2 | 1 |
| A671 | 3 | 0 | (1) | A2079 | 3 | 1 | 2 |
| A779 | 1 | 0 | 0 | A2089 | 4 | 1 | 1 |
| A899 | 5 | 1 | - | A2092 | 4 | 1 | (2) |
| A963 | 5 | 3 | - | A2100 | 5 | 3 | - |
| A1177 | 4 | 0 | 1 | A2107 | 4 | 1 | (2) |
| A1213 | 2 | 1 | 3 | A2148 | 3 | 0 | 1 |
| A1228 | 1 | 1 | 1 | A2162 | 1 | 0 | 5 |
| A1254 | 3 | 1 | 1 | A2244 | 5 | 2 | .. |
| A1267 | 3 | 0 | 1+(1) | A2301 | 4 | 0 | 2+(1) |
| A1268 | 5 | 2 | - | A2572 | 3 | 0 | 3+(1) |
| A1377 | 3 | 1 | 1+(1) | A2625 | 3 | 0 | 1 |
| A1413 | 5 | 3 | - | A2630 | 3 | 0 | 0 |
| A1425 | 5 | 1 | - | A2666 | 1 | 0 | 0 |
| A1500 | 3 | 0 | 1 | | | | |

https://doi.org/10.1017/S007418090002742X Published online by Cambridge University Press