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I/331 Absolute Proper motions Outside the Plane (APOP) (Qi+, 2015)

Absolute Proper motions Outside the Plane - APOP.

A step towards the GSC2.4.

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Abstract:

We present a new catalog of absolute proper motions and updated positions derived from the same Space Telescope Science Institute digitized Schmidt survey plates utilized for the construction of the Guide Star Catalog II. As special attention was devoted to the absolutization process and removal of position, magnitude and color dependent systematic errors through the use of both stars and galaxies, this release is solely based on plate data outside the galactic plane, i.e. $|b| \geq 27^\circ$. The resulting global zero point error is less than 0.6 mas/yr, and the precision better than 4.0 mas/yr for objects brighter than $R_F = 18.5$, rising to 9.0 mas/yr for objects with magnitude in the range $18.5 < R_F < 20.0$. The catalog covers 22,525 square degrees and lists 100,774,153 objects to the limiting magnitude of $R_F \sim 20.8$. Alignment with the International Celestial Reference System (ICRS) was made using 1288 objects common to the second realization of the International Celestial Reference Frame (ICRF2) at radio wavelengths. As a result, the coordinate axes realized by our astrometric data are believed to be aligned with the extragalactic radio frame to within ± 0.2 mas at the reference epoch J2000.0. This makes our compilation one of the deepest and densest ICRF-registered astrometric catalogs outside the galactic plane. Although the Gaia mission is poised to set the new standard in catalog astronomy and will in many ways supersede this catalog, the methods and procedures reported here will prove useful to remove astrometric magnitude- and color-dependent systematic errors from the next generation of ground-based surveys reaching significantly deeper than the Gaia catalog.

Description:

The APOP is a absolute proper motion catalog achieved on the Digitized Sky Survey Schmidt plates data established by GSC-II project that outside the galactic plane ($|b| > 27^\circ$). The sky cover of this catalog is 22,525 square degree, the mean density is 4473 objects/sq.deg. and the magnitude limit is around $R = 20.8$ mag. The systematic errors of absolute proper motions related to the position, magnitude and color are practically all removed by using the extragalactic objects. The zero point error of absolute proper motions is less than 0.6 mas/yr, and the accuracy is better than 4.0 mas/yr for objects bright than $R = 18.5$, and rises to 9.0 mas/yr for objects with magnitude $18.5 < R < 20.0$.

We believe the catalog is reliable for operational applications and will be also fine for astrophysical research. But the user should use this catalog with that in mind, the accuracy condition is good for objects with Declination > -30 degree and is not very well for others, the reason is that the epoch difference is large for Declination $> -30^\circ$ (45 years) but South than that is only around 12 years. It is fine for statistical studies for objects with Declination $< 30^\circ$ that people could find and remove obviously incorrect entries.

File Summary:

FileName	Lrec1	Records	Explanations
ReadMe	80	.	This file
apop.sam	156	100	*Absolute Proper motions Outside the Plane

Note on apop.sam: The reading format when using Fortran is
'(A13,1X,I3,1X,2F12.7,1X,2F7.1,1X,2F8.1, 1X,2F6.1,1X,I3,1X,F7.3,1X,7F8.3)'

See also:

<http://gsss.stsci.edu/catalogs/gsc/gsc2/gsc2.htm> : the GSC-II Home Page
[I/254](#) : The HST Guide Star Catalog, Version 1.2 (Lasker+ 1996)
[I/271](#) : The Guide Star Catalog, Version 2.2 (GSC2.2) (STScI, 2001)
[I/305](#) : The Guide Star Catalog, Version 2.3.2 (GSC2.3) (STScI, 2006)

Byte-by-byte Description of file: [apop.sam](#)

Bytes	Format	Units	Label	Explanations
1- 13	A13	---	ID	Source identifier (1)
17	A1	---	Type	Classification of the source (2)
20- 30	F11.7	deg	RAdeg	Right ascension (ICRS, position epoch=J2000.0, TDB)
32- 42	F11.7	deg	DEdeg	Declination (ICRS, position epoch=J2000.0, TDB)
45- 51	F7.2	mas	e_RAdeg	Error in right ascension at Epoch
52- 58	F7.2	mas	e_DEdeg	Error in declination at Epoch
59- 66	F8.1	mas/yr	pmRA	Absolute proper motion in RA (pmRA*cos(DE))
68- 74	F7.1	mas/yr	pmDE	Absolute proper motion in Declination
76- 81	F6.1	mas/yr	e_pmRA	Error in pmRA at Epoch
83- 87	F5.1	mas/yr	e_pmDE	Error in pmDE at Epoch
89- 91	I3	---	Nobs	Number of observations (3)
94- 99	F6.3	yr	Dt	Maximal time differences (4)
102-108	F7.3	mag	Rmag	?=-99 Magnitude in R _F photographic band (red) (5)
110-116	F7.3	mag	Bmag	?=-99 Magnitude in B _J photographic band (blue) (5)
118-124	F7.3	mag	Nmag	?=-99 Magnitude in I _N photographic band (near infrared) (5)
126-132	F7.3	mag	Vmag	?=-99 Magnitude in V photographic band (visible) (5)
134-140	F7.3	mag	Jmag	?=-99 2MASS J magnitude (6)
142-148	F7.3	mag	Hmag	?=-99 2MASS H magnitude (6)
150-156	F7.3	mag	Kmag	?=-99 2MASS Ks magnitude(6)

Note (1): The ID is the source identifier for object in the APOP, which is as same as the source identifier of that object in GSC2.3 catalog.
Here the APOP ID is the combination of the HTM_ID and the running_number in GSC2.3, i.e.
32768+0000005 for GSC2.3=S000000005, HTM6=S0000000 source,
32785+0003424 for GSC2.3=S00H003424, HTM6=S0000101 source
in GSC2.3 (Cat. [I/305](#)).

Note (2): The classification is based on the following codes:

- 0 = star as defined in the GSC23
- 1 = stars from the GSC23 used as reference sources
- 2 = QSOs from the GIQC catalog
- 3 = Non-stars as defined in the GSC23
- 4 = Non-stars indicated as extragalactic from Non-stars

Note (3): The Nobs is the number of plates used for deriving the pmRA, pmDE of that object.

Note (4): The Dt is the maximal time differences between the plates used for the calculation.

Note (5): The magnitudes data are extracted directly from GSC2.3 catalog.
Users can identify the exact meaning by looking at the 'Table 3' in GSC2.3 paper (Lasker et al., [2008AJ....136..735L](#), Cat. [I/305](#)).
The default value is -99.000 if there is no data in that passband.

Note (6): The photometric data are the near-infrared J (1.25um), H (1.65um), and Ks (2.16um) from the 2MASS catalog (Skrutskie et al., [2006AJ....131.1163S](#), Cat. [VII/233](#)).
The default value is -99.000 if there is no data in that passband.

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The document above follows the rules of the [Standard Description for Astronomical Catalogues](#); from this documentation it is possible to generate *f77* program to load files [into arrays](#) or [line by line](#)