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ISTITUTO NAZIONALE DI ASTROFISICA
OSSERVATORIO ASTROFISICO DI TORINO

NGP Reference Catalogue for the SPICA FGS

SIGNATURE AND APPROVALS ON ORIGINAL

Authors: *S. Perina, R. Morbidelli, A. Spagna*

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Program Manager / Techn. Resp.: A. Spagna

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1. INTRODUCTION

This technical note describes the properties of the NGP Reference Catalogue used for the analysis presented in AD2.

2. REFERENCES

3.1 Applicable Documents

[AD 1] INAF-OATo OAToBest and final offer: “Input Star Catalo for the SPICA mission (WP 1400). Prot. 2020/III/2, Fasc.1199, n.309, 19/02/2020

[AD 2] A. Spagna, B. Bucciarelli, R. Drimmel, R. Morbidelli, S. Perina, R.L. Smart, *Input Star Catalogue for SPICA mission;* OATO-SPICA-FGS-TNO-001 (07/2020)

3.2 Reference Documents

[RD1] Gaia Collaboration; Brown et al., *Gaia Data Release 2. Summary of the contents and survey properties,* A&A, 616, A1 (2018)

[RD2] Wright et al., *The Wide-field Infrared Survey Explorer (WISE): Mission Description and Initial On-orbit Performance*, AJ, 140, 1868 (2010)

4. ACRONYMS

Acronym	*Definition*
A&A	Astronomy and Astrophysics
AD	Applicable Document
AJ	Astronomical Journal
DEC	Declination
DR	Data Release
FGS	Fine Guidance Sensor
INAF	Istituto Nazionale di Astrofisica
ISC	Input Star Catalogue
MIR	Mid-Infrared
NGP	North Galactic Pole
NIR	Near Infrared
OATo	Osservatorio Astrofisico di Torino
RA	Right Ascension
RD	Reference Document
SPICA	SPace Infrared telescope for Cosmology and Astrophysics
TN	Technical Note
WISE	Wide-field Infrared Survey Explorer
WP	Work Package

5. CATALOGUE DESCRIPTION

The NGP Reference Catalogue is made up of all the sources from Gaia-DR2 [RD 1] within a region of 137 square degrees located at RA = 193°, DEC = +27° (186° < RA < 200°, 21.3° < DEC < 32.3°) towards the North Galactic Pole (NGP).
The catalogue contains 357,457 entries and 5-parameter astrometry (i.e. Gaia-DR2 positions, proper motions, parallaxes and respective errors) are available for 302,720 sources (~85%). For such sources the catalogue provides positions and errors at the SPICA reference epoch 2035.5, which have been derived from the Gaia-DR2 positions by applying the astrometric propagation described in [AD 2].

NIR J magnitudes are available for all the sources. These magnitudes have been computed from the Gaia-DR2 G magnitude and the G_{BP}-G_{RP} color by means of the photometric transformation described in [AD 2]. When the color is missing the average color $\langle G_{BP}\text{-}G_{RP}\rangle = 1$ has been used.

The values of the J magnitude error (JmagError) are set to 0.2, a conservative value corresponding to the total error (random + systematic) of the transformation estimated in [AD 2]. The maximum value JmagError=0.499 is set in case we assume the average color $\langle G_{BP}\text{-}G_{RP}\rangle$.

Finally, Gaia-DR2 sources have been cross-matched with the infrared catalogue, Catwise and Allwise [RD 2], using a 5 arcsec cone search radius as described in [AD 2]. As a result 319,983 sources (~90% of the catalogue) have the MIR magnitude W1 and 240,816 sources (~67% of the catalogue) have the MIR magnitudes W3 and W4. Note that many matched sources do not have a valid W3magError and W4magError (see Table 5.3).

The content and format of the NGP Reference Catalogue is summarized in Table 5.1. Table 5.2 shows the minimum and maximum values for each parameter in the catalogue, and the adopted “Null Value” if a parameter does not exist for a given entry. Table 5.3 shows the detailed source statistics.

Parameter	Description	Units	Format
SourceId	GAIA-DR2 source identifier	long	A19
Alpha	Position (RA)	degree	F14.10
Delta	Position (Dec)	degree	F14.10
AlphaError	Position error (RA)	Mas	F8.4
DeltaError	Position error (Dec)	Mas	F8.4
muAlpha	Proper motion in RA	Mas/yr	F11.4
muDelta	Proper motion in Dec	Mas/yr	F11.4
muAlphaError	Proper motion in RA error	Mas/yr	F8.4
muDeltaError	Proper motion in Dec error	Mas/yr	F8.4
Parallax	Parallax	Mas	F10.4
ParallaxError	Parallax error	Mas	F8.4
Alpha2035	Position (RA) at J2035.5	degree	F14.10
Delta2035	Position (Dec) at J2035.5	degree	F14.10
AlphaError2035	Position error (RA) at J2035.5	Mas	F8.4
DeltaError2035	Position error (Dec) at J2035.5	Mas	F8.4
Jmag	Magnitude in J band (from Gaia)	Mag	F8.4
JmagError	Magnitude error in J band	Mag	F8.4
W1mag	Magnitude in Catwise w1 band	Mag	F8.4
W1magError	Magnitude error in Catwise w1 band	Mag	F8.4
W3mag	Magnitude in Allwise w3 band	Mag	F8.4
W3magError	Magnitude error in Allwise w3 band	Mag	F8.4
W4mag	Magnitude in Allwise w4 band	Mag	F8.4
W4magError	Magnitude error in Allwise w4 band	Mag	F8.4

Table 5.1: NGP Reference Catalogue parameters

Parameter	min	Max	Null Value
SourceId	1442631101855087360	4015821226651770496	
Alpha	186.0001825672	199.9999680002	
Delta	21.3000074800	32.2999230791	
AlphaError	0.0117	98.1702	
DeltaError	0.0084	97.7554	
muAlpha	-928.1250	290.1310	999999.0000
muDelta	-896.2341	882.5117	999999.0000
muAlphaError	0.0232	5.3676	999.0000
muDeltaError	0.0182	5.1219	999.0000
Parallax	-22.3860	108.8951	99999.0000
ParallaxError	0.0177	5.1735	999.0000
Alpha2035	186.0001286731	199.9999483477	999.0000000000
Delta2035	21.2998338884	32.2999438942	999.0000000000
AlphaError2035	0.6700	136.1100	999.0000
DeltaError2035	0.4700	119.5300	999.0000
Jmag	2.6958	20.4536	
JmagError	0.2000	0.4990	
W1mag	4.1520	19.7990	999.0000
W1magError	0.0090	0.5290	999.0000
W3mag	-0.2880	13.2100	999.0000
W3magError	0.0100	0.5430	999.0000
W4mag	-1.2740	9.6360	999.0000
W4magError	0.0050	0.5430	999.0000

Table 5.2. Minimum, maximum and Null values in the catalogue.

Source statistics	
All sources	357,457
Sources with full astrometry (5 parameters) from GaiaDR2	302,720
Sources with W1mag from CatWISE	319,983
Sources with W1magError from CatWISE	319,982
Sources with W3mag from AllWISE	240,816
Sources with W3magError from AllWISE	37,315
Sources with W4mag from AllWISE	240,816
Sources with W4magError from AllWISE	9248
Sources with G_{BP}-G_{RP} color in Gaia DR2 (JmagError = 0.2)	317,908
Sources without G_{BP}-G_{RP} color in Gaia DR2 (JmagError = 0.499)	39,549

Table 5.3 NGP Reference Catalogue statistics.

6. MANIFEST

This delivery includes the following file

SPICA_RSC_NGP.csv

MD5: A561AEDA132F5DD19735D6FB5E25D7EC

This file is available in the INAF Owncloud repository and the credentials for the download are available upon request.