13 The ICRF2 Catalogue

13.1 The ICRF2 Catalogue Positions (AMG, ALF)

The ICRF2 catalogue positions are obtained from the gsf008a solution after inflating the formal errors and aligning it onto the ICRS as discussed in §12.2. It consists of positions of 3414 sources. Of the total number of sources, 2197 sources are observed only in VCS sessions. Among the remaining 1217 sources, 295 have been designated as "defining" sources, i.e., the positions of these 295 sources define the axes of the ICRF2 frame (see §11).

The coordinates of the 295 ICRF2 defining sources are listed in Table 18. It should be noted that these positions *are not* epoch-dependent and hence no epoch is explicitly stated. However, the listed positions *are* consistent with J2000.0. Coordinates of the remaining 922 (out of 1217) non-defining sources are listed in Table 19. The coordinates of all 1217 sources (including the 295 defining sources) are also available at:

- `http://hpiers.obspm.fr/icrs-pc/icrf2/icrf2-non-vcs.dat`.

Note that the correlation coefficient $C_{\alpha-\delta}$ cannot be provided for the 39 special handling sources, due to the method by which the positions and their formal uncertainties were estimated (see §4).

The coordinates of the 2197 VCS-only sources of the ICRF2, are listed in Table 20 and are also available at:

- `http://hpiers.obspm.fr/icrs-pc/icrf2/icrf2-vcs-only.dat`.

Note that seven sources from the ICRF1-Ext.2 catalogue are not in ICRF2 [0647 − 475, 1020 − 103, 1039 − 474, 1217+295 (NGC 4278), 1329 − 665, 1601+173 (NGC 6034), and 1829 − 106]. The total number of group delay observations for each of these seven sources was less than three, insufficient to derive a reliable position.

13.2 Physical characteristics of ICRF2 defining sources (AMG, ZMM, OAT, CB)

This subsection introduces Table 21 on the physical characteristics of the defining sources. This table includes, where known, the object type, 8.4 GHz and 2.3 GHz flux, spectral index, visual magnitude, a classification of spectrum and comments for each ICRF2 defining sources.

The material in Table 21 is entirely compiled information, obtained from the following primary sources:

- The Large Quasar Astrometric Catalog (LQAC) [Souchay et al., 2009] is a compilation of 12 largest quasar catalogues (4 from radio interferometry programs, 8 from optical surveys). It contains 113666 quasars, providing information when available on: u, b, v, g, r, i, z, J, K photometry as well as redshift, radio fluxes at 1.4GHz, 2.3GHz, 5.0GHz, 8.4GHz, 24GHz and redshift references. This catalogue is available from the Centre de Donnees astronomiques de Strasbourg (CDS) (http://cdsweb.u-strasbg.fr/), as catalogue J/A+A/494/799.
- The "Optical Characteristics of Astrometric Radio Sources" [Malkin & Titov, 2008] includes 4261 radio sources with J2000.0 coordinates, redshift, V magnitude, object type and comments. This catalog is available at:
  http://www.gao.spb.ru/english/as/ac_vlbi/sou_car.dat

- The "Quasar and Active Galactic Nuclei (12th Ed.)", [Veron-Cetty & Veron, 2006] —hereafter VCV06—includes 85221 quasars, 1122 BL Lac objects and 21737 active galaxies together with known lensed quasars and double quasars. This catalogue is available from the CDS as catalogue VII/248.
- The "All-sky survey of Flat-spectrum Radio Sources" [Healey et al., 2007] —hereafter HR07—catalog provides precise positions, subarcsecond structures, and spectral indices for some 11000 sources. This catalog is available from the CDS as catalogue J/ApJS/171/61.
- The "Optical spectroscopy of 1Jy, S4 and S5 radio source identifications" [Stickel et al., 1989-94] —hereafter SK94. Position, magnitude, type of the optical identification, flux at 5GHz and two-point spectral index between 2.7 GHz and 5 GHz are provided. This catalog is available from the CDS as catalogue III/175.

Table 21 is arranged in J2000 Right Ascension order. The data in the table was derived by sequentially searching the above five references.

In practice, the LQAC was used to provide information on flux at 8.4 GHz and 2.3 GHz and initial information for the redshift and the magnitude.

Secondly, a comparison was made with the MT08 catalogue. Matches were done here by name. In this comparison, information on object type and comments was brought in. The redshift and the magnitude were checked and such data were provided for some sources. Most of the discrepancies found are explained by the comments.

Thirdly, the VCV06 data were merged in a similar fashion. At this stage, the object type was refined and the classification of spectrum was added.

As a fourth step, spectral index data between low frequency and 8.4 GHz were taken from the HR07 catalogue and completed for 7 sources by the SK94 catalogue.

At each of these steps, comparison printouts were generated to show the differences between the database as it existed to that point and the new data being read. As just noted, this provided for checks that the right objects were being matched and that the data were reasonable.

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