Gaia Focused Product Release

Focused Product Release 1.2

European Space Agency (ESA)
and
Gaia Data Processing and Analysis Consortium (DPAC)

25 June 2024

Executive summary

The Gaia Focused Product Release presents five data products which showcase a subset of the improvements and new data products expected for Gaia DR4. The FPR data products are based on the Gaia observations collected over the same period as used for Gaia DR3 (except for the astrometry and photometry for ω Centauri and the updated Solar System objects astrometry). These data are products based on new observation modes (astrometry and photometry from full-frame CCD images in selected crowded regions), new data processing pipelines (search for gravitationally lensed quasars, DIBs from aggregated RVS spectra), and they offer a taste of the epoch radial velocities to be publised as part of Gaia DR4. For Solar System objects new astrometry and orbits are presented based on 5.5 years of observations (the period covered by Gaia DR4) which leads to a very significant improvement in the quality of the orbits.

The FPR contents are summarized in Table 1.

Table 1: Summary of all the FPR tables available in the Gaia archive. For an extensive description of these tables and their contents see Chapter 2.

Table name	**Short description**
Crowded fields: Astrometry and photometry for ω Cen	
`crowded_field_source`	astrometry and photometry for sources in ω Cen
Solar System: Solar System object astrometry	
`sso_source`	data related to Solar System objects observed by Gaia
`sso_observation`	Solar System object observations
Extra-galactic: Gravitational Lenses	
`lens_candidates`	sources identified as possible gravitational lens candidates
`lens_catalogue_name`	input catalogues that have been used to select sources that were analysed by the Gravitational Lens module
`lens_observation`	observations associated with the components found in the `lens_candidates` table
`lens_outlier`	individual observations that have been discarded from the analysis of the gravitational lenses around the sources in `lens_candidates`
Variability: Epoch radial velocities for long-period variables	
`vari_epoch_radial_velocity`	epoch radial velocity data points for a sub-set of variable stars
`vari_long_period_variable`	describes the long-period variable stars.
`vari_rad_vel_statistics`	statistical parameters of radial velocity time series
Spectroscopy: Diffuse interstellar bands from aggregated RVS spectra	
`interstellar_medium_params`	main table of DIB parameters
`interstellar_medium_spectra`	stacked interstellar medium spectra

Summary of miscellaneous links:

- Gaia archive (data access);
- Gaia FPR Datamodel description (table and field descriptions);
- Gaia mission home page (news, images, publications, outreach material, etc.);

- Gaia tools;
- Gaia FPR papers;
- Gaia helpdesk;
- Gaia FAQs;
- Gaia FPR credit and citation instructions;
- Online version of Gaia FPR documentation;
- Pdf version of Gaia FPR documentation;
- Gaia acronym list;
- Gaia on Twitter and Gaia on Facebook.

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Chapter 1

Introduction to the Gaia Focused Product Release

Author(s): A.G.A. Brown, J. Castañeda, M. Davidson, C. Ducourant, L. Galluccio, Z. Kostrzewa-Rutkowska, A. Krone-Martins, T. Lebzelter, I. Lecœur-Taïbi, A. Mints, N. Mowlavi, M. Schultheis, P. Tanga, M. Trabucchi, K. Weingrill

The Gaia focused product release presents the following five data products:

- Astrometry and photometry from engineering images taken in the core of the ω Cen globular cluster.
- Updated astrometry for Solar System objects.
- The first results of the search for lensed quasars.
- Radial velocity time series for long-period variables.
- Diffuse interstellar bands from aggregated RVS spectra.

Each of these data products is briefly introduced in the following sections. More details can be found in the papers referred to below. Table 1 provides a list of all focused product release tables in the Gaia archive.

1.1 Astrometry and photometry for omega Centauri

Author(s): K. Weingrill, A. Mints, J. Castañeda, Z. Kostrzewa-Rutkowska, M. Davidson

This FPR features astrometry and G-band photometry of half a million sources located on the sky in the ω Centauri globular cluster. The source density in this region is above the astrometric crowding limit for Gaia ($\sim$ 1 050 000 objects deg^{-2} Gaia Collaboration et al. 2016, Section 6.6) which leads to severe incompleteness of the Gaia catalogue in this region. In order to mitigate this issue special observations of ω Cen are taken using the so-called Service Interface Function (SIF) from Gaia. This functionality enables the collection of full-frame images from the Sky Mapper CCDs which can be processed iteratively to obtain astrometry and G-band photometry for sources otherwise not found in the standard Gaia survey. These two dimensional images thus overcome the Gaia crowding limitations.

The resulting catalogue of the ω Cen region contains the astrometry (positions, parallaxes, and proper motions) and photometry (mean G-band flux) for sources that were detected in the full frame images and did not exist as sources in the main Gaia DR3 catalogue already. Hence the data contained in this FPR is fully complementary to Gaia DR3.

In the very dense core of the ω Centauri cluster this FPR catalogue contains ten times as many sources as Gaia DR3, and the combined catalogue goes more than three magnitudes deeper. Furthermore, comparing the newly found sources to a dedicated HST sample introduced by Bellini et al. (2017), it could be shown that 90% of the FPR sources match HST and can thus be regarded as reliable.

Note: The `crowded_field_source` data model description detailed in Section 2.1.1 was copied from the nominal `gaia_source` descriptions for Gaia DR3 and adapted to peculiarities of the SIF CF data. That adaptation led to the following inaccuracies in the descriptions of some of the data fields, which were discovered when it was technically too late to change them:

- The nominal limitations regarding the magnitude (G < 13) and the AC observations (`astrometric_n_obs_ac` > 0) mentioned in the fields `astrometric_n_obs_ac`, `ipd_gof_harmonic_phase` and `scan_direction_*` don't hold for the SIF CF FPR data. For this FPR, these fields are always filled.
- The items referring to the quantities `nu_eff_used_in_astrometry` and `ipd_frac_multi_peak` in the fields `pseudocolour` and `ipd_gof_harmonic_phase` are irrelevant for this FPR dataset, because these quantities do not exist for `crowded_field_source` data.
- `pseudocolour` and related fields are empty for a few sources for which a position-only solution is reported.
- In a few places the descriptions refer to “Gaia DR3” where “this FPR” would be more appropriate.

The data processing, validation and data model for this FPR are described in Gaia Collaboration, Weingrill, K., et al. (2023d).

1.2 Solar System object astrometry

Author(s): P. Tanga

This FPR contains updated astrometry and the orbits for Solar System objects that were published as part of Gaia DR3. The update consists of using the observations covered by the Gaia DR4 time baseline, processed with essentially the same pipeline as used for Gaia DR3. In addition the Solar System object orbits are also included as part of the FPR. We recall here that preliminary orbit solutions were provided in Gaia DR3 as auxiliary data. The FPR version represents a totally different determination of the orbits, fully integrated in the processing pipeline. It is intended to replace completely the previous solution.

No new epoch photometry or reflectance spectra are included in this FPR.

The data processing and properties for Solar System objects in this FPR are described in Gaia Collaboration, David, P., et al. (2023a).

1.3 Gravitational Lenses

Author(s): A. Krone-Martins, C. Ducourant, L. Galluccio

This FPR contains a catalogue, `lens_candidates`, of the mean positions and fluxes of all sources detected on the sky within 6 arcseconds around a list of about 3.7 million selected QSO candidates. Among these groups of sources are a number of quasars that are multiply imaged by gravitational lensing. The positions and fluxes of the sources are inferred by a clustering algorithm that groups the individual Gaia detections into components (sources). The individual detections contributing to each component are provided in `lens_observation` and those rejected by the algorithm in `lens_outlier`. The name of the original catalogue from which each analysed QSO was drawn is also provided in a separate table `lens_catalogue_name`.

The data processing for this FPR covers the same time baseline as Gaia DR3.

The data processing and data model for this FPR are described together with the selection of the best gravitational lens candidates in Gaia Collaboration, Krone-Martins, A., et al. (2024).

1.4 Epoch radial velocities for long-period variables

Author(s): M. Trabucchi, N. Mowlavi, T. Lebzelter, I. Lecœur-Taïbi

This FPR features the time series of radial velocity measurements for 9614 long-period variables. The time baseline for these time series is the same as for Gaia DR3. The frequencies and associated uncertainties of all the radial velocity times series, as well as their amplitudes, are published together with their time series statistics.

All sources published in the FPR have their radial velocity frequency compatible with the frequency of at least one of the three photometric time series (G, G_{BP} or G_{RP}). Sources where all four frequencies are compatible with each other are further flagged, indicating the highest level of confidence in the derived frequency.

We also re-publish the frequencies, associated uncertainties, and the amplitudes of the G-band time series for the FPR sample. These values might slightly differ from those published in Gaia DR3 due to a Java-programming language bug in the Java version used for Gaia DR3 (which has since been fixed in the most recent Java versions) that slightly affected some results of long-period variable processing.

For more details, we refer to Gaia Collaboration, Trabucchi, M., et al. (2023c), where the data processing, data model, and catalogue content for this FPR are described.

1.5 Diffuse interstellar bands from aggregated RVS spectra

Author(s): M. Schultheis, A.G.A. Brown

This FPR presents the parameters of two Diffuse Interstellar Bands (DIBs) identified in stacked spectra from the Gaia Radial Velocity Spectrograph (RVS). DIBs are absorption features seen in optical spectra of stars and extragalactic objects that are probably caused by large and complex molecules in the Galactic interstellar medium (ISM).

In order to isolate the DIB from the stellar features in each individual spectrum, a set of 160 thousand spectra were identified at high Galactic latitudes ($|b| \geq 65^\circ$) covering a range of stellar parameters which are used as DIB-free reference sample. Matching each target spectrum to its closest reference spectrum in stellar parameter space makes it possible to remove the stellar spectrum empirically, without reference to stellar models, leaving a set of 6 million interstellar medium (ISM) spectra. Using the parallax of the star and its Galactic longitude and latitude, we then allocate each ISM spectrum in a voxel (VOlume piXEL) on a contiguous three-dimensional grid with angular size of 1.8° (level 5 HEALPix) leading to a total of 235 428 voxels.

Identifying the two DIBs at 862.1 nm (λ862.1) and 864.8 nm (λ864.8) in the stacked spectra, their shapes are modelled and the central wavelength, width, depth, and equivalent width for each DIB, along with confidence bounds on these measurements calculated.

This FPR contains a parameter table listing the fitted DIB parameters in each voxel and a table containing the stacked ISM spectra in each voxel. The input data for this FPR cover the same time baseline as Gaia DR3.

The data processing and data model for this FPR are described in Gaia Collaboration, Schultheis, M., et al. (2023b).

Chapter 2

Datamodel description

Author(s): Nigel Hambly, Francesca De Angeli, Marc Audard, Ulrich Bastian, Elisa Brugaletta, Jos de Bruijne, Orlagh Creevey, Ludovic Delchambre, Christine Ducourant, Laurent Eyer, Morgan Fouesneau, Laurent Gallucio, Pedro Garcia–Lario, Gonzalo Gracia-Abril, Ulrike Heiter, Jose Hernandez, Alessandro Lanzafame, Malgorzata van Leeuwen, Alexy Mints, Nami Mowlavi, Christophe Ordenovic, Jordi Portell de Mora, Wilhem Roux, Paola Sartoretti, Mathias Schultheis, Inna Slezak, Federica Spoto, Paolo Tanga, David Teyssier, Enrique Utrilla Molina, Katja Weingrill

Introductory note:

- all table names must be prefixed with `gaiafpr` in ADQL scripts;
- types given in parenthesis for each column are Java data types.

2.1 Focused product release

2.1.1 CROWDED_FIELD_SOURCE

Sources based on Service Interface Function (SIF) images of very dense regions in the sky. These sources build an add-on catalogue to the nominal Gaia catalogue. Nominal and SIF detections were not mixed to create these sources. These Sources are thus obtained from SIF image detections only. Sources already present in the nominal catalogue were removed from the SIF add-on catalogue.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that were used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

DESIGNATION : Unique source designation (unique across all Data Releases) (string)

A source designation, unique across all Gaia Data Releases, that is constructed from the prefix 'Gaia DRx ' or 'Gaia FPR ' followed by a string of digits corresponding to `source_id` (3 space–separated words in total). Note that the integer source identifier `source_id` is **not** guaranteed to be unique across Data Releases; moreover it is not guaranteed that the same astronomical source will always have the same `source_id` in different Data Releases. Hence the only safe way to compare source records between different Data Releases in general is to check the records of proximal source(s) in the same small part of the sky.

REGION_NAME : Name of the designated CrowdedField region in the sky (string)

String, that identifies the SIF CF region in the sky, this source is located in. Gaia observed 9 regions with SIF CF images. The corresponding String values are:

BAADE_S_WINDOW: Baade's Window (Bulge region)
SGR_I: Sagittarius window (Bulge region)
LMC: Large Magellanic Cloud, satellite galaxy of the Milky Way
SMC: Small Magellanic Cloud, dwarf irregular galaxy near the Milky Way
NGC104: (aka 47 Tucanae) in the constellation Tucana
NGC4372: (aka Caldwell 108) in the southern constellation of Musca
NGC5139: (aka Omega Centauri or Caldwell 80) in the constellation of Centaurus
NGC6121: (aka Messier 4) in the constellation of Scorpius
NGC6656: (aka Messier 22) in the constellation Sagittarius

SOURCE_ID : Unique source identifier (unique within a particular Data Release) providing the CrowdedField-nature of the source via location bit (long)

A unique numerical identifier of the source, encoding the approximate position of the source (roughly to the nearest arcmin), the provenance (data processing centre where it was created), a running number, and a component number following the construction conventions of those in the Gaia DR3 main source catalogue (for a detailed description see `gaiadr3.gaia_source.source_id`). Note that the Gaia DPAC Data Processing Code provenance value (in bits 33 to 35) is 6 for the crowded field image analysis pipeline, i.e. (source_id >> 32) & 7 = 6 for sources in `crowded_field_source`.

REF_EPOCH : Reference epoch (double, Time[Julian Years])

Reference epoch to which the astrometric source parameters are referred, expressed as a Julian Year in TCB.

RA : Right ascension (double, Angle[deg])

Barycentric right ascension α of the source in ICRS at the reference epoch `ref_epoch`

RA_ERROR : Standard error of right ascension (float, Angle[mas])

Standard error $\sigma_{\alpha*} \equiv \sigma_\alpha \cos\delta$ of the right ascension of the source in ICRS at the reference epoch `ref_epoch`.

DEC : Declination (double, Angle[deg])

Barycentric declination δ of the source in ICRS at the reference epoch `ref_epoch`

DEC_ERROR : Standard error of declination (float, Angle[mas])

Standard error σ_δ of the declination of the source in ICRS at the reference epoch `ref_epoch`

PARALLAX : Parallax (double, Angle[mas])

Absolute stellar parallax ϖ of the source at the reference epoch `ref_epoch`

PARALLAX_ERROR : Standard error of parallax (float, Angle[mas])

Standard error σ_ϖ of the stellar parallax at the reference epoch `ref_epoch`

PARALLAX_OVER_ERROR : Parallax divided by its standard error (float)

Parallax divided by its standard error

PM : Total proper motion (float, Angular Velocity[mas yr^{-1}])

The total proper motion calculated as the magnitude of the resultant vector of the proper motion component vectors `pmra` and `pmdec`, i.e. $\mathtt{pm}^2 = \mathtt{pmra}^2 + \mathtt{pmdec}^2$.

PMRA : Proper motion in right ascension direction (double, Angular Velocity[mas yr^{-1}])

Proper motion in right ascension $\mu_{\alpha*} \equiv \mu_\alpha \cos\delta$ of the source in ICRS at the reference epoch `ref_epoch`. This is the local tangent plane projection of the proper motion vector in the direction of increasing right ascension.

PMRA_ERROR : Standard error of proper motion in right ascension direction (float, Angular Velocity[mas yr^{-1}])

Standard error $\sigma_{\mu\alpha*}$ of the local tangent plane projection of the proper motion vector in the direction of increasing right ascension at the reference epoch `ref_epoch`

PMDEC : Proper motion in declination direction (double, Angular Velocity[mas yr^{-1}])

Proper motion in declination μ_δ of the source at the reference epoch `ref_epoch`. This is the projection of the proper motion vector in the direction of increasing declination.

PMDEC_ERROR : Standard error of proper motion in declination direction (float, Angular Velocity[mas yr^{-1}])

Standard error $\sigma_{\mu\delta}$ of the proper motion component in declination at the reference epoch `ref_epoch`

RA_DEC_CORR : Correlation between right ascension and declination (float)

Correlation coefficient $\rho(\alpha, \delta)$ between right ascension and declination. This is a dimensionless quantity in the range [-1,+1].

RA_PARALLAX_CORR : Correlation between right ascension and parallax (float)

Correlation coefficient $\rho(\alpha, \varpi)$ between right ascension and parallax, a dimensionless quantity in the range [-1,+1].

RA_PMRA_CORR : Correlation between right ascension and proper motion in right ascension (float)

Correlation coefficient $\rho(\alpha, \mu_{\alpha*})$ between right ascension and proper motion in right ascension, a dimensionless quantity in the range [-1,+1].

RA_PMDEC_CORR : Correlation between right ascension and proper motion in declination (float)

Correlation coefficient $\rho(\alpha, \mu_\delta)$ between right ascension and proper motion in declination, a dimensionless quantity in the range [-1,+1].

DEC_PARALLAX_CORR : Correlation between declination and parallax (float)

Correlation coefficient $\rho(\delta, \varpi)$ between declination and parallax, a dimensionless quantity in the range [-1,+1].

DEC_PMRA_CORR : Correlation between declination and proper motion in right ascension (float)

Correlation coefficient $\rho(\delta, \mu_{\alpha*})$ between declination and proper motion in right ascension, a dimensionless quantity in the range [-1,+1].

DEC_PMDEC_CORR : Correlation between declination and proper motion in declination (float)

Correlation coefficient $\rho(\delta, \mu_\delta)$ between declination and proper motion in declination, a dimensionless quantity in the range [-1,+1].

PARALLAX_PMRA_CORR : Correlation between parallax and proper motion in right ascension (float)

Correlation coefficient $\rho(\varpi, \mu_{\alpha*})$ between parallax and proper motion in right ascension, a dimensionless quantity in the range [-1,+1].

PARALLAX_PMDEC_CORR : Correlation between parallax and proper motion in declination (float)

Correlation coefficient $\rho(\varpi, \mu_\delta)$ between parallax and proper motion in declination, a dimensionless quantity in the range [-1,+1].

PMRA_PMDEC_CORR : Correlation between proper motion in right ascension and proper motion in declination (float)

Correlation coefficient $\rho(\mu_{\alpha*}, \mu_\delta)$ between proper motion in right ascension and proper motion in declination, a dimensionless quantity in the range [-1,+1].

N_SCANS : Number of CrowdedField scans of the source location (short)

Number of SIF scans or images covering the source location. When compared to the number of matched detections, it will allow to assess the quality/reliability of the source.

ASTROMETRIC_N_OBS_AL : Total number of observations in the along-scan (AL) direction (short)

Total number of AL observations (= CCD transits) used in the astrometric solution of the source, independent of their weight. Note that some observations may be strongly downweighted (see `astrometric_n_bad_obs_al`).

ASTROMETRIC_N_OBS_AC : Total number of observations in the across-scan (AC) direction (short)

Total number of AC observations (= CCD transits) used in the astrometric solution of the source, independent of their weight (note that some observations may be strongly downweighted). Nearly all sources having G < 13 will have AC observations from 2d windows, while fainter than that limit only ~ 1% of transit observations (the so–called 'calibration faint stars') are assigned 2d windows resulting in AC observations.

ASTROMETRIC_N_GOOD_OBS_AL : Number of good observations in the along-scan (AL) direction (short)

Number of AL observations (= CCD transits) that were not strongly downweighted in the astrometric solution of the source. Strongly downweighted observations (with downweighting factor $w < 0.2$) are instead counted in `astrometric_n_bad_obs_al`. The sum of `astrometric_n_good_obs_al` and `astrometric_n_bad_obs_al` equals `astrometric_n_obs_al`, the total number of AL observations used in the astrometric solution of the source.

ASTROMETRIC_N_BAD_OBS_AL : Number of bad observations in the along-scan (AL) direction (short)

Number of AL observations (= CCD transits) that were strongly downweighted in the astrometric solution of the source, and therefore contributed little to the determination of the astrometric parameters. An observation is considered to be strongly downweighted if its downweighting factor $w < 0.2$, which means that the absolute value of the astrometric residual exceeds 4.83 times the total uncertainty of the observation, calculated as the quadratic sum of the centroiding uncertainty, excess source noise, and excess attitude noise.

ASTROMETRIC_GOF_AL : Goodness of fit statistic of model wrt along-scan observations (float)

Goodness-of-fit statistic of the astrometric solution for the source in the along-scan direction. This is the 'gaussianized chi-square', which for good fits should approximately follow a normal distribution with zero mean value and unit standard deviation. Values exceeding, say, +3 thus indicate a bad fit to the data.

This statistic is computed according to the formula

$\texttt{astrometric\_gof\_al} = (9\nu/2)^{1/2}[\texttt{ruwe}^{2/3} + 2/(9\nu) - 1]$

where `ruwe` is the renormalised unit weight error and

$\nu = \texttt{astrometric\_n\_good\_obs\_al} - N$

is the number of degrees of freedom for a source update. Here $N = 5$ for 2-parameter and 5-parameter solutions (respectively `astrometric_params_solved` = 3 or 31) and 6 for 6-parameter solutions (`astrometric_params_solved` = 95). Note that only 'good' (i.e. not strongly downweighted) observations are included in ν. For further details please see Lindegren et al. (2021).

ASTROMETRIC_CHI2_AL : AL chi-square value (float)

Astrometric goodness-of-fit (χ^2) in the AL direction.

χ^2 values were computed for the 'good' AL observations of the source, without taking into account the `astrometric_excess_noise` (if any) of the source. They do however take into account the attitude excess noise (if any) of each observation.

ASTROMETRIC_EXCESS_NOISE : Excess noise of the source (float, Angle[mas])

This is the excess noise ϵ_i of the source. It measures the disagreement, expressed as an angle, between the observations of a source and the best-fitting standard astrometric model (using five astrometric parameters). The assumed observational noise in each observation is quadratically increased by ϵ_i in order to statistically match the residuals in the astrometric solution. A value of 0 signifies that the source is astrometrically well-behaved, i.e. that the residuals of the fit statistically agree with the assumed observational noise. A positive value signifies that the residuals are statistically larger than expected.

The significance of ϵ_i is given by `astrometric_excess_noise_sig` (D). If $D \leq 2$ then ϵ_i is probably not significant, and the source may be astrometrically well-behaved even if ϵ_i is large.

The excess noise ϵ_i may absorb all kinds of modelling errors that are not accounted for by the observational noise (image centroiding error) or the excess attitude noise. Such modelling errors include LSF and PSF calibration errors, geometric instrument calibration errors, and part of the high-frequency attitude noise. These modelling errors are particularly important in the early data releases, but should decrease as the astrometric modelling of the instrument and attitude improves over the years.

Additionally, sources that deviate from the standard five-parameter astrometric model (e.g. unresolved binaries, exoplanet systems, etc.) may have positive ϵ_i. Given the many other possible contributions to the excess noise, the user must study the empirical distributions of ϵ_i and D to make sensible cutoffs before filtering out sources for their particular application.

The excess source noise is further explained in Sections 3.6 and 5.1.2 of Lindegren et al. (2012).

ASTROMETRIC_EXCESS_NOISE_SIG : Significance of excess noise (float)

A dimensionless measure (D) of the significance of the calculated `astrometric_excess_noise` (ϵ_i). A value $D > 2$ indicates that the given ϵ_i is probably significant.

For good fits in the limit of a large number of observations, D should be zero in half of the cases and approximately follow the positive half of a normal distribution with zero mean and unit standard deviation for the other half. Consequently, D is expected to be greater than 2 for only a few percent of the sources with well-behaved astrometric solutions.

In the early data releases ϵ_i will however include instrument and attitude modelling errors that are statistically significant and could result in large values of ϵ_i and D. The user must study the empirical distributions of these statistics and make sensible cutoffs before filtering out sources for their particular application.

The excess noise significance is further explained in Section 5.1.2 of Lindegren et al. (2012).

ASTROMETRIC_PARAMS_SOLVED : Which parameters have been solved for? (byte)

The seven bits of `astrometric_params_solved` indicate which parameters have been estimated in AGIS for this source. A set bit means the parameter was updated, an unset bit means the parameter was not updated. The least-significant bit corresponds to `ra`. The table below shows the values of `astrometric_params_solved` for relevant combinations of the parameters.

The radial proper motion (μ_r) is formally considered to be one of the astrometric parameters of a source, and the sixth bit is therefore reserved for it. It is also in principle updatable in AGIS, but in practice it will always be computed from a spectroscopic radial velocity and the estimated parallax, in which case the bit is not set.

C is the `pseudocolour` of the source, i.e. the astrometrically estimated effective wavenumber.

`astrometric_params_solved`	`ra`	`dec`	`parallax`	`pmra`	`pmdec`	μ_r	C
$0000011_2 = 3$	✓	✓					
$0000111_2 = 7$	✓	✓	✓				
$0011011_2 = 27$	✓	✓		✓	✓		
$0011111_2 = 31$	✓	✓	✓	✓	✓		
$0111111_2 = 63$	✓	✓	✓	✓	✓	✓	
$1011111_2 = 95$	✓	✓	✓	✓	✓		✓

In practice all the sources in DR3 have only values of 3, 31 or 95 for the `astrometric_params_solved`, corresponding to two-parameter (position), five-parameter (position, parallax, and proper motion) and six-parameter (position, parallax, proper motion and astrometrically estimated effective wavenumber) solutions.

PSEUDOCOLOUR : Astrometrically estimated pseudocolour of the source (float, Misc[μm^{-1}])

Effective wavenumber of the source estimated in the final astrometric processing.

The `pseudocolour` is the astrometrically estimated effective wavenumber of the photon flux distribution in the astrometric (G) band, measured in μm^{-1}. The value in this field was estimated from the chromatic displacements of image centroids, calibrated by means of the photometrically determined effective wavenumbers (ν_{eff}) of primary sources.

The field is empty when chromaticity was instead taken into account using the photometrically determined ν_{eff} given in the field `nu_eff_used_in_astrometry`.

PSEUDOCOLOUR_ERROR : Standard error of the pseudocolour of the source (float, Misc[μm^{-1}])

Standard error $\sigma_{\texttt{pseudocolour}}$ of the astrometrically determined `pseudocolour` of the source.

RA_PSEUDOCOLOUR_CORR : Correlation between right ascension and pseudocolour (float)

Correlation coefficient $\rho(\alpha, \texttt{pseudocolour})$ between right ascension `ra` and `pseudocolour`, a dimensionless quantity in the range [-1,+1]

DEC_PSEUDOCOLOUR_CORR : Correlation between declination and pseudocolour (float)

Correlation coefficient $\rho(\delta, \texttt{pseudocolour})$ between declination `dec` and `pseudocolour`, a dimensionless quantity in the range [-1,+1]

PARALLAX_PSEUDOCOLOUR_CORR : Correlation between parallax and pseudocolour (float)

Correlation coefficient $\rho(\varpi, \texttt{pseudocolour})$ between `parallax` and `pseudocolour`, a dimensionless quantity in the range [-1,+1]

PMRA_PSEUDOCOLOUR_CORR : Correlation between proper motion in right asension and pseudocolour (float)

Correlation coefficient $\rho(\mu_{\alpha*}, \texttt{pseudocolour})$ between proper motion in right ascension `pmra` and `pseudocolour`, a dimensionless quantity in the range [-1,+1]

PMDEC_PSEUDOCOLOUR_CORR : Correlation between proper motion in declination and pseudocolour (float)

Correlation coefficient $\rho(\mu_{\delta}, \texttt{pseudocolour})$ between proper motion in declination `pmdec` and `pseudocolour`, a dimensionless quantity in the range [-1,+1]

ASTROMETRIC_MATCHED_TRANSITS : Matched FOV transits used in the AGIS solution (short)

The number of field–of–view transits matched to this source, counting only the transits containing CCD observations actually used to compute the astrometric solution.

This number will always be equal to or smaller than `matched_transits`, the difference being the FOV transits that were not used in the astrometric solution because of bad data or excluded time intervals.

VISIBILITY_PERIODS_USED : Number of visibility periods used in Astrometric solution (short)

Number of visibility periods used in the astrometric solution.

A visibility period is a group of observations separated from other groups by a gap of at least 4 days. A source may have from one to tens of field–of–view transits in a visibility period, but with a small spread in time, direction of scanning, and parallax factor. From one visibility period to the next these variables have usually changed significantly. A high number of visibility periods is therefore a better indicator of an astrometrically well–observed source than a large number of field–of–view transits (`matched_transits` or `astrometric_matched_transits`) or CCD observations (`astrometric_n_obs_al`). A small value (e.g. less than 10) indicates that the calculated parallax could be more vulnerable to errors, e.g. from the calibration model, not reflected in the formal uncertainties. See Lindegren et al. (2018) for a discussion of this and other astrometric quality indicators.

ASTROMETRIC_SIGMA5D_MAX : The longest semi-major axis of the 5-d error ellipsoid (float, Angle[mas])

The longest principal axis in the 5-dimensional error ellipsoid.

This is a 5-dimensional equivalent to the semi-major axis of the position error ellipse and is therefore useful for filtering out cases where one of the five parameters, or some linear combination of several parameters, is particularly ill-determined. It is measured in mas and computed as the square root of the largest singular value of the scaled 5×5 covariance matrix of the astrometric parameters. The matrix is scaled so as to put the five parameters on a comparable scale, taking into account the maximum along-scan parallax factor for the parallax and the time coverage of the observations for the proper motion components. If C is the unscaled covariance matrix, the scaled matrix is SCS, where $S = \mathrm{diag}(1, 1, \sin\xi, T/2, T/2)$, $\xi = 45^\circ$ is the solar aspect angle in the nominal scanning law, and T the time coverage of the data used in the solution.

`astrometric_sigma5d_max` is given for all the solutions, as its size is one of the criteria for accepting or rejecting the 5 or 6-parameter solution. In case of a 2- parameter solution (`astrometric_params_solved` = 3) it gives the value for the rejected 5 or 6-parameter solution, and can then be arbitrarily large.

MATCHED_TRANSITS : The number of transits matched to this source (short)

The total number of field–of–view transits matched to this source.

IPD_GOF_HARMONIC_AMPLITUDE : Amplitude of the IPD GoF versus position angle of scan (float)

This statistic measures the amplitude of the variation of the Image Parameter Determination (IPD) goodness–of–fit (GoF; reduced chi-square) as function of the position angle of the scan direction. A large amplitude indicates that the source has some non-isotropic spatial structure, for example a binary or galaxy, that is at least partially resolved by Gaia. The phase of the variation is given by the parameter `ipd_gof_harmonic_phase`.

Let ψ be the position angle of the scan direction. The following expression is fitted to the IPD GoF for the accepted AF observations of the source:

$$\ln(\mathrm{GoF}) = c_0 + c_2 \cos(2\psi) + s_2 \sin(2\psi)$$

The amplitude and phase of the variation are calculated as

$$\texttt{ipd\_gof\_harmonic\_amplitude} = \sqrt{c_2^2 + s_2^2}$$

$$\texttt{ipd\_gof\_harmonic\_phase} = \frac{1}{2}\,\mathrm{atan2}(s_2, c_2) \quad (+\ 180^\circ)$$

where atan2 returns the angle in degrees. In the last expression 180 is added for negative values, so that `ipd_gof_harmonic_phase` is always between 0 and 180°. Only the AF observations accepted by the astrometric solution are used to compute the amplitude and phase, thus for example outliers and observations in the early Ecliptic Pole Scanning Law phase are not used.

The GoF variation is modelled as a periodic function of 2ψ because a source with fixed structure is normally expected to give fits of similar quality when scanned in opposite directions (ψ differing by 180°). See `ipd_gof_harmonic_phase` for the interpretation of the phase.

IPD_GOF_HARMONIC_PHASE : Phase of the IPD GoF versus position angle of scan (float, Angle[deg])

This statistic measures the phase of the variation of the IPD GoF (reduced chi-square) as function of the position angle of the scan direction. See the description of `ipd_gof_harmonic_amplitude` for details on the computation of the phase.

The interpretation of this parameter is non-trivial because of the complex interaction between the source structure and the IPD. At least the following different scenarios could occur:

- For a binary with separation $\lesssim 0.1$ arcsec the GoF is expected to be higher when the scan is along the arc joining the components than in the perpendicular direction, in which case `ipd_gof_harmonic_phase` should indicate the position angle of the binary modulo 180°. Such a binary will normally have negligible `ipd_frac_multi_peak` (less than a few per cent).
- For a resolved binary the GoF may instead have a minimum when the scan is along the arc joining the two components, in which case `ipd_gof_harmonic_phase` differs from the position angle of the binary (modulo 180°) by approximately ±90°. Such a binary will normally have a large `ipd_frac_multi_peak`.
- For a bright binary ($G \lesssim 13$) the GoF refers to the fitting of a two-dimensional PSF, which could further complicate the intrepretation.
- For a galaxy with elongated intensity distribution, the IPD may give a smaller GoF when the scan is along the major axis of the image, resulting in an offset of approximately ±90° between the `ipd_gof_harmonic_phase` and the position angle of the major axis (modulo 180°).

SCAN_DIRECTION_STRENGTH_K1 : Degree of concentration of scan directions across the source (float)

The `scan_direction_strength_k1`...4 and `scan_direction_mean_k1`...4 quantify the distribution of AL scan directions across the source. `scan_direction_strength_k1` (and similarly 2,3,4) are the absolute value of the trigonometric moments $m_k = \langle \exp(ik\theta) \rangle$ for $k = 1, 2, 3, 4$ where θ is the position angle of the scan and the mean value is taken over the `astrometric_n_good_obs_al` observations contributing to the astrometric parameters of the source. θ is defined in the usual astronomical sense: $\theta = 0$ when the FoV is moving towards local North, and $\theta = 90°$ towards local East.

N.B. When `astrometric_n_obs_ac` > 0 the scan direction attributes are not provided at Gaia DR3. Hence for all sources brighter than G ≈ 13, and for a tiny fraction of fainter sources (≈ 1%), these 8 scan direction fields will be NULL.

The `scan_direction_strength_k1`...4 are numbers between 0 and 1, where 0 means that the scan directions are well spread out in different directions, while 1 means that they are concentrated in a single direction (given by the corresponding `scan_direction_mean_k1`...4).

The different orders k are statistics of the scan directions modulo $360°/k$. For example, at first order ($k = 1$), $\theta = 10°$ and $\theta = 190°$ count as different directions, but at second order ($k = 2$) they are the same. Thus, `scan_direction_strength_k1` is the degree of concentration when the sense of direction is taken into account, while `scan_direction_strength_k2` is the degree of concentration without regard to the sense of direction. A large value of `scan_direction_strength_k4` indicates that the scans are concentrated in two nearly orthogonal directions.

SCAN_DIRECTION_STRENGTH_K2 : Degree of concentration of scan directions across the source (float)

The `scan_direction_strength_k1`...4 and `scan_direction_mean_k1`...4 attributes quantify the distribution of AL scan directions across the source.

See the description for attribute `scan_direction_strength_k1` for further details.

SCAN_DIRECTION_STRENGTH_K3 : Degree of concentration of scan directions across the source (float)

The `scan_direction_strength_k1`...4 and `scan_direction_mean_k1`...4 attributes quantify the distribution of AL scan directions across the source.

See the description for attribute `scan_direction_strength_k1` for further details.

SCAN_DIRECTION_STRENGTH_K4 : Degree of concentration of scan directions across the source (float)

The `scan_direction_strength_k1`...4 and `scan_direction_mean_k1`...4 attributes quantify the distribution of AL scan directions across the source.

See the description for attribute `scan_direction_strength_k1` for further details.

SCAN_DIRECTION_MEAN_K1 : Mean position angle of scan directions across the source (float, Angle[deg])

The `scan_direction_strength_k1`...4 and `scan_direction_mean_k1`...4 attributes quantify the distribution of AL scan directions across the source. `scan_direction_mean_k1` (and similarly for $k = 2, 3, 4$) is $1/k$ times the argument of the trigonometric moments $m_k = \langle \exp(ik\theta) \rangle$, where θ is the position angle of the scan and the mean value is taken over the `astrometric_n_good_obs_al` observations contributing to the astrometric parameters of the source. θ is defined in the usual astronomical sense: $\theta = 0$ when the FoV is moving towards local North, and $\theta = 90^\circ$ towards local East.

N.B. When `astrometric_n_obs_ac` > 0 the scan direction attributes are not provided at Gaia DR3. Hence for all sources brighter than G ≈ 13, and for a tiny fraction of fainter sources (≈ 1%), these 8 scan direction fields will be NULL.

`scan_direction_mean_k1` (and similarly for $k = 2, 3, 4$) is an angle between $-180^\circ/k$ and $+180^\circ/k$, giving the mean position angle of the scans at order k.

The different orders k are statistics of the scan directions modulo $360^\circ/k$. For example, at first order ($k = 1$), $\theta = 10^\circ$ and $\theta = 190^\circ$ count as different directions, but at second order ($k = 2$) they are the same. Thus, `scan_direction_mean_k1` is the mean direction when the sense of direction is taken into account, while `scan_direction_mean_k2` is the mean direction without regard to the sense of the direction. For example, `scan_direction_mean_k1` = 0 means that the scans preferentially go towards North, while `scan_direction_mean_k2` = 0 means that they preferentially go in the North-South direction, and `scan_direction_mean_k4` = 0 that they preferentially go either in the North-South or in the East-West direction.

SCAN_DIRECTION_MEAN_K2 : Mean position angle of scan directions across the source (float, Angle[deg])

The `scan_direction_strength_k1`...4 and `scan_direction_mean_k1`...4 attributes quantify the distribution of AL scan directions across the source.

See the description for attribute `scan_direction_mean_k1` for further details.

SCAN_DIRECTION_MEAN_K3 : Mean position angle of scan directions across the source (float, Angle[deg])

The `scan_direction_strength_k1`...4 and `scan_direction_mean_k1`...4 attributes quantify the distribution of AL scan directions across the source.

See the description for attribute `scan_direction_mean_k1` for further details.

SCAN_DIRECTION_MEAN_K4 : Mean position angle of scan directions across the source (float, Angle[deg])

The `scan_direction_strength_k1`...4 and `scan_direction_mean_k1`...4 attributes quantify the distribution of AL scan directions across the source.

See the description for attribute `scan_direction_mean_k1` for further details.

ASTROMETRIC_PRIMARY_FLAG : Primary or secondary (boolean)

Flag indicating if this source was used as a primary source (`true`) or secondary source (`false`). Only primary sources contribute to the estimation of attitude, calibration, and global parameters. The estimation of source parameters is otherwise done in exactly the same way for primary and secondary sources.

PHOT_G_N_OBS : Number of observations contributing to G photometry (short)

Number of observations (CCD transits) that contributed to the G mean flux (`phot_g_mean_flux`) and mean flux error (`phot_g_mean_flux_error`).

PHOT_G_MEAN_FLUX : G-band mean flux (double, Flux[e^{-} s^{-1}])

Mean flux in the G-band.

PHOT_G_MEAN_FLUX_ERROR : Error on G-band mean flux (float, Flux[e^{-} s^{-1}])

Standard deviation of the G-band fluxes divided by the square root of the number of observations (`phot_g_n_obs`).

PHOT_G_MEAN_FLUX_OVER_ERROR : G-band mean flux divided by its error (float)

Mean flux in the G-band `phot_g_mean_flux` divided by its error `phot_g_mean_flux_error`.

PHOT_G_MEAN_MAG : G-band mean magnitude (float, Magnitude[mag])

Mean magnitude in the G band. This is computed from the G-band mean flux (`phot_g_mean_flux`) applying the magnitude zero-point in the Vega scale (see Gaia DR3 on-line documentation and references therein).

No error is provided for this quantity as the error distribution is only symmetric in flux space. This converts to an asymmetric error distribution in magnitude space which cannot be represented by a single error value.

PHOT_G_FLUX_UWV : Unit weight variance of fluxes (double)

The unit weight variance of the flux values.

PHOT_G_FLUX_MEDIAN : Median flux (float, Flux[e^{-} s^{-1}])

Median of the flux distribution.

When an insufficient number of observations are available to compute these quantities, the corresponding field will be set to Float.NaN.

PHOT_G_FLUX_SKEWNESS : Measure of the skewness of the flux distribution (float)

Measure of the skewness of the flux distribution.

When an insufficient number of observations are available to compute these quantities, the corresponding field will be set to Float.NaN.

PHOT_G_FLUX_KURTOSIS : Measure of the kurtosis of the flux distribution (float)

Kurtosis of the flux distribution.

When an insufficient number of observations are available to compute these quantities, the corresponding field will be set to Float.NaN.

PHOT_G_FLUX_MAD : MAD of the flux distribution (float, Flux[e^{-} s^{-1}])

Median Absolute Deviation (MAD) of the flux distribution.

When an insufficient number of observations are available to compute these quantities, the corresponding field will be set to Float.NaN.

PHOT_G_FLUX_FIRST_QUARTILE : First quartile of the flux distribution (float, Flux[e^{-} s^{-1}])

First (25%) quartile of the flux distribution.

When an insufficient number of observations are available to compute these quantities, the corresponding field will be set to Float.NaN.

PHOT_G_FLUX_THIRD_QUARTILE : Third quartile of the flux distribution (float, Flux[e^- s^{-1}])

Third (75%) quartile of the flux distribution.

When an insufficient number of observations are available to compute these quantities, the corresponding field will be set to Float.NaN.

PHOT_G_FLUX_MIN : Minimum flux value (float, Flux[e^- s^{-1}])

Minimum flux value.

PHOT_G_FLUX_MAX : Maximum flux value (float, Flux[e^- s^{-1}])

Maximum flux value.

PHOT_PROC_MODE : Photometry processing mode (byte)

This flag indicates the photometric calibration process used for the source. For nominal processing, this process is determined by the availability of colour information derived from the internally calibrated mean BP and RP source spectra. The following values are defined for Gaia DR3:

- 0: this corresponds to the 'gold' photometric dataset. Sources in this dataset have complete colour information.
- 1: this corresponds to the 'silver' photometric dataset. Sources in this dataset have incomplete colour information and therefore were calibrated using an iterative process that estimated the missing colour information from the source mean G and either BP or RP photometry (depending on which band had full colour information available) using empirical relationships derived from the gold dataset.
- 2: this corresponds to the 'bronze' photometric dataset. Sources in this dataset had insufficient colour information and therefore were calibrated using default colour information derived from the gold dataset.
- 16: this data was not produced with the nominal PhotPipe code, but with a dedicated photometric overlap calibration performed for SIF CF Focussed Product Release using calibrated DR3 sources as reference.

Because the process of generating the mean BP and RP spectra and the process of producing mean BP and RP integrated photometry are very different and have different requirements it is possible for gold sources to be missing any of the bands, i.e. gold does not imply anything about the availability of mean G, BP and RP photometry. Similarly for silver and bronze sources it is possible to have photometry available in any bands (and possible combinations).

More details about the different calibration procedures are available in Chapter 5 of the Gaia DR3 on-line documentation and in Riello et al. (2021) and references therein.

L : Galactic longitude (double, Angle[deg])

Galactic Longitude of the object at reference epoch `ref_epoch`.

B : Galactic latitude (double, Angle[deg])

Galactic Latitude of the object at reference epoch `ref_epoch`.

ECL_LON : Ecliptic longitude (double, Angle[deg])

Ecliptic Longitude of the object at reference epoch `ref_epoch`, obtained from the equatorial coordinates using the transformation defined in Volume 1, Section 1.5.3 of ESA (1997).

Note that in the transformation applied here the ICRS origin is shifted in the equatorial plane from Γ by $\phi = 0.05542$ arcsec, positive from Γ to the ICRS origin (Chapront et al. 2002). The ICRS has an unambiguous definition with an origin in the ICRF equator defined by the realisation of the ICRF. The ecliptic system is less well-defined, potentially depending on additional conventions in dynamical theories. The transformation employed here corresponds to the inertial mean ecliptic with obliquity and Γ defined by reference to the ICRS equator. Both the obliquity and the position of Γ on the ICRS equator with respect to the ICRS origin have been obtained from Lunar Laser Ranging measurements. This has no time dependence – there is no secular variation of the obliquity and no precession – and it simply defines the relative situation of the various planes at J2000.

ECL_LAT : Ecliptic latitude (double, Angle[deg])

Ecliptic Latitude of the object at reference epoch `ref_epoch`. For further details see the description for attribute `ecl_lon`.

2.1.2 INTERSTELLAR_MEDIUM_PARAMS

This is the main table of DIB parameters from DIB-Spec, derived from spectra binned in galactic latitude, longitude and distance.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that were used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

HEALPIX : HEALPix identification (int)

The pixel number determined by a level 5 HEALPix scheme, which is one of the two identifiers of the DIB-Spec bin voxel. Each voxel is defined by a HEALPix number (level 5) made in the equatorial system and the central heliocentric distance (dc).

LC : Central galactic longitude of voxel (float, Angle[deg])

Galactic longitude of the centre of the DIB-Spec voxel.

BC : Central galactic latitude of voxel (float, Angle[deg])

Galactic latitude of the centre of the DIB-Spec voxel.

DC : Central heliocentric distance of voxel (float, Length & Distance[kpc])

Heliocentric distance of the centre of the DIB-Spec voxel. The distance is defined as the inverse of parallax.

N_TARGETS : Number of target stars in a voxel (int)

Number of target stars used in each DIB-Spec voxel to make the stacked interstellar medium (ISM) spectrum.

SNR : SNR of the stacked ISM spectrum at 862.0 nm (float)

Signal-to-noise ratio measured in the stacked ISM spectrum in each DIB-Spec voxel between 860.2 and 861.2 nm, defined as the mean value of flux divided by the standard deviation of the flux.

EW8620 : DIB equivalent width at 862.0 nm (float, Length & Distance[nm])

Equivalent width of the DIB at 862.0 nm in each DIB-Spec voxel.

It is defined from a Gaussian model $f(\lambda, p_0, p_1, p_2) = p_0 \times \exp\left(-\frac{(\lambda-p_1)^2}{2p_2^2}\right)$ where p_0 and p_2 are the depth and width of the DIB profile, p_1 is the central wavelength and λ is the wavelength. The latter is the parameter `lambda` in the interstellar medium spectra table.

ew8620_lower : Lower confidence level (16%) of DIB equivalent width at 862.0 nm (float, Length & Distance[nm])

Lower confidence level (16%) of the equivalent width of the DIB at 862.0 nm in each DIB-Spec voxel.

The confidence interval has been evaluated by numerical integration of the spectra, while the ew8620 has been computed by an analytical solution. This inconsistency between the calculation of the EW and their upper and lower levels implies that sometimes `ew8620` < `ew8620_lower` or `ew8620` > `ew8620_upper`, even if the upper and lower values are consistent with each other. We recommend application of the scaling factor of 1.003 to `ew8620_lower` and `ew8620_upper`, see Gaia Collaboration, Schultheis, M., et al. (2023b).

ew8620_upper : Upper confidence level (84%) of DIB equivalent width at 862.0 nm (float, Length & Distance[nm])

Upper confidence level (84%) of the equivalent width of the DIB at 864.8 nm in each DIB-Spec voxel.

The confidence interval has been evaluated by numerical integration of the spectra, while the ew8620 has been computed by an analytical solution. This inconsistency between the calculation of the EW and their upper and lower levels implies that sometimes `ew8620` < `ew8620_lower` or `ew8620` > `ew8620_upper`, even if the upper and lower values are consistent with each other. We recommend application of the scaling factor of 1.003 to `ew8620_lower` and `ew8620_upper`, see Gaia Collaboration, Schultheis, M., et al. (2023b).

flags8620 : Quality flag of DIB parameters at 862.0 nm (int)

Quality flag of the DIB parameters at 862.0 nm in each DIB-Spec voxel. 0 is the best value and 5 is the worst. The exact definition of the quality flags can be found in Gaia Collaboration, Schultheis, M., et al. (2023b).

p08620 : p0 parameter at 862.0 nm (float)

Depth parameter of the DIB at 862 nm in each DIB-Spec voxel, see parameter `ew8620` for details.

p08620_lower : Lower confidence level (16%) of p0 parameter at 862.0 nm (float)

Lower confidence level (16%) of the p0 parameter (depth) of the DIB at 862.0 nm in each DIB-Spec voxel, see parameter `p08620` for details.

p08620_upper : Upper confidence level (84%) of p0 parameter at 862.0 nm (float)

Upper confidence level (84%) of the p0 parameter (depth) of the DIB at 862.0 nm in each DIB-Spec voxel, see parameter `p08620` for details.

P18620 : p1 parameter at 862.0 nm (float, Length & Distance[nm])

Central wavelength (p1 parameter) of the DIB at 862.0 nm in each DIB-Spec voxel, see parameter `p08620` for details.

P18620_LOWER : Lower confidence level (16%) of p1 parameter at 862.0 nm (float, Length & Distance[nm])

Lower confidence level (16%) of the p1 parameter (central wavelength) of the DIB at 862.0 nm in each DIB-Spec voxel, see parameter `p08620` for details.

P18620_UPPER : Upper confidence level (84%) of p1 parameter at 862.0 nm (float, Length & Distance[nm])

Upper confidence level (84%) of the p1 parameter (central wavelength) of the DIB at 862.0 nm in each DIB-Spec voxel, see parameter `p08620` for details.

P28620 : p2 parameter at 862.0 nm (float, Length & Distance[nm])

Width (p2 parameter) of the DIB at 862.0 nm in each DIB-Spec voxel, see parameter `p08620` for details.

P28620_LOWER : Lower confidence level (16%) of p2 parameter at 862.0 nm (float, Length & Distance[nm])

Lower confidence level (16%) of the p2 parameter (width) of the DIB at 862.0nm in each DIB-Spec voxel, see parameter `p08620` for details.

P28620_UPPER : Upper confidence level (84%) of p2 parameter at 862.0 nm (float, Length & Distance[nm])

Upper confidence level (84%) of the p2 parameter (width) of the DIB at 862.0 nm in each DIB-Spec voxel, see parameter `p08620` for details.

EW8648 : DIB equivalent width at 864.8 nm (float, Length & Distance[nm])

Equivalent width of the DIB at 864.8 nm in each DIB-Spec voxel.

It is defined from a Lorentzian model $f(\lambda, p_0, p_1, p_2) = \frac{-(p_0 p_2^2)}{(\lambda - p_1)^2 + p_2^2}$ where p_0 and p_2 are the depth and width of the DIB profile, p_1 is the central wavelength and λ is the wavelength. The latter is the parameter `lambda` in the interstellar medium spectra table.

EW8648_LOWER : Lower confidence level (16%) of DIB equivalent width at 864.8 nm (float, Length & Distance[nm])

Lower confidence level (16%) of the equivalent width of the DIB at 864.8 nm in each DIB-Spec voxel.

The confidence interval has been evaluated by numerical integration of the spectra, while the ew8648 has been computed by an analytical solution. This inconsistency between the calculation of the EW and their upper and lower levels implies that sometimes `ew8648` < `ew8648_lower` or `ew8648` > `ew8648_upper`, even if the upper and lower values are consistent with each other. We recommend application of the scaling factor of 1.258 to `ew8648_lower` and `ew8648_upper`, see Gaia Collaboration, Schultheis, M., et al. (2023b).

EW8648_UPPER : Upper confidence level (84%) of DIB equivalent width at 864.8 nm (float, Length & Distance[nm])

Upper confidence level (84%) of the equivalent width of the DIB at 864.8 nm in each DIB-Spec voxel.

The confidence interval has been evaluated by numerical integration of the spectra, while the ew8648 has been computed by an analytical solution. This inconsistency between the calculation of the EW and their upper and lower levels implies that sometimes `ew8648` < `ew8648_lower` or `ew8648` > `ew8648_upper`, even if the upper and lower values are consistent with each other. We recommend application of the scaling factor of 1.258 to `ew8648_lower` and `ew8648_upper`, see Gaia Collaboration, Schultheis, M., et al. (2023b).

FLAGS8648 : Quality flag of DIB parameters at 864.8 nm (int)

Quality flag of the DIB parameters at 864.8 nm in each DIB-Spec voxel. 0 is the best value and 5 is the worst. The exact definition of the quality flags can be found in Gaia Collaboration, Schultheis, M., et al. (2023b).

P08648 : p0 parameter at 864.8 nm (float)

Depth (p0 parameter) of the DIB at 864.8 nm in each DIB-Spec voxel, see parameter `ew8648` for details.

P08648_LOWER : Lower confidence level (16%) of p0 parameter at 864.8 nm (float)

Lower confidence level (16%) of the p0 parameter (depth) of the DIB at 864.8 nm in each DIB-Spec voxel, see parameter `ew8648` for details.

P08648_UPPER : Upper confidence level (84%) of p0 parameter at 864.8 nm (float)

Upper confidence level (84%) of the p0 parameter (depth) of the DIB at 864.8 nm in each DIB-Spec voxel, see parameter `ew8648` for details.

P18648 : p1 parameter at 864.8 nm (float, Length & Distance[nm])

Central wavelength (p1 parameter) of the DIB at 864.8 nm in each DIB-Spec voxel, see parameter `ew8648` for details.

P18648_LOWER : Lower confidence level (16%) of p1 parameter at 864.8 nm (float, Length & Distance[nm])

Lower confidence level (16%) of the p1 parameter (central wavelength) of the DIB at 864.8 nm in each DIB-Spec voxel, see parameter `ew8648` for details.

p18648_upper : Upper confidence level (84%) of p1 parameter at 864.8 nm (float, Length & Distance[nm])

Upper confidence level (84%) of the p1 parameter (central wavelength) of the DIB at 864.8 nm in each DIB-Spec voxel, see parameter `ew8648` for details.

p28648 : p2 parameter at 864.8 nm (float, Length & Distance[nm])

Width (p2 parameter) of the DIB at 864.8 nm in each DIB-Spec voxel, see parameter `ew8648` for details.

p28648_lower : Lower confidence level (16%) of p2 parameter at 864.8 nm (float, Length & Distance[nm])

Lower confidence level (16%) of the p2 parameter (width) of the DIB at 864.8 nm in each DIB-Spec voxel, see parameter `ew8648` for details.

p28648_upper : Upper confidence level (84%) of p2 parameter at 864.8 nm (float, Length & Distance[nm])

Upper confidence level (84%) of the p2 parameter (width) of the DIB at 864.8 nm of the DIB-Spec bin, see parameter `ew8648` for details.

dibcont_a0 : Slope a0 of the global continuum fit of the full stacked spectrum (float)

The coefficient a_0 (slope) of the global fit to the continuum of the stacked spectrum. The continuum is defined as $a_0\lambda + a_1$ where λ is the wavelength given in parameter `lambda` in the `interstellar_medium_spectra` table.

dibcont_a0_lower : Lower confidence level (16%) of the slope a0 of the global continuum fit (float)

Lower confidence level (16%) of the `dibcont_a0` parameter in each DIB-Spec voxel, see parameter `dibcont_a0` for details.

dibcont_a0_upper : Upper confidence level (84%) of the slope a0 of the global continuum fit (float)

Upper confidence level (84%) of the `dibcont_a0` parameter in each DIB-Spec voxel, see parameter `dibcont_a0` for details.

dibcont_a1 : Intercept a1 of the global continuum fit of the full stacked spectrum (float)

The coefficient a_1 (intercept) of the global fit to the continuum of the stacked spectrum, see parameter `dibcont_a0` for details.

2.1.3 INTERSTELLAR_MEDIUM_SPECTRA

Table of the stacked Interstellar Medium Spectra

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that were used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

HEALPIX : The HEALPix Identification (int)

The pixel number determined by a level 5 HEALPix scheme, which is one of the two identifiers of the DIB-Spec bin voxel. Each voxel is defined by a HEALPix number (level 5) made in the equatorial system and the central heliocentric distance (dc).

LC : Central galactic longitude of voxel (float, Angle[deg])

Galactic longitude of the centre of the DIB-Spec voxel.

BC : Central galactic latitude of voxel (float, Angle[deg])

Galactic latitude of the centre of the DIB-Spec voxel.

DC : Central heliocentric distance of voxel (float, Length & Distance[kpc])

Heliocentric distance of the centre of the DIB-Spec voxel. The distance is defined as the inverse of parallax.

LAMBDA : Wavelength (float, Length & Distance[Å])

Wavelength of the interstellar medium stacked spectrum.

FLUX : Normalised flux (float)

Median value of the normalised flux of the interstellar medium stacked spectrum corresponding to wavelength `lambda`.

FLUX_UNCERTAINTY : Uncertainty in the flux parameter (float)

Uncertainty value of the parameter `flux`. It is defined as the mean value of the flux errors on the individual spectra used to construct the stacked spectrum, divided by the square root of the number of spectra.

2.1.4 LENS_CANDIDATES

This table contains the sources identified as possible gravitational lens candidates based on an analysis of the observations in the neighbourhood of a list of sources selected from a compilation of quasar candidates. Information about the catalogues from which these quasars proceed is given in the table of lens catalogue names.

For each `source_id`, a list of components found around that source is tabulated, together with some information about their position and flux as derived from the cluster of observations associated with each of them. These individual observations are provided in `lens_observations`.

A separate table `lens_outliers` compiles all those observations that could not be associated with a component around a given `source_id`, and that have therefore been discarded from the analysis.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that were used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (long)

A unique single numerical identifier of the related quasar whose neighbourhood has been analysed. The `source_id` is obtained from the Gaia DR3 main source catalogue (for a detailed description see `gaiadr3.gaia_source.source_id`).

NAME : The name of the gravitational lens candidate (string)

The gravitational lens candidate name, in the form DR3Gaiahhmmss.sss+/-ddmmss.ss, where hhmmss.sss and ddmmss.ss are the right ascension and declination respectively.

FLAG : GravLens flag (byte)

This flag provides information about the processing or scientific quality of the results of the GravLens chain for the source of interest. The flag checks two conditions:

1. Whether the magnitude difference between the brightest and the faintest component of the system is larger than 5 mag.
2. Whether the number of outlier observations (tabulated in `lens_outlier`) is larger than the number of valid observations (tabulated in `lens_observation`).

The flag then is coded in the following way:

- 0 when none of the conditions above are met.
- 1 when the first condition is met but not the second.
- 10 when the second condition is met but not the first.
- 11 when both conditions are met.

N_COMPONENTS : Number of components (int)

Number of components around the `source_id` obtained from the clustering algorithm applied in a fixed radius.

COMPONENT_ID : Index of the component for this source_id (int)

An index used to identify the various components found around this source_id. This number varies between 1 and `n_components`.

N_OBS_COMPONENT : Number of valid observations used for this component (short)

Number of valid observations used for this `component_id`.

COMPONENT_FLAG : Component object flag (byte)

This flag provides information about the processing or scientific quality of the results of the GravLens chain on the component level. The flag checks two conditions:

1. Whether `ra_std_component` > 100 mas or `dec_std_component` > 100 mas.
2. Whether `g_mag_std_component` > 0.4 mag.

The flag then is coded in the following way:

- 0 when none of the conditions above are met.
- 1 when the first condition is met but not the second.
- 10 when the second condition is met but not the first.
- 11 when both conditions are met.

RA_COMPONENT : Mean right ascension of the component (double, Angle[deg])

The mean right ascension of the cluster of observations associated with this component within a fixed radius. The individual right ascensions as decoded from the transit_ids are stored in `lens_observations`.

RA_STD_COMPONENT : Standard deviation of the right ascension of the component (float, Angle[mas])

The standard deviation of right ascension measurements (multiplied by cos (`dec_std_component`)) for the cluster of observations associated with this component within a fixed radius. The individual right ascensions as decoded from the transit_ids are stored in `lens_observations`.

DEC_COMPONENT : Mean declination of the clusters of measurements (double, Angle[deg])

The mean declination of the cluster of observations associated with this component within a fixed radius. The individual declinations as decoded from the transit_ids are stored in `lens_observations`.

DEC_STD_COMPONENT : Standard deviation of the declination measurements (float, Angle[mas])

The standard deviation of declination measurements for the cluster of observations associated with this component within a fixed radius. The individual declinations as decoded from the transit identifiers are stored in `lens_observations`.

G_FLUX_COMPONENT : Mean G flux of the component (double, Flux[e^{-} s^{-1}])

Mean G-band flux value for all observations belonging to this component. Note that this value may be missing in some cases.

G_FLUX_COMPONENT_ERROR : Uncertainty of the mean flux value for this component (float, Flux[e^{-} s^{-1}])

Uncertainty of the mean G-band flux value for this component. Note that this value may be missing in some cases.

G_MAG_COMPONENT : Mean onboard G magnitude of the component (float, Magnitude[mag])

Mean VPU onboard G-band magnitude for the observations belonging to this component.

G_MAG_STD_COMPONENT : Standard deviation of the onboard G magnitude of the component (float, Magnitude[mag])

Standard deviation of the VPU onboard G-band magnitudes for the observations belonging to this component.

2.1.5 LENS_CATALOGUE_NAME

This table provides the list of input catalogues that have been used to select any given source that was analysed by the Gravitational Lens module and published in the lens candidate table.

Each source may have been cross-matched to more than one catalogue and therefore can have several entries in the table.

For the FPR, the catalogues considered for this selection are mostly external, although sources identified by DPAC based on the classification performed by other processing have also been included here.

Each catalogue is assigned a `catalogue_id`. For the FPR the following applies:

- 1: Ducourant+2022 Ducourant et al. (2023)
- 2: Gravitational Lens data base (Ducourant+2023): Ducourant (2023)
- 3: Gravitational Lens candidates (Krone-Martins+2023): Gaia Collaboration, Krone-Martins, A., et al. (2024)
- 4: Milliquas 7.5b Flesch (2021)
- 5: Milliquas 7.5 Flesch (2021)
- 6: Milliquas 7.4d Flesch (2021)
- 7: Milliquas 7.4c Flesch (2021)
- 8: Milliquas 7.1b Flesch (2019)
- 9: Milliquas 7.0 Flesch (2019)
- 10: Milliquas 6.4 Flesch (2019)
- 11: Assef R90 Assef et al. (2018)
- 12: Shu+2019 Shu et al. (2019)
- 13: Assef C75 Assef et al. (2018)
- 14: Sergei Klioner, private communication, 2022.

Further details on these catalogues are given in Ducourant+2023.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that were used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (unique within a particular Data Release) (long)

A unique single numerical identifier of the source obtained from the Gaia DR3 main source catalogue (for a detailed description see `gaiadr3.gaia_source.source_id`).

CATALOGUE_ID : The unique identifier for the catalogue(s) used to select the sources in the gravitational lenses analysis (byte)

Each catalogue used to select the sources analysed by the gravitational lens module is assigned a unique ID. The corresponding catalogues are listed in the description of the `lens_catalogue_name` table, and further details are given in the FPR documentation.

2.1.6 LENS_OBSERVATION

This table contains the observations associated with the components found in the lens candidates table.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that were used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (long)

A unique single numerical identifier of the source obtained from the Gaia DR3 main source catalogue (for a detailed description see `gaiadr3.gaia_source.source_id`).

COMPONENT_ID : Index of the component for this source_id (int)

An index used to identify the various components found around this source_id. This number varies between 1 and `lens_candidates.n_components`.

OBSERVATION_ID : Counter for the observations of each component (int)

A sequential counter that uniquely identifies the observations belonging to a given component.

RA_OBS : Right ascension of each individual observation belonging to this component, as decoded from the transit_id (double, Angle[deg])

Right ascension of each individual observation belonging to this component, as decoded from the `transit_id`.

DEC_OBS : Declination of each individual observation belonging to this component, as decoded from the transit_id (double, Angle[deg])

Declination of each individual observation belonging to this component, as decoded from the `transit_id`.

G_FLUX_OBS : Flux value of each individual observation belonging to this component (double, Flux[e^{-} s^{-1}])

Flux value of each individual observation belonging to this component. Note that this value may be missing in some cases.

G_FLUX_OBS_ERROR : Flux error value of each individual observation belonging to this component (float, Flux[e^{-} s^{-1}])

Flux error value of each individual observation belonging to this component. Note that this value may be missing in some cases.

G_MAG_OBS : Onboard G magnitudes of each individual observation belonging to this component (float, Magnitude[mag])

Onboard G-band magnitude of each individual observation belonging to this component.

EPOCH_OBS : Epoch of the individual observation belonging to this component (double, Time[Barycentric JD in TCB − 2 455 197.5 (day)])

Epoch of the individual observation belonging to this component, given as Julian Days in TCB at the Barycentre, minus 2 455 197.5 days.

2.1.7 LENS_OUTLIER

This table contains the individual observations that have been discarded from the analysis of the gravitational lenses around the list of source_ids tabulated in the lens candidate table. These are observations that could not be associated with any of the components assigned to the source of interest.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that were used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (long)

A unique single numerical identifier of the source obtained from the Gaia DR3 main source catalogue (for a detailed description see `gaiadr3.gaia_source.source_id`).

OUTLIER_ID : Counter for the outliers of each component (int)

A sequential counter that uniquely identifies the outliers belonging to a given component.

RA_OBS : Right ascension of each individual outlier observation (double, Angle[deg])

Right ascension of each individual outlier observation, as decoded from the `transit_id`.

DEC_OBS : Declination of each individual outlier observation (double, Angle[deg])

Declination of each individual outlier observation, as decoded from the `transit_id`.

G_FLUX_OBS : Flux value of each individual outlier observation (double, Flux[e^{-} s^{-1}])

G-band flux value of each individual outlier observation. Note that this value may be missing in some cases.

G_FLUX_OBS_ERROR : Flux error value of each individual outlier observation (float, Flux[e^{-} s^{-1}])

G-band flux error value of each individual outlier observation. Note that this value may be missing in some cases.

G_MAG_OBS : Onboard G magnitudes of each individual outlier observation (float, Magnitude[mag])

Onboard G-band magnitude of each individual outlier observation.

EPOCH_OBS : Epoch of the individual outlier observation (double, Time[Barycentric JD in TCB − 2 455 197.5 (day)])

Epoch of the individual outlier observation, given as Julian Days in TCB at the Barycentre, minus 2 455 197.5 days.

2.1.8 SSO_OBSERVATION

Solar System object observations. Each table line contains data obtained during the transit of the source on a single CCD, during a single transit. The corresponding epoch is provided. Data not varying within the transit are repeated identically for all single observations of that transit.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that were used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Source identifier (long)

A unique single numerical identifier of the source obtained from the Gaia DR3 main source catalogue (for a detailed description see `gaiadr3.gaia_source.source_id`). Note in particular that these identifiers are by convention negative for SSOs.

DENOMINATION : standard MPC denomination of the asteroid (string)

Name of the object. It follows the Minor Planet Centre convention for the minor planets and natural satellites of the planets.

TRANSIT_ID : Transit Identifier (long)

The `transit_id` is a unique identifier assigned to each detected (and confirmed) source as it transits the Gaia focal plane. Each time a given source is detected as Gaia scans and re-scans the sky a new `transit_id` will be created to badge that apparition. Hence the along–scan time and the across–scan position along with the telescope in which the source was detected are used to form a unique integer with which to label the transit.

The several features of a detection that are encoded in `transit_id` can be easily retrieved using bit masks (&) and shifts (>>) as follows:

- On-Board Mission Time line [ns]
  = 204800 * ((`transit_id` >> 17) & (0x000003FFFFFFFFFF))
- Field-of-view = 1 + (`transit_id` >> 15) & 0x03 [1 for ‘preceding’ and 2 for ‘following’ fields-of-view respectively]
- CCD row = (`transit_id` >> 12) & 0x07 [dimensionless, in the range 1 to 7]
- Across-scan ‘reference acquisition pixel’ in strip AF1 = (`transit_id`) & 0x0FFF [pixels] (this is the across-scan centre of the AF1 window and is odd if immediately below the mid-point of the window and even if immediately above)

where the bit mask prefix ‘0x’ denotes hexadecimal.

For further details see Portell et al. (2020). For convenience a decoder for `transit_id` is available on-line at

`https://gaia.esac.esa.int/decoder/transitidDecoder.jsp`

OBSERVATION_ID : Observation Identifier (long)

Identifier at single CCD level of the observation of a Solar System object. It is unique, and obtained from a combination of `transit_id` and an integer number representing the CCD strip: `observation_id` = `transit_id` x 10 + AF CCD number.

NUMBER_MP : Minor Planet number (long)

Minor planet number attributed by the Minor Planet Centre (MPC). It is set to zero for the natural planetary satellites.

EPOCH : Gaia-Centric epoch TCB(Gaia) (double, Time[Gaia-Centric JD in TCB − 2 455 197.5 (day)])

Gaia-Centric epoch TCB(Gaia) in JD corresponding to the time of crossing of the fiducial line of the CCD (mid exposure). This is the epoch to which the target coordinates and the position/velocity of Gaia are referred. To avoid loss of precision the reference time J2010.0 has been subtracted.

EPOCH_ERR : Error in Gaia-Centric epoch (double, Time[day])

The error in the Gaia-Centric epoch (for both `epoch` and `epoch_utc`).

EPOCH_UTC : Gaia-Centric TCB epoch converted to UTC (double, Time[Gaia-Centric JD in UTC − 2 455 197.5 (day)])

Gaia-Centric epoch in UTC in JD-J2010.0 corresponding to right ascension and declination obtained from the conversion of TCB(Gaia) to UTC.

RA : Right ascension of the source (double, Angle[deg])

ICRS right ascension of the source as observed by Gaia at `epoch`, corrected for full relativistic aberration but not for relativistic light deflection in the gravitational field of the Solar System.

DEC : Declination of the source (double, Angle[deg])

ICRS declination of the source as observed by Gaia at `epoch`, corrected for full relativistic aberration but not for relativistic light deflection in the gravitational field of the Solar System.

RA_ERROR_SYSTEMATIC : Standard error of right ascension, systematic (double, Angle[mas])

Uncertainty on right ascension, systematic component (assumed to be constant during a transit), multiplied by cos of declination.

DEC_ERROR_SYSTEMATIC : Standard error of declination, systematic (double, Angle[mas])

Standard error for declination, systematic component (assumed to be constant during a transit).

RA_DEC_CORRELATION_SYSTEMATIC : Correlation of ra and dec errors, systematic (double)

Correlation of `ra_error_systematic` and `dec_error_systematic`.

RA_ERROR_RANDOM : Standard error of right ascension, random (double, Angle[mas])

Uncertainty on right ascension, random component, multiplied by cos of declination.

DEC_ERROR_RANDOM : Standard error of declination, random (double, Angle[mas])

Standard error for declination, random component.

RA_DEC_CORRELATION_RANDOM : Correlation of ra and dec errors, random (double)

Correlation of ra and dec uncertainty, random component.

X_GAIA : Barycentric x position of Gaia (double, Length & Distance[AU])

Barycentric equatorial J2000 (ICRS) x position of Gaia at the epoch of the observation.

Y_GAIA : Barycentric y position of Gaia (double, Length & Distance[AU])

Barycentric equatorial J2000 y position (ICRS) of Gaia at the epoch of the observation.

Z_GAIA : Barycentric z position of Gaia (double, Length & Distance[AU])

Barycentric equatorial J2000 z position (ICRS) of Gaia at the epoch of observation.

VX_GAIA : Barycentric x velocity of Gaia (double, Velocity[AU day^{-1}])

Barycentric equatorial J2000 (ICRS) x velocity of Gaia at the epoch of the observation.

VY_GAIA : Barycentric y velocity of Gaia (double, Velocity[AU day^{-1}])

Barycentric equatorial J2000 (ICRS) y velocity of Gaia at the epoch of observation.

VZ_GAIA : Barycentric z velocity of Gaia (double, Velocity[AU day^{-1}])

Barycentric equatorial J2000 (ICRS) z velocity of Gaia at the epoch of observation.

X_GAIA_GEOCENTRIC : Geocentric x position of Gaia (double, Length & Distance[AU])

Geocentric equatorial J2000 x position of Gaia at the epoch of observation, in a reference aligned to ICRS.

Y_GAIA_GEOCENTRIC : Geocentric y position of Gaia (double, Length & Distance[AU])

Geocentric equatorial J2000 y position of Gaia at the epoch of observation in a reference aligned to ICRS.

Z_GAIA_GEOCENTRIC : Geocentric z position of Gaia (double, Length & Distance[AU])

Geocentric equatorial J2000 z position of Gaia at the epoch of observation in a reference aligned to ICRS.

VX_GAIA_GEOCENTRIC : Geocentric x velocity of Gaia (double, Velocity[AU day^{-1}])

Geocentric equatorial J2000 x velocity of Gaia at the epoch of observation in a reference aligned to ICRS.

VY_GAIA_GEOCENTRIC : Geocentric y velocity of Gaia (double, Velocity[AU day^{-1}])

Geocentric equatorial J2000 y velocity of Gaia at the epoch of observation in a reference aligned to ICRS.

VZ_GAIA_GEOCENTRIC : Geocentric z velocity of Gaia (double, Velocity[AU day^{-1}])

Geocentric equatorial J2000 z velocity of Gaia at the epoch of observation in a reference aligned to ICRS.

POSITION_ANGLE_SCAN : Position angle of the scanning direction (double, Angle[deg])

Position angle of the scan direction at the epoch of observation in the equatorial reference frame. 0 = North direction, $\pi/2$ = increasing right ascension, pi = South, $3\pi/2$ = decreasing right ascension. It is defined as the angle between the AL direction and the direction to the North Pole, at the SSO position, after applying the correction for aberration. As a consequence of this correction for aberration, the AC direction is not strictly perpendicular to the AL direction.

ASTROMETRIC_OUTCOME_CCD : Result of processing the CCDs (int)

Result of the astrometric processing of the individual CCDs in the transit. Values presently defined:

1 Good position derived.

11 No position derived, because no centroid could be determined.

12 Position rejected a priori, because previous studies have shown that it is unreliable.

24 Position rejected, because this CCD has some samples that have been eliminated.

25 Position rejected, because this CCD is affected by an AOCS update.

26 Position rejected, because this CCD is affected by a non-nominal gating.

29 Position rejected, because of more than one reason, combination of codes 21–26.

32 Position rejected as outlier, because this position does not fit on the regression line.

35 Position rejected, because it does not fulfill the magnitude-uncertainty relation, see documentation.

39 Position rejected, because the value of the distance to last charge injection event recorded for the relevant CCD is invalid.

40 Position rejected, because the epoch corresponds to known bad attitude, see documentation.

41 Position rejected, because no attitude or no calibration is available for the epoch of observation.

ASTROMETRIC_OUTCOME_TRANSIT : Result of processing the transit (int)

Result of the astrometric processing of the transit. Values defined at present are:

1 The transit contains at least one good position.

2 Positions derived, but less consistent than expected. This means that the criterion to reject outliers had to be relaxed to find an unambiguous set of consistent positions.

5 Positions derived, but outlier rejection was not possible because of dramatic loss of precision.

6 Positions derived, but no future field angles in RP/BP, because no attitude is available for the future epochs (reference epoch + 45, 50 and 55 seconds).

FOV : Field of view (byte)

Field of view (0 = preceding, 1 = following)

IS_REJECTED : Flag indicating if rejected by the orbital fit (boolean)

This flag indicates if the observation was considered as an outlier by the orbital fit. This happens if the post–fit residuals are above a given threshold (provided in the DR3 documentation), in which case the flag is set to `true`.

2.1.9 SSO_SOURCE

This table contains data related to Solar System objects observed by Gaia. The quantities in the table are derived from data reduction and are associated with single objects.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that were used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Source identifier (long)

A unique single numerical identifier of the source obtained from the Gaia DR3 main source catalogue (for a detailed description see `gaiadr3.gaia_source.source_id`). Note in particular that these identifiers are by convention negative for SSOs.

NUM_OF_OBS : number of observations (int)

Number of CCD-level observations of the asteroid that appear in the `sso_observation` table.

NUMBER_MP : Minor Planet number (long)

Minor planet number attributed by the Minor Planet Centre (MPC). It is set to zero for the natural planetary satellites.

DENOMINATION : standard MPC denomination of the asteroid (string)

Name of the object. It follows the Minor Planet Centre convention for the minor planetsand natural planetary satellites.

EPOCH_STATE_VECTOR : TCB epoch for the state vector (double, Time[Gaia-Centric JD in TCB − 2 455 197.5 (day)])

Reference epoch of the state vector defined at the mid-point of the time interval spanned by the observations of the Solar System Object (TCB). It is expressed in days, with origin at the epoch JD 2 455 197.5 TCB (0h on January 1 2010).

ORBITAL_ELEMENTS_VAR_COVAR_MATRIX : var-covar matrix on elliptical elements at reference Epoch (double[21] array)

Covariance uncertainty matrix of the osculating orbit at reference epoch (`epoch_state_vector`) (heliocentric). In the order, the values correspond to the following elements of the matrix, representing the upper triangle (indices are given):

- 00 = variance(a)
- 01 = co-variance(a, e)
- 02 = co-variance(a, i)
- 03 = co-variance(a, node)
- 04 = co-variance(a, peri)
- 05 = co-variance(a, M0)
- 11 = variance(e)
- 12 = co-variance(e, i)
- 13 = co-variance(e, node)
- 14 = co-variance(e, peri)
- 15 = co-variance(e, M0)
- 22 = variance(i)
- 23 = co-variance(i, node)
- 24 = co-variance(i, peri)
- 25 = co-variance(i, M0)
- 33 = variance(node)
- 34 = co-variance(node, peri)
- 35 = co-variance(node, M0)
- 44 = variance(peri)
- 45 = co-variance(peri, M0)
- 55 = variance(M0)

where the abbreviations and their units are:

- a (au); semi-major axis
- e (adimesional); eccentricity
- i (rad); inclination
- node (rad); longitude of the ascending node
- peri (rad); argument of periastron
- M0 (rad); mean anomaly

H_STATE_VECTOR : Heliocentric State Vector at reference Epoch (double[6] array, StateVector[au, au d^{-1}])

Initial conditions position and velocity (state vector) in cartesian coordinates at reference epoch (`epoch_state_vector`) (heliocentric, ICRF). Units are au for positions, and au/day for velocities.

H_STATE_VECTOR_VAR_COVAR_MATRIX : Covariance matrix of the State Vector (double[21] array)

Covariance uncertainty matrix of the state vector (`h_state_vector`) at reference epoch (`epoch_state_vector`; heliocentric, in the ICRF).

2.1.10 VARI_EPOCH_RADIAL_VELOCITY

This table contains the epoch radial velocity data points for a sub-set of variable stars. Each entry is a radial velocity in the solar barycentric reference frame for a given object and observation time.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that were used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (unique within a particular Data Release) (long)

A unique single numerical identifier of the source obtained from the Gaia DR3 main source catalogue (for a detailed description see `gaiadr3.gaia_source.source_id`).

TRANSIT_ID : Transit unique identifier (long)

The `transit_id` is a unique identifier assigned to each detected (and confirmed) source as it transits the Gaia focal plane. Each time a given source is detected as Gaia scans and re-scans the sky a new `transit_id` will be created to badge that apparition. Hence the along–scan time and the across–scan position along with the telescope in which the source was detected are used to form a unique integer with which to label the transit.

The several features of a detection that are encoded in `transit_id` can be easily retrieved using bit masks (&) and shifts (>>) as follows:

- On-Board Mission Time line [ns]
  = 204800 * ((`transit_id` >> 17) & (0x000003FFFFFFFFFF))
- Field-of-view = 1 + (`transit_id` >> 15) & 0x03 [1 for ‘preceding’ and 2 for ‘following’ fields-of-view respectively]
- CCD row = (`transit_id` >> 12) & 0x07 [dimensionless, in the range 1 to 7]
- Across-scan ‘reference acquisition pixel’ in strip AF1 = (`transit_id`) & 0x0FFF [pixels] (this is the across-scan centre of the AF1 window and is odd if immediately below the mid-point of the window and even if immediately above)

where the bit mask prefix ‘0x’ denotes hexadecimal.

For further details see Portell et al. (2020). For convenience a decoder for `transit_id` is available on-line at

`https://gaia.esac.esa.int/decoder/transitidDecoder.jsp`

RV_OBS_TIME : Observing time of the transit (double, Time[Barycentric JD in TCB − 2 455 197.5 (day)])

Observation time of the radial velocity in the solar barycentric reference frame. It corresponds to the mean of the observation times of the three CCDs used to collect spectra in the RVS during that transit.

RADIAL_VELOCITY : Barycentric radial velocity (double, Velocity[km s^{-1}])

Radial velocity in the solar barycentric frame for the transit of interest.

RADIAL_VELOCITY_ERROR : Barycentric radial velocity error (double, Velocity[km s^{-1}])

Error on the radial velocity for the transit of interest.

REJECTED_BY_VARIABILITY : Rejected by DPAC variability processing (or variability analysis) (boolean)

Indicates whether the radial velocity at this transit was rejected by the DPAC variability processing (or variability analysis)

2.1.11 VARI_LONG_PERIOD_VARIABLE

This table describes the Long Period Variable stars.

Some entries can be NaN when absent.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that were used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (long)

A unique single numerical identifier of the source obtained from the Gaia DR3 main source catalogue (for a detailed description see `gaiadr3.gaia_source.source_id`).

FREQUENCY : Frequency from G FoV time series (double, Frequency[day^{-1}])

Frequency found for the Long-Period Variable star from the cleaned G FoV time series.

FREQUENCY_ERROR : Uncertainty on the frequency from G FoV time series (float, Frequency[day^{-1}])

Uncertainty on the frequency found for the Long-Period Variable star from the cleaned G FoV time series.

AMPLITUDE : Variability amplitude based on the best-fit model to the G FoV time series (float, Magnitude[mag])

Half peak-to-peak variability amplitude of the fundamental component of the best-fit Fourier series model (up to three harmonics) to the cleaned G FoV time series of the Long-Period Variable using the published frequency.

MEDIAN_DELTA_WL_RP : Median of the pseudo-wavelength separations between the two highest peaks in RP spectra (float)

Median among all $G_{\rm RP}$ epoch spectra of the pseudo-wavelength separations between the two highest peaks in the $G_{\rm RP}$ spectra. It is set to Null when the spectrum does not allow an automatic identification of two maxima. This value is used in the definition of the `is_cstar` parameter.

IS_CSTAR : Flag to mark C-stars (Boolean)

The parameter `is_cstar` is set to TRUE if a star has been identified as a C-star based on the value of the `median_delta_wl_rp` parameter derived from the $G_{\rm RP}$ spectrum shape. It is set to FALSE if it is an O-rich star. It is set to NULL when the shape of the spectrum cannot allow an automatic classification between these two types of LPVs. A note on S-type stars: the method cannot classify correctly the nature of these stars. As a consequence, they may have the `is_cstar` flag set to either TRUE or FALSE.

FREQUENCY_RV : Frequency from radial velocity time series (double, Frequency[day^{-1}])

Frequency found for the Long-Period Variable star from the cleaned radial velocity time series.

FREQUENCY_RV_ERROR : Uncertainty on the frequency from radial velocity time series (float, Frequency[day^{-1}])

Uncertainty on the frequency found for the Long-Period Variable star from the cleaned radial velocity time series.

AMPLITUDE_RV : Variability amplitude based on the best-fit model to the radial velocity time series (float, Velocity[km s^{-1}])

Half peak-to-peak variability amplitude of the fundamental component of the best-fit Fourier series model (up to three harmonics) to the cleaned radial velocity time series of the Long-Period Variable using the published frequency.

FLAG_RV : Flag identifying a top-quality subsample (Boolean)

Flag indicating that the period derived from the cleaned radial velocity time series is compatible with the periods from the cleaned G FoV, G_{BP}, and G_{RP} photometric time series.

2.1.12 VARI_RAD_VEL_STATISTICS

Statistical parameters of radial velocity time series using only transits retained and not rejected (see the relevant rejection flag in the epoch radial velocity variability table).

Note that NaN will be reported when the parameter value is missing or cannot be calculated.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that were used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (long)

A unique single numerical identifier of the source obtained from the Gaia DR3 main source catalogue (for a detailed description see `gaiadr3.gaia_source.source_id`).

NUM_SELECTED_RV : Total number of radial velocity transits selected for variability analysis (short)

The number of processed observations for variability analyses of this source, using only transits not rejected, see `rejected_by_variability` column in `vari_epoch_radial_velocity`.

MEAN_OBS_TIME_RV : Mean observation time for radial velocity transits (double, Time[Barycentric JD in TCB − 2 455 197.5 (day)])

Name: The mean observation time

Output: Let y_i be a time series of size N at times t_i. The mean $\bar{t}$ is defined as

$$\bar{t} = \frac{1}{N}\sum_{i=1}^{N} t_i.$$

TIME_DURATION_RV : Time duration of the time series for radial velocity transits (float, Time[day])

Name: The time duration of the time series

Output: Let y_i be a time series of size N at times t_i, with $i = 1$ to N. The time duration of the time series is equal to $t_N - t_1$.

MIN_RV : Minimum radial velocity (float, Velocity[km s^{-1}])

Name: The minimum value of the time series

Output: Let y_i be a time series of size N at times t_i, with $i = 1$ to N. The minimum value of the time series is defined as:

$$min(y_i)\ \forall i \in (1, N)$$

MAX_RV : Maximum radial velocity (float, Velocity[km s^{-1}])

Name: The maximum value of the time series

Output: Let y_i be a time series of size N at times t_i, with $i = 1$ to N. The maximum value of the time series is defined as:

$$max(y_i)\ \forall i \in (1, N)$$

MEAN_RV : Mean radial velocity (float, Velocity[km s^{-1}])

Name: The mean of the time series

Output: Let y_i be a time series of size N. The mean $\overline{y}$ is defined as

$$\overline{y} = \frac{1}{N} \sum_{i=1}^{N} y_i.$$

MEDIAN_RV : Median radial velocity (float, Velocity[km s^{-1}])

Name: The median of the time series

Output: The 50th percentile unweighted value.

Let y_i be a time series of size N ordered such as $y_{(1)} \leq y_{(2)} \leq \cdots \leq y_{(N)}$. The m-th (per cent) percentile P_m is defined for $0 < m \leq 100$ as follows:

$$P_m = \begin{cases} y_{(1)} & \text{if } 0 < m < 100/N, \\ y_{(i)} & \text{if } Nm/100 - i = 0, \\ y_{(i+1)} & \text{otherwise.} \end{cases}$$

RANGE_RV : Difference between the highest and lowest radial velocity transits (float, Velocity[km s^{-1}])

Name: The range of the time series

Output: Let y_i be a time series, $y_{\max}$ its largest element, and $y_{\min}$ its smallest element, then the range is defined as

$$R = y_{\max} - y_{\min}$$

STD_DEV_RV : Square root of the unweighted radial velocity variance (float, Velocity[km s^{-1}])

Name: The square root of the unbiased unweighted variance.

Output: Let y_i be a time series of size N. The unweighted standard deviation $\hat{\sigma}$ is defined as the square root of the sample-size unbiased unweighted variance:

$$\hat{\sigma} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(y_i - \overline{y})^2}.$$

SKEWNESS_RV : Standardized unweighted radial velocity skewness (float)

Name: The standardised unbiased unweighted skewness.

Output: Let y_i be a time series of size $N > 2$. The sample-size unbiased unweighted skewness moment $\mathcal{E}$ is defined as:

$$\mathcal{E} = \frac{N}{(N-1)(N-2)}\sum_{i=1}^{N}(y_i - \overline{y})^3.$$

The standardized unbiased skewness E is defined as:

$$E = \frac{\mathcal{E}}{\hat{\sigma}^3}$$

where $\hat{\sigma}$ is the square root of the unbiased unweighted variance around the unweighted mean. While $\mathcal{E}$ is an unbiased estimate of the population value, E becomes unbiased in the limit of large N.

KURTOSIS_RV : Standardized unweighted radial velocity kurtosis (float)

Name: The standardised unbiased unweighted kurtosis.

Output: Let y_i be a time series of size $N > 3$. The sample-size unbiased unweighted kurtosis cumulant $\mathcal{K}$ is defined as:

$$\mathcal{K} = \frac{N(N+1)}{(N-1)(N-2)(N-3)}\sum_{i=1}^{N}(y_i - \overline{y})^4 - \frac{3}{(N-2)(N-3)}\left[\sum_{i=1}^{N}(y_i - \overline{y})^2\right]^2.$$

The standardized unbiased kurtosis K is defined as:

$$K = \frac{\mathcal{K}}{\hat{\sigma}^4}$$

where $\hat{\sigma}^2$ is the unbiased unweighted variance around the unweighted mean. While $\mathcal{K}$ is an unbiased estimate of the population value, K becomes unbiased in the limit of large N.

MAD_RV : Median Absolute Deviation (MAD) for radial velocity transits (float, Velocity[km s^{-1}])

Name: The Median Absolute Deviation (MAD)

Output: Let y_i be a time series of size N. The MAD is defined as the median of the absolute deviations from the median of the data, scaled by a factor of $1/\Phi^{-1}(3/4) \approx 1.4826$ (where Φ^{-1} is the inverse of the cumulative distribution function for the standard normal distribution), so that the expectation of the scaled MAD at large N equals the standard deviation of a normal distribution:

$$\mathrm{MAD} = 1.4826\ \mathrm{median}\{|y_i - \mathrm{median}\{y_j, \forall j \in (1,N)\}|, \forall i \in (1,N)\}.$$

ABBE_RV : Abbe value for radial velocity transits (float)

Name: The Abbe value

Output: Let $\{t_i, y_i\}$ be a time-sorted time series of size N, such that $t_i < t_{i+1}$ for all $i < N$. The Abbe value $\mathcal{A}$ is defined as

$$\mathcal{A} = \frac{\sum_{i=1}^{N-1}(y_{i+1} - y_i)^2}{2\sum_{i=1}^{N}(y_i - \bar{y})^2}$$

where $\bar{y}$ is the unweighted mean.

IQR_RV : Interquartile range for radial velocity transits (float, Velocity[km s^{-1}])

Name: The Interquartile Range (IQR)

Output: The difference between the (unweighted) 75th and 25th percentile values: IQR= $P_{75} - P_{25}$.

Let y_i be a time series of size N ordered such as $y_{(1)} \leq y_{(2)} \leq \cdots \leq y_{(N)}$. The m-th (per cent) percentile P_m is defined for $0 < m \leq 100$ as follows:

$$P_m = \begin{cases} y_{(1)} & \text{if } 0 < m < 100/N, \\ y_{(i)} & \text{if } Nm/100 - i = 0, \\ y_{(i+1)} & \text{otherwise.} \end{cases}$$

Miscellaneous

Acknowledgements

This work presents results from the European Space Agency (ESA) space mission Gaia. Gaia data are being processed by the Gaia Data Processing and Analysis Consortium (DPAC). Funding for the DPAC is provided by national institutions, in particular the institutions participating in the Gaia MultiLateral Agreement (MLA). The Gaia mission website is `https://www.cosmos.esa.int/gaia`. The Gaia archive website is `https://archives.esac.esa.int/gaia`.

The Gaia mission and data processing have financially been supported by, in alphabetical order by country:

- the Algerian Centre de Recherche en Astronomie, Astrophysique et Géophysique of Bouzareah Observatory;
- the Austrian Fonds zur Förderung der wissenschaftlichen Forschung (FWF) Hertha Firnberg Programme through grants T359, P20046, and P23737;
- the BELgian federal Science Policy Office (BELSPO) through various PROgramme de Développement d'Expériences scientifiques (PRODEX) grants of the European Space Agency (ESA), the Research Foundation Flanders (Fonds Wetenschappelijk Onderzoek) through grant VS.091.16N, the Fonds de la Recherche Scientifique (FNRS), and the Research Council of Katholieke Universiteit (KU) Leuven through grant C16/18/005 (Pushing AsteRoseismology to the next level with TESS, GaiA, and the Sloan DIgital Sky SurvEy – PARADISE);
- the Brazil-France exchange programmes Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) and Coordenação de Aperfeicoamento de Pessoal de Nível Superior (CAPES) - Comité Français d'Evaluation de la Coopération Universitaire et Scientifique avec le Brésil (COFECUB);
- the Chilean Agencia Nacional de Investigación y Desarrollo (ANID) through Fondo Nacional de Desarrollo Científico y Tecnológico (FONDECYT) Regular Project 1210992 (L. Chemin);
- the National Natural Science Foundation of China (NSFC) through grants 11573054, 11703065, and 12173069, the China Scholarship Council through grant 201806040200, and the Natural Science Foundation of Shanghai through grant 21ZR1474100;
- the Tenure Track Pilot Programme of the Croatian Science Foundation and the École Polytechnique Fédérale de Lausanne and the project TTP-2018-07-1171 'Mining the Variable Sky', with the funds of the Croatian-Swiss Research Programme;
- the Czech-Republic Ministry of Education, Youth, and Sports through grant LG 15010 and INTER-EXCELLENCE grant LTAUSA18093, and the Czech Space Office through ESA PECS contract 98058;
- the Danish Ministry of Science;
- the Estonian Ministry of Education and Research through grant IUT40-1;
- the European Commission's Sixth Framework Programme through the European Leadership in Space Astrometry (ELSA) Marie Curie Research Training Network (MRTN-CT-2006-033481), through Marie Curie project PIOF-GA-2009-255267 (Space AsteroSeismology & RR Lyrae stars, SAS-RRL), and through a Marie Curie Transfer-of-Knowledge (ToK) fellowship (MTKD-CT-2004-014188); the European Commission's Seventh Framework Programme through grant FP7-606740 (FP7-SPACE-2013-1) for the Gaia European Network for Improved data User Services (GENIUS) and through grant 264895 for the Gaia Research for European Astronomy Training (GREAT-ITN) network;

- the European Cooperation in Science and Technology (COST) through COST Action CA18104 'Revealing the Milky Way with Gaia (MW-Gaia)';
- the European Research Council (ERC) through grants 320360, 647208, and 834148 and through the European Union's Horizon 2020 research and innovation and excellent science programmes through Marie Skłodowska-Curie grants 687378 (Small Bodies: Near and Far), 682115 (Using the Magellanic Clouds to Understand the Interaction of Galaxies), 695099 (A sub-percent distance scale from binaries and Cepheids – CepBin), 716155 (Structured ACCREtion Disks – SACCRED), 745617 (Our Galaxy at full HD – Gal-HD), 895174 (The build-up and fate of self-gravitating systems in the Universe), 951549 (Sub-percent calibration of the extragalactic distance scale in the era of big surveys – UniverScale), 101004214 (Innovative Scientific Data Exploration and Exploitation Applications for Space Sciences – EXPLORE), 101004719 (OPTICON-RadioNET Pilot), 101055318 (The 3D motion of the Interstellar Medium with ESO and ESA telescopes – ISM-FLOW), and 101063193 (Evolutionary Mechanisms in the Milky waY: the Gaia Data Release 3 revolution – EMMY);
- the European Science Foundation (ESF), in the framework of the Gaia Research for European Astronomy Training Research Network Programme (GREAT-ESF);
- the European Space Agency (ESA) in the framework of the Gaia project, through the Plan for European Cooperating States (PECS) programme through contracts C98090 and 4000106398/12/NL/KML for Hungary, through contract 4000115263/15/NL/IB for Germany, through PROgramme de Développement d'Expériences scientifiques (PRODEX) grants 4000132054 for Hungary and through contract 4000132226/20/ES/CM;
- the Academy of Finland through grants 299543, 307157, 325805, 328654, 336546, and 345115 and the Magnus Ehrnrooth Foundation;
- the French Centre National d'Études Spatiales (CNES), the Agence Nationale de la Recherche (ANR) through grant ANR-10-IDEX-0001-02 for the 'Investissements d'avenir' programme, through grant ANR-15-CE31-0007 for project 'Modelling the Milky Way in the Gaia era' (MOD4Gaia), through grant ANR-14-CE33-0014-01 for project 'The Milky Way disc formation in the Gaia era' (ARCHEOGAL), through grant ANR-15-CE31-0012-01 for project 'Unlocking the potential of Cepheids as primary distance calibrators' (UnlockCepheids), through grant ANR-19-CE31-0017 for project 'Secular evolution of galaxies' (SEGAL), and through grant ANR-18-CE31-0006 for project 'Galactic Dark Matter' (GaDaMa), the Centre National de la Recherche Scientifique (CNRS) and its SNO Gaia of the Institut des Sciences de l'Univers (INSU), its Programmes Nationaux: Cosmologie et Galaxies (PNCG), Gravitation Références Astronomie Métrologie (PNGRAM), Planétologie (PNP), Physique et Chimie du Milieu Interstellaire (PCMI), and Physique Stellaire (PNPS), supported by INSU along with the Institut National de Physique (INP) and the Institut National de Physique nucléaire et de Physique des Particules (IN2P3), and co-funded by CNES; the 'Action Fédératrice Gaia' of the Observatoire de Paris, and the Région de Franche-Comté;
- the German Aerospace Agency (Deutsches Zentrum für Luft- und Raumfahrt e.V., DLR) through grants 50QG0501, 50QG0601, 50QG0602, 50QG0701, 50QG0901, 50QG1001, 50QG1101, 50-QG1401, 50QG1402, 50QG1403, 50QG1404, 50QG1904, 50QG2101, 50QG2102, and 50QG2202, and the Centre for Information Services and High Performance Computing (ZIH) at the Technische Universität Dresden for generous allocations of computer time;
- the Hungarian Academy of Sciences through the János Bolyai Research Scholarship (G. Marton and Z. Nagy), the Lendület Programme grants LP2014-17 and LP2018-7 and the Hungarian National Research, Development, and Innovation Office (NKFIH) through grant KKP-137523 ('SeismoLab');
- the Science Foundation Ireland (SFI) through a Royal Society - SFI University Research Fellowship (M. Fraser);

- the Israel Ministry of Science and Technology through grant 3-18143 and the Israel Science Foundation (ISF) through grant 1404/22;

- the Agenzia Spaziale Italiana (ASI) through contracts I/037/08/0, I/058/10/0, 2014-025-R.0, 2014-025-R.1.2015, and 2018-24-HH.0 and its addendum 2018-24-HH.1-2022 to the Italian Istituto Nazionale di Astrofisica (INAF), contract 2014-049-R.0/1/2, 2022-14-HH.0 to INAF for the Space Science Data Centre (SSDC, formerly known as the ASI Science Data Center, ASDC), contracts I/008/10/0, 2013/030/I.0, 2013-030-I.0.1-2015, and 2016-17-I.0 to the Aerospace Logistics Technology Engineering Company (ALTEC S.p.A.), INAF, and the Italian Ministry of Education, University, and Research (Ministero dell'Istruzione, dell'Università e della Ricerca) through the Premiale project 'MIning The Cosmos Big Data and Innovative Italian Technology for Frontier Astrophysics and Cosmology' (MITiC);

- the Netherlands Organisation for Scientific Research (NWO) through grant NWO-M-614.061.414, through a VICI grant (A. Helmi), and through a Spinoza prize (A. Helmi), and the Netherlands Research School for Astronomy (NOVA);

- the Polish National Science Centre through HARMONIA grant 2018/30/M/ST9/00311 and DAINA grant 2017/27/L/ST9/03221 and the Ministry of Science and Higher Education (MNiSW) through grant DIR/WK/2018/12;

- the Portuguese Fundação para a Ciência e a Tecnologia (FCT) through national funds, grants 2022.06962.PTDC and 2022.03993.PTDC, and work contract DL 57/2016/CP1364/CT0006, grants UIDB/04434/2020 and UIDP/04434/2020 for the Instituto de Astrofísica e Ciências do Espaço (IA), grants UIDB/00408/2020 and UIDP/00408/2020 for LASIGE, and grants UIDB/00099/2020 and UIDP/00099/2020 for the Centro de Astrofísica e Gravitação (CENTRA);

- the Slovenian Research Agency through grant P1-0188;

- the Spanish Ministry of Economy (MINECO/FEDER, UE), the Spanish Ministry of Science and Innovation (MCIN), the Spanish Ministry of Education, Culture, and Sports, and the Spanish Government through grants BES-2016-078499, BES-2017-083126, BES-C-2017-0085, ESP2016-80079-C2-1-R, FPU16/03827, RTI2018-095076-B-C22, PID2021-122842OB-C22, PDC2021-121059-C22, and TIN2015-65316-P ('Computación de Altas Prestaciones VII'), the Juan de la Cierva Incorporación Programme (FJCI-2015-2671 and IJC2019-04862-I for F. Anders), the Severo Ochoa Centre of Excellence Programme (SEV2015-0493) and MCIN/AEI/10.13039/501100011033/ EU FEDER and Next Generation EU/PRTR (PRTR-C17.I1); the European Union through European Regional Development Fund 'A way of making Europe' through grants PID2021-122842OB-C21, PID2021-125451NA-I00, CNS2022-13523 and RTI2018-095076-B-C21, the Institute of Cosmos Sciences University of Barcelona (ICCUB, Unidad de Excelencia 'María de Maeztu') through grant CEX2019-000918-M, the University of Barcelona's official doctoral programme for the development of an R+D+i project through an Ajuts de Personal Investigador en Formació (APIF) grant, the Spanish Virtual Observatory project funded by MCIN/AEI/10.13039/501100011033/ through grant PID2020-112949GB-I00; the Centro de Investigación en Tecnologías de la Información y las Comunicaciones (CITIC), funded by the Xunta de Galicia through the collaboration agreement to reinforce CIGUS research centers, research consolidation grant ED431B 2021/36 and scholarships from Xunta de Galicia and the EU - ESF ED481A-2019/155 and ED481A 2021/296; the Red Española de Supercomputación (RES) computer resources at MareNostrum, the Barcelona Supercomputing Centre - Centro Nacional de Supercomputación (BSC-CNS) through activities AECT-2017-2-0002, AECT-2017-3-0006, AECT-2018-1-0017, AECT-2018-2-0013, AECT-2018-3-0011, AECT-2019-1-0010, AECT-2019-2-0014, AECT-2019-3-0003, AECT-2020-1-0004, and DATA-2020-1-0010, the Departament d'Innovació, Universitats i Empresa de la Generalitat de Catalunya through grant 2014-SGR-1051 for project 'Models de Programació i Entorns d'Execució Parallels' (MPEXPAR), and Ramon y Cajal Fellowships RYC2018-025968-I, RYC2021-031683-I and RYC2021-033762-I, funded by

MICIN/AEI/10.13039/501100011033 and by the European Union NextGenerationEU/PRTR and the European Science Foundation ('Investing in your future'); the Port d'Informació Científica (PIC), maintained through a collaboration between the Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT) and the Institut de Física d'Altes Energies (IFAE), supported by the call for grants for Scientific and Technical Equipment 2021 of the State Program for Knowledge Generation and Scientific and Technological Strengthening of the R+D+i System, financed by MCIN/AEI/ 10.13039/501100011033 and the EU NextGeneration/PRTR (Hadoop Cluster for the comprehensive management of massive scientific data, reference EQC2021-007479-P);

- the Swedish National Space Agency (SNSA/Rymdstyrelsen);
- the Swiss State Secretariat for Education, Research, and Innovation through the Swiss Activités Nationales Complémentaires and the Swiss National Science Foundation through an Eccellenza Professorial Fellowship (award PCEFP2_194638 for R. Anderson);
- the United Kingdom Particle Physics and Astronomy Research Council (PPARC), the United Kingdom Science and Technology Facilities Council (STFC), and the United Kingdom Space Agency (UKSA) through the following grants to the University of Bristol, Brunel University London, the Open University, the University of Cambridge, the University of Edinburgh, the University of Leicester, the Mullard Space Sciences Laboratory of University College London, and the United Kingdom Rutherford Appleton Laboratory (RAL): PP/D006503/1, PP/D006511/1, PP/D006546/1, PP/D006570/1, PP/D006791/1, ST/I000852/1, ST/J005045/1, ST/K00056X/1, ST/K000209/1, ST/K000756/1, ST/K000578/1, ST/L002388/1, ST/L006553/1, ST/L006561/1, ST/N000595/1, ST/N000641/1, ST/N000978/1, ST/N001117/1, ST/S000089/1, ST/S000976/1, ST/S000984/1, ST/S001123/1, ST/S001948/1, ST/S001980/1, ST/S002103/1, ST/V000969/1, ST/W002469/1, ST/W002493/1, ST/W002671/1, ST/W002809/1, EP/V520342/1, ST/X00158X/1, ST/X001601/1, ST/X001636/1, ST/X001687/1, ST/X002667/1, ST/X002683/1 and ST/X002969/1.

The Gaia project and data processing have made use of:

- the Set of Identifications, Measurements, and Bibliography for Astronomical Data (SIMBAD, Wenger et al. 2000), the 'Aladin sky atlas' (Bonnarel et al. 2000; Boch & Fernique 2014), and the VizieR catalogue access tool (Ochsenbein et al. 2000), all operated at the Centre de Données astronomiques de Strasbourg (CDS);
- the National Aeronautics and Space Administration (NASA) Astrophysics Data System (ADS);
- the SPace ENVironment Information System (SPENVIS), initiated by the Space Environment and Effects Section (TEC-EES) of ESA and developed by the Belgian Institute for Space Aeronomy (BIRA-IASB) under ESA contract through ESA's General Support Technologies Programme (GSTP), administered by the BELgian federal Science Policy Office (BELSPO);
- the software products TOPCAT, STIL, and STILTS (Taylor 2005, 2006);
- Matplotlib (Hunter 2007);
- IPython (Pérez & Granger 2007);
- Astropy, a community-developed core Python package for Astronomy (Astropy Collaboration et al. 2018);
- R (R Core Team 2013);
- the HEALPix package (Górski et al. 2005, `http://healpix.sourceforge.net/`);

- Vaex (Breddels & Veljanoski 2018);

- the Hipparcos-2 catalogue (van Leeuwen 2007). The Hipparcos and Tycho catalogues were constructed under the responsibility of large scientific teams collaborating with ESA. The Consortia Leaders were Lennart Lindegren (Lund, Sweden: NDAC) and Jean Kovalevsky (Grasse, France: FAST), together responsible for the Hipparcos Catalogue; Erik Høg (Copenhagen, Denmark: TDAC) responsible for the Tycho Catalogue; and Catherine Turon (Meudon, France: INCA) responsible for the Hipparcos Input Catalogue (HIC);

- the Tycho-2 catalogue (Høg et al. 2000), the construction of which was supported by the Velux Foundation of 1981 and the Danish Space Board;

- the Tycho double star catalogue (TDSC, Fabricius et al. 2002), based on observations made with the ESA Hipparcos astrometry satellite, as supported by the Danish Space Board and the United States Naval Observatory through their double-star programme;

- data products from the Two Micron All Sky Survey (2MASS, Skrutskie et al. 2006), which is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center (IPAC) / California Institute of Technology, funded by the National Aeronautics and Space Administration (NASA) and the National Science Foundation (NSF) of the USA;

- the ninth data release of the AAVSO Photometric All-Sky Survey (APASS, Henden et al. 2016), funded by the Robert Martin Ayers Sciences Fund;

- the first data release of the Pan-STARRS survey (Chambers et al. 2016; Magnier et al. 2020a; Waters et al. 2020; Magnier et al. 2020c,b; Flewelling et al. 2020). The Pan-STARRS1 Surveys (PS1) and the PS1 public science archive have been made possible through contributions by the Institute for Astronomy, the University of Hawaii, the Pan-STARRS Project Office, the Max-Planck Society and its participating institutes, the Max Planck Institute for Astronomy, Heidelberg and the Max Planck Institute for Extraterrestrial Physics, Garching, The Johns Hopkins University, Durham University, the University of Edinburgh, the Queen's University Belfast, the Harvard-Smithsonian Center for Astrophysics, the Las Cumbres Observatory Global Telescope Network Incorporated, the National Central University of Taiwan, the Space Telescope Science Institute, the National Aeronautics and Space Administration (NASA) through grant NNX08AR22G issued through the Planetary Science Division of the NASA Science Mission Directorate, the National Science Foundation through grant AST-1238877, the University of Maryland, Eotvos Lorand University (ELTE), the Los Alamos National Laboratory, and the Gordon and Betty Moore Foundation;

- the second release of the Guide Star Catalogue (GSC2.3, Lasker et al. 2008). The Guide Star Catalogue II is a joint project of the Space Telescope Science Institute (STScI) and the Osservatorio Astrofisico di Torino (OATo). STScI is operated by the Association of Universities for Research in Astronomy (AURA), for the National Aeronautics and Space Administration (NASA) under contract NAS5-26555. OATo is operated by the Italian National Institute for Astrophysics (INAF). Additional support was provided by the European Southern Observatory (ESO), the Space Telescope European Coordinating Facility (STECF), the International GEMINI project, and the European Space Agency (ESA) Astrophysics Division (nowadays SCI-S);

- the eXtended, Large (XL) version of the catalogue of Positions and Proper Motions (PPM-XL, Roeser et al. 2010);

- data products from the Wide-field Infrared Survey Explorer (WISE), which is a joint project of the University of California, Los Angeles, and the Jet Propulsion Laboratory/California Institute of Technology, and NEOWISE, which is a project of the Jet Propulsion Laboratory/California Institute of Technology. WISE and NEOWISE are funded by the National Aeronautics and Space Administration (NASA);

- the first data release of the United States Naval Observatory (USNO) Robotic Astrometric Telescope (URAT-1, Zacharias et al. 2015);
- the fourth data release of the United States Naval Observatory (USNO) CCD Astrograph Catalogue (UCAC-4, Zacharias et al. 2013);
- the sixth and final data release of the Radial Velocity Experiment (RAVE DR6, Steinmetz et al. 2020a,b). Funding for RAVE has been provided by the Leibniz Institute for Astrophysics Potsdam (AIP), the Australian Astronomical Observatory, the Australian National University, the Australian Research Council, the French National Research Agency, the German Research Foundation (SPP 1177 and SFB 881), the European Research Council (ERC-StG 240271 Galactica), the Istituto Nazionale di Astrofisica at Padova, the Johns Hopkins University, the National Science Foundation of the USA (AST-0908326), the W.M. Keck foundation, the Macquarie University, the Netherlands Research School for Astronomy, the Natural Sciences and Engineering Research Council of Canada, the Slovenian Research Agency, the Swiss National Science Foundation, the Science & Technology Facilities Council of the UK, Opticon, Strasbourg Observatory, and the Universities of Basel, Groningen, Heidelberg, and Sydney. The RAVE website is at `https://www.rave-survey.org/`;
- the first data release of the Large sky Area Multi-Object Fibre Spectroscopic Telescope (LAMOST DR1, Luo et al. 2015);
- the K2 Ecliptic Plane Input Catalogue (EPIC, Huber et al. 2016);
- the ninth data release of the Sloan Digitial Sky Survey (SDSS DR9, Ahn et al. 2012). Funding for SDSS-III has been provided by the Alfred P. Sloan Foundation, the Participating Institutions, the National Science Foundation, and the United States Department of Energy Office of Science. The SDSS-III website is `http://www.sdss3.org/`. SDSS-III is managed by the Astrophysical Research Consortium for the Participating Institutions of the SDSS-III Collaboration including the University of Arizona, the Brazilian Participation Group, Brookhaven National Laboratory, Carnegie Mellon University, University of Florida, the French Participation Group, the German Participation Group, Harvard University, the Instituto de Astrofísica de Canarias, the Michigan State/Notre Dame/JINA Participation Group, Johns Hopkins University, Lawrence Berkeley National Laboratory, Max Planck Institute for Astrophysics, Max Planck Institute for Extraterrestrial Physics, New Mexico State University, New York University, Ohio State University, Pennsylvania State University, University of Portsmouth, Princeton University, the Spanish Participation Group, University of Tokyo, University of Utah, Vanderbilt University, University of Virginia, University of Washington, and Yale University;
- the thirteenth release of the Sloan Digital Sky Survey (SDSS DR13, Albareti et al. 2017). Funding for SDSS-IV has been provided by the Alfred P. Sloan Foundation, the United States Department of Energy Office of Science, and the Participating Institutions. SDSS-IV acknowledges support and resources from the Center for High-Performance Computing at the University of Utah. The SDSS web site is `https://www.sdss.org/`. SDSS-IV is managed by the Astrophysical Research Consortium for the Participating Institutions of the SDSS Collaboration including the Brazilian Participation Group, the Carnegie Institution for Science, Carnegie Mellon University, the Chilean Participation Group, the French Participation Group, Harvard-Smithsonian Center for Astrophysics, Instituto de Astrofísica de Canarias, The Johns Hopkins University, Kavli Institute for the Physics and Mathematics of the Universe (IPMU) / University of Tokyo, the Korean Participation Group, Lawrence Berkeley National Laboratory, Leibniz Institut für Astrophysik Potsdam (AIP), Max-Planck-Institut für Astronomie (MPIA Heidelberg), Max-Planck-Institut für Astrophysik (MPA Garching), Max-Planck-Institut für Extraterrestrische Physik (MPE), National Astronomical Observatories of China, New Mexico State University, New York University, University of Notre Dame, Observatário Nacional / MCTI, The Ohio State University, Pennsylvania State University, Shanghai Astronomical Observatory, United Kingdom Participation Group, Universidad Nacional Autónoma

de México, University of Arizona, University of Colorado Boulder, University of Oxford, University of Portsmouth, University of Utah, University of Virginia, University of Washington, University of Wisconsin, Vanderbilt University, and Yale University;

- the second release of the SkyMapper catalogue (SkyMapper DR2, Onken et al. 2019, Digital Object Identifier 10.25914/5ce60d31ce759). The national facility capability for SkyMapper has been funded through grant LE130100104 from the Australian Research Council (ARC) Linkage Infrastructure, Equipment, and Facilities (LIEF) programme, awarded to the University of Sydney, the Australian National University, Swinburne University of Technology, the University of Queensland, the University of Western Australia, the University of Melbourne, Curtin University of Technology, Monash University, and the Australian Astronomical Observatory. SkyMapper is owned and operated by The Australian National University's Research School of Astronomy and Astrophysics. The survey data were processed and provided by the SkyMapper Team at the Australian National University. The SkyMapper node of the All-Sky Virtual Observatory (ASVO) is hosted at the National Computational Infrastructure (NCI). Development and support the SkyMapper node of the ASVO has been funded in part by Astronomy Australia Limited (AAL) and the Australian Government through the Commonwealth's Education Investment Fund (EIF) and National Collaborative Research Infrastructure Strategy (NCRIS), particularly the National eResearch Collaboration Tools and Resources (NeCTAR) and the Australian National Data Service Projects (ANDS);
- the Gaia-ESO Public Spectroscopic Survey (GES, Gilmore et al. 2022; Randich et al. 2022). The Gaia-ESO Survey is based on data products from observations made with ESO Telescopes at the La Silla Paranal Observatory under programme ID 188.B-3002. Public data releases are available through the ESO Science Portal. The project has received funding from the Leverhulme Trust (project RPG-2012-541), the European Research Council (project ERC-2012-AdG 320360-Gaia-ESO-MW), and the Istituto Nazionale di Astrofisica, INAF (2012: CRA 1.05.01.09.16; 2013: CRA 1.05.06.02.07).

The GBOT programme (GBOT) uses observations collected at (i) the European Organisation for Astronomical Research in the Southern Hemisphere (ESO) with the VLT Survey Telescope (VST), under ESO programmes 092.B-0165, 093.B-0236, 094.B-0181, 095.B-0046, 096.B-0162, 097.B-0304, 098.B-0030, 099.B-0034, 0100.B-0131, 0101.B-0156, 0102.B-0174, 0103.B-0165, 0104.B-0081, 0106.20ZA.001 (OmegaCam), 0106.20ZA.002 (FORS2), 0108.21YF; and under INAF programs 110.256C, 112.266Q; and (ii) the Liverpool Telescope, which is operated on the island of La Palma by Liverpool John Moores University in the Spanish Observatorio del Roque de los Muchachos of the Instituto de Astrofísica de Canarias with financial support from the United Kingdom Science and Technology Facilities Council, and (iii) telescopes of the Las Cumbres Observatory Global Telescope Network.

In addition to the currently active DPAC (and ESA science) authors of the peer-reviewed papers accompanying Gaia DR3 and Gaia FPR, there are large numbers of former DPAC members who made significant contributions to the (preparations of the) data processing. Among those are, in alphabetical order: Stephanie Accart, Christopher Agard, Juan José Aguado, Michaël Ajaj, Fernando Aldea-Montero, Alexandra Alecu, Peter Allan, France Allard, Walter Allasia, Carlos Allende Prieto, Javier Álvarez Cid-Fuentes, Marco Antonio Álvarez, Antonio Amorim, Kader Amsif, Alexandre Andrei, Antonino Angi, Guillem Anglada-Escudé, Eduardo Anglada Varela, Erika Antiche, Sonia Antón, Bernardino Arcay, Borja Arroyo Galende, Vladan Arsenijevic, Tri Astraatmadja, Rajesh Kumar Bachchan, Eduardo Balbinot, Adrien Bangma, Carlos Barata, Fabio Barblan, Paul Barklem, Jean-Luc Bassilana, Mickael Batailler, Duncan Bates, Alexandre Baudesson-Stella, Mathias Beck, Luigi Bedin, Dan Beilis, Antonio Bello García, Vasily Belokurov, Philippe Bendjoya, Hans Bernstein†, Olivier Bienaymé, Lionel Bigot, Albert Bijaoui, Louis Bil, Françoise Billebaud, Nadejda Blagorodnova, Sergi Blanco-Cuaresma, Thierry Bloch, Klaas de Boer†, Marco Bonfigli, Giuseppe Bono, Simon Borgniet, Raul Borrachero-Sanchez, François Bouchy, Steve Boudreault, Geraldine Bourda, Guy Boutonnet, Pascal Branet, Maarten Breddels, Scott Brown, Pierre-Marie Brunet, Thomas Brüsemeister, Peter Bunclark†, Roberto Buonanno, Alexandru Burlacu, Robert Bu-

torafuchs, Joan Cambras, Heather Campbell, Christophe Carret, Manuel Carrillo, César Carrión, Andy Casey, Pau Castro Sampol, Francisco Javier Casquero, Laurence Chaoul, Jonathan Charnas, Fabien Chéreau, Maria-Rosa Cioni, Marcial Clotet, Gabriele Cocozza, Gabriele Comoretto, Leonardo Corcione, Gráinne Costigan, Sue Cowell, Françoise Crifo, Alessandro Crisafi, Nick Cross, Jan Cuypers[†], Jean-Charles Damery, Anastasios Dapergolas, Eric Darmigny, Jonas Debosscher, Peter De Cat, Domitilla De Martino, Enrique Del Pozo, Héctor Delgado, David Delhoume, Jean-Baptiste Delisle, Céline Delle Luche, Markus Demleitner, Charles Demouchy, Paola Di Matteo, Carla Domingues, Sandra Dos Anjos, Laurent Douchy, Petros Drazinos, Pierre Dubath, Javier Durán, Yifat Dzigan, Deepak Eappachen, Sebastian Els, Arjen van Elteren, Kjell Eriksson, Carolina von Essen, Wyn Evans, Guillaume Eynard Bontemps, Antonio Falcão, Martí Farràs Casas, Jacopo Federici, Luciana Federici, Fernando de Felice, Agnès Fienga, Krzysztof Findeisen, Christian Fischer, Florin Fodor, Frédéric Franke, Benoit Frezouls, Aidan Fries, Jan Fuchs, Flavio Fusi Pecci, Diego Fustes, Duncan Fyfe, Eva Gallardo, Silvia Galleti, Fernando García, María García-Reinaldos, Daniele Gardiol, Emilien Gaudin, Alvin Gavel, Marwan Gebran, Yoann Gérard, Nathalie Gerbier, Joris Gerssen, Andreja Gomboc, Miguel Gomes, Anita Gómez, Ana González-Marcos, Juan José González-Vidal, Eva Grebel, Michel Grenon, Björn Grieger, Eric Grux, Alain Gueguen, Pierre Guillout, Julie Guiraud, Andrés Gúrpide, Leanne Guy, Jean-Louis Halbwachs, Marcus Hauser, Aurelien Hees, Julien Heu, Albert Heyrovsky, Thomas Hilger, Natalia Hładczuk, Wilfried Hofmann, Erik Høg, David Hogg, Andrew Holland, Greg Holland, Gordon Hopkinson[†], Claude Huc, Jason Hunt, Brigitte Huynh, Arkadiusz Hypki, Giacinto Iannicola, Sergio Ibarmia, Vilma Icardi, Laura Inno, Mike Irwin, Yago Isasi Parache, Javier Izquierdo, Thierry Jacq, Asif Jan, Anne-Marie Janotto, Gérard Jasniewicz, Anne Jean-Antoine Piccolo, Laurent Jean-Rigaud, Isabelle Jégouzo-Giroux, Christian Jezequel, François Jocteur-Monrozier, Paula Jofré, Anthony Jonckheere, Peter Jonker, Áron Juhász, Francesc Julbe, Antonios Karampelas, Lea Karbevska, Ralf Keil, Pierre Kervella, Adam Kewley, Dae-Won Kim, Peter Klagyivik, Jochen Klar, Jonas Klüter, Jens Knude, Angela Kochoska, Oleg Kochukhov, Katrien Kolenberg, Indrek Kolka, Pavel Koubsky, Janez Kos, Irina Kovalenko, Katarzyna Kruszyńska, Maria Kudryashova, Ilya Kull, Alex Kutka, Frédéric Lacoste-Seris, Sylvain Lafosse, Valéry Lainey, Pascal Laizeau, Yannick Lasne, Antoni Latorre, Felix Lauwaert, Claudia Lavalley, Jean-Baptiste Lavigne, David Le Bouquin, Yann Le Fustec, Vassili Lemaitre, Helmut Lenhardt, Christophe Le Poncin-Lafitte, Frédéric Leroux, Thierry Levoir, Chao Liu, Mauro López Del Fresno, Davide Loreggia, Denise Lorenz, Cristina Luengo, Ian MacDonald, Marc Madaule, Pau Madrero Pardo, Tiago Magalhães Fernandes, Arrate Magdaleno Romeo, Kirill Makan, Valeri Makarov, Jean-Christophe Malapert, Sandrine Managau, Hervé Manche, Carmelo Manetta, Gregory Mantelet, José Marcos, Miguel Marcos Santos, Federico Marocco, Gabor Marschalko, Mathieu Marseille, Christophe Martayan, Luis Martín Polo, Óscar Martínez-Rubi, Michele Martino, Paul Marty, Benjamin Massart, Gal Matijevič, Mohamed Meharga, Emmanuel Mercier, Frédéric Meynadier, Anthony Michon, Shan Mignot, Hadi Minbashian, Bruno Miranda, Marco Molinaro, Marc Moniez, Alain Montmory, Angelo Mulone, Ulisse Munari, Daniel Munoz, Jérôme Narbonne, Gijs Nelemans, Anne-Thérèse Nguyen, Luciano Nicastro, Thomas Nordlander, Alexandre Nouvel, Markus Nullmeier, Derek O'Callaghan, Francisco Ocaña, Pierre Ocvirk, Semyeong Oh, Joaquín Ordieres-Meré, Diego Ordonez, Giuseppe Orrù, Patricio Ortiz, José Osinde, Jose Osorio, Dagmara Oszkiewicz, Alex Ouzounis, Hugo Palacin, Max Palmer, Vincent Papy, Peregrine Park, Ester Pasquato, Xavier Passot, Michał Pawlak, Roselyne Pedrosa, Christian Peltzer, Hanna Pentikäinen, Xavier Peñalosa Esteller, Jordi Peralta, Rubén Pérez, Jean-Marc Petit, Fabien Péturaud, Bernard Pichon, Tuomo Pieniluoma, Enrico Pigozzi, Federic Pireddu, Léa Planquart, Bertrand Plez, Joel Poels[†], Eric Poujoulet, Arnaud Poulain, Guylaine Prat, Thibaut Prod'homme, Adrien Raffy, Silvia Ragaini, Serena Rago, Nicolas Rambaux, Piero Ranalli, Gregor Rauw, Andrew Read, José Rebordao, Philippe Redon, Rita Ribeiro, Ariadna Ribes Metidieri, Pascal Richard, Phil Richards, Carlos Ríos Díaz, Daniel Risquez, Adrien Rivard, Clement Robin, Brigitte Rocca-Volmerange, Maroussia Roelens, Hervé Rogues, Laurent Rohrbasser, Nicolas de Roll, Siv Rosén, Stefano Rubele, Laura Ruiz Dern, Idoia Ruiz-Fuertes, Federico Russo, Jan Rybizki, Jesús Salgado, Eugenio Salguero, Nik Samaras, Paula Sánchez Gayet, Toni Santana, Helder Savietto, María Henar Sarmiento, Maud Segol, Damien Segransan, Didier Semeux, I-Chun Shih, Hassan Siddiqui, André Silva, Helder Silva, Arturo Silvelo, Dimitris Sinachopoulos, Riccardo Smareglia, Kester Smith, Michael Soffel, Sergio Soria Nieto, Danuta Sosnowska, Maxime Spano, Ulrike Stampa, Craig Stephenson, Hristo Stoev, Vytautas Straižys, Frank Suess, Maria Süveges, Elza Szegedi-Elek, Francis Tâche, Jeff Tambouez, Guy Tauran, Dirk Terrell, David Terrett, Pierre Teyssandier, Stephan Theil, William Thuillot, Carola Tiede, Brandon Tingley, Anastasia Titarenko, Nadia Tonello, Jordi Torra[†], Scott Trager, Licia Troisi, Paraskevi Tsalmantza, David Tur, Catherine Turon, Stefano Uzzi, Mattia Vaccari, Frédéric Vachier, Emmanouil Vachlas, Marc Vaillant, Gaetano Valentini, Pau

Vallès, Veronique Valette, Emmanuel van Dillen, Walter Van Hamme, Eric Van Hemelryck, Wouter van Reeven, Mihaly Varadi, Marco Vaschetto, Jovan Veljanoski, Lionel Veltz, Sjoert van Velzen, Teresa Via, Yves Viala, Jenni Virtanen, Antonio Volpicelli, Holger Voss, Viktor Votruba, Jean-Marie Wallut, Gavin Walmsley, Olivier Wertz, Thomas Wevers, Rainer Wichmann, Mark Wilkinson, Abdullah Yoldas, Patrick Yvard, Petar Zečević, Tim de Zeeuw, Maruska Zerjal, Houri Ziaeepour, Claude Zurbach, and Sven Zschocke.

In addition to the DPAC consortium, past and present, there are numerous people, mostly in ESA and in industry, who have made or continue to make essential contributions to Gaia, for instance those employed in science and mission operations or in the design, manufacturing, integration, and testing of the spacecraft and its modules, subsystems, and units. Many of those will remain unnamed yet spent countless hours, occasionally during nights, weekends, and public holidays, in cold offices and dark clean rooms. At the risk of being incomplete, we specifically acknowledge, in alphabetical order, from Airbus DS (Toulouse): Alexandre Affre, Marie-Thérèse Aimé, Audrey Albert, Aurélien Albert-Aguilar, Jeanine Alloun-Etcheberry, Hania Arsalane, Arnaud Aurousseau, Denis Bassi, Franck Bayle, Bernard Bayol, Pierre-Luc Bazin, Emmanuelle Benninger, Philippe Bertrand, Jean-Bernard Biau, François Binter, Cédric Blanc, Eric Blonde, Patrick Bonzom, Bernard Bories, Jean-Jacques Bouisset, Joël Boyadjian, Isabelle Brault, Corinne Buge, Bertrand Calvel, Jean-Michel Camus, France Canton, Lionel Carminati, Michel Carrie, Didier Castel, Philippe Charvet, François Chassat, Fabrice Cherouat, Ludovic Chirouze, Michel Choquet, Claude Coatantiec, Emmanuel Collados, Philippe Corberand, Christelle Dauga, Robert Davancens, Catherine Deblock, Eric Decourbey, Charles Dekhtiar, Michel Delannoy, Michel Delgado, Damien Delmas, Emilie Demange, Victor Depeyre, Isabelle Desenclos, Christian Dio, Kevin Downes, Marie-Ange Duro, Eric Ecale, Omar Emam, Elizabeth Estrada, Coralie Falgayrac, Benjamin Farcot, Claude Faubert, Frédéric Faye, Sébastien Finana, Grégory Flandin, Loic Floury, Gilles Fongy, Michel Fruit, Florence Fusero, Christophe Gabilan, Jérémie Gaboriaud, Cyril Gallard, Damien Galy, Benjamin Gandon, Patrick Gareth, Eric Gelis, André Gellon, Laurent Georges, Philippe-Marie Gomez, José Goncalves, Frédéric Guedes, Vincent Guillemier, Thomas Guilpain, Stéphane Halbout, Marie Hanne, Grégory Hazera, Daniel Herbin, Tommy Hercher, Claude Hoarau le Papillon, Matthias Holz, Philippe Humbert, Sophie Jallade, Grégory Jonniaux, Frédéric Juillard, Philippe Jung, Charles Koeck, Marc Labaysse, Réné Laborde, Anouk Laborie, Jérôme Lacoste-Barutel, Baptiste Laynet, Virginie Le Gall, Julien L'Hermitte, Marc Le Roy, Christian Lebranchu, Didier Lebreton, Patrick Lelong, Jean-Luc Leon, Stephan Leppke, Franck Levallois, Philippe Lingot, Laurant Lobo, Didier Loche, Céline Lopez, Jean-Michel Loupias, Carlos Luque, Sébastien Maes, Bruno Mamdy, Denis Marchais, Alexandre Marson, Benjamin Massart, Rémi Mauriac, Philippe Mayo, Caroline Meisse, Hervé Mercereau, Olivier Michel, Florent Minaire, Xavier Moisson, David Monteiro, Denis Montperrus, Boris Niel, Cédric Papot, Jean-François Pasquier, Gareth Patrick, Pascal Paulet, Martin Peccia, Sylvie Peden, Sonia Penalva, Michel Pendaries, Philippe Peres, Grégory Personne, Dominique Pierot, Jean-Marc Pillot, Lydie Pinel, Fabien Piquemal, Vincent Poinsignon, Maxime Pomelec, André Porras, Pierre Pouny, Severin Provost, Sébastien Ramos, Fabienne Raux, Audrey Rehby, Florian Reuscher, Xavier Richard, Nicolas Riguet, Mickael Roche, Gilles Rougier, Bruno Rouzier, Stephane Roy, Jean-Paul Ruffie, Frédéric Safa, Heloise Scheer, Claudie Serris, André Sobeczko, Jean-François Soucaille, Romain Suze, Philippe Tatry, Théo Thomas, Pierre Thoral, Dominique Torcheux, Vincent Tortel, Damien Tourbez, Stephane Touzeau, Didier Trantoul, Cyril Vétel, Jean-Axel Vatinel, Jean-Paul Vormus, and Marc Zanoni; from Airbus DS (Friedrichshafen): Jan Beck, Frank Blender, Volker Hashagen, Armin Hauser, Bastian Hell, Cosmas Heller, Matthias Holz, Heinz-Dieter Junginger, Klaus-Peter Koeble, Karin Pietroboni, Ulrich Rauscher, Rebekka Reichle, Florian Reuscher, Ariane Stephan, Christian Stierle, Riccardo Vascotto, Christian Hehr, Markus Schelkle, Rudi Kerner, Udo Schuhmacher, Peter Moeller, Rene Stritter, Jürgen Frank, Wolfram Beckert, Evelyn Walser, Steffen Roetzer, Fritz Vogel, and Friedbert Zilly; from Airbus DS (Stevenage): Mohammed Ali, Bill Bental, David Bibby, Leisha Carratt, Veronica Carroll, Clive Catley, Patrick Chapman, Christoper Chetwood, Alison Colegrove, Tom Colegrove, Andrew Davies, Denis Di Filippantonio, Andy Dyne, Alex Elliot, Omar Emam, Colin Farmer, Steve Farrington, Nick Francis, Albert Gilchrist, Brian Grainger, Yann Le Hiress, Vicky Hodges, Jonathan Holroyd, Haroon Hussain, Roger Jarvis, Lewis Jenner, Steve King, Chris Lloyd, Neil Kimbrey, Alessandro Martis, Bal Matharu, Karen May, Florent Minaire, Katherine Mills, James Myatt, Chris Nicholas, Paul Norridge, David Perkins, Michael Pieri, Matthew Pigg, Angelo Povoleri, Robert Purvinskis, Phil Robson, Julien Saliege, Satti Sangha, Paramijt Singh, John Standing, Dongyao Tan, Keith Thomas, Rosalind Warren, Andy Whitehouse, Robert Wilson, Hazel Wood, Steven Danes, Scott Englefield, Juan Flores-Watson, Chris Lord, Allan Parry, Juliet Morris, Nick Gregory, and Ian Mansell.

From ESA, in alphabetical order: Ricard Abello, Asier Abreu, Ivan Aksenov, Matthew Allen, Salim Ansari, Philippe Armbruster, Mari-Liis Aru, Alessandro Atzei, Liesse Ayache, Samy Azaz, Nana Bach, Jean-Pierre Balley, Paul Balm, Manuela Baroni, Rainer Bauske, Thomas Beck, Gabriele Bellei, Carlos Bielsa, Gerhard Billig, Carmen Blasco, Andreas Boosz, Bruno Bras, Julia Braun, Thierry Bru, Frank Budnik, Joe Bush, Marco Butkovic, Jacques Candeé, David Cano, Carlos Casas, Francesco Castellini, David Chapmann, Nebil Cinar, Mark Clements, Giovanni Colangelo, Peter Collins, Ana Colorado McEvoy, Gabriele Comoretto, Vincente Companys, Federico Cordero, Yannis Croizat, Sylvain Damiani, Fabienne Delhaise, Gianpiero Di Girolamo, Yannis Diamantidis, John Dodsworth, Ernesto Dölling, Jane Douglas, Jean Doutreleau, Dominic Doyle, Mark Drapes, Frank Dreger, Peter Droll, Gerhard Drolshagen, Michal Ďurovič, Bret Durrett, Christina Eilers, Yannick Enginger, Alessandro Ercolani, Matthias Erdmann, Orcun Ergincan, Robert Ernst, Daniel Escolar, Maria Espina, Hugh Evans, Fabio Favata, Stefano Ferreri, Daniel Firre, Michael Flegel, Melanie Flentge, Alan Flowers, Steve Foley, Julia Fortuno-Benavent, Jens Freihöfer, Rob Furnell, Julio Gallegos, Maria De La Cruz Garcia Gonzalez, Philippe Garé, Wahida Gasti, José Gavira, Frank Geerling, Franck Germes, Gottlob Gienger, Bénédicte Girouart, Bernard Godard, Nick Godfrey, César Gómez Hernández, Roy Gouka, Cosimo Greco, Robert Guilanya, Kester Habermann, Manfred Hadwiger, Ian Harrison, Angela Head, Martin Hechler, Javier Hernando Bravo, Kjeld Hjortnaes, John Hoar, Jacolien Hoek, Frank Hoffmann, Justin Howard, Fredrik Hülphers, Arjan Hulsbosch, Christopher Hunter, Premysl Janik, José Jiménez, Emmanuel Joliet, Helma van de Kamp-Glasbergen, Simon Kellett, Andrea Kerruish, Kevin Kewin, Oliver Kiddle, Sabine Kielbassa, Volker Kirschner, Kees van 't Klooster, Ralf Kohley, Jan Kolmas, Oliver El Korashy, Arek Kowalczyk, Holger Krag, Benoît Lainé, Markus Landgraf, Sven Landström, Mathias Lauer, Robert Launer, Laurence Tu-Mai Levan, Mark ter Linden, Santiago Llorente, Tim Lock[†], Alejandro Lopez-Lozano, Guillermo Lorenzo, Tiago Loureiro, James Madison, Juan Manuel Garcia, Federico di Marco, Jonas Marie, Filip Marinic, Pier Mario Besso, Arturo Martín Polegre, Ander Martínez, Monica Martínez Fernández, Marco Massaro, Paolo de Meo, Ana Mestre, Claudio Mevi, Luca Michienzi, David Milligan, Ali Mohammadzadeh, David Monteiro, Richard Morgan-Owen, Trevor Morley, Prisca Mühlmann, Jana Mulacova, Michael Müller, Pablo Muñoz, Petteri Nieminen, Alfred Nillies, Wilfried Nzoubou, Alistair O'Connell, Karen O'Flaherty, Alfonso Olias Sanz, William O'Mullane, José Osinde, Oscar Pace, Mohini Parameswaran, Ramon Pardo, Taniya Parikh, Paul Parsons, Panos Partheniou, Torgeir Paulsen, Dario Pellegrinetti, José-Louis Pellon-Bailon, Joe Pereira, Michael Perryman, Christian Philippe, Alex Popescu, Frédéric Raison, Riccardo Rampini, Florian Renk, Alfonso Rivero, Andrew Robson, Gerd Rössling, Martina Rossmann, Markus Rückert, Andreas Rudolph, Frédéric Safa, Johannes Sahlmann, Eugenio Salguero, Jamie Salt, Giovanni Santin, Fabio de Santis, Rui Santos, Giuseppe Sarri, Stefano Scaglioni, Melanie Schabe, Dominic Schäfer, Micha Schmidt, Rudolf Schmidt, Ared Schnorhk, Klaus-Jürgen Schulz, Jean Schütz, Julia Schwartz, Andreas Scior, Jörg Seifert, Christopher Semprimoschnig[†], Ed Serpell, Iñaki Serraller Vizcaino, Gunther Sessler, Felicity Sheasby, Alex Short, Hassan Siddiqui, Heike Sillack, Swamy Siram, Chloe Sivac, Christopher Smith, Claudio Sollazzo, Steven Straw, Daniel Tapiador, Pilar de Teodoro, Mark Thompson, Giulio Tonelloto, Felice Torelli, Raffaele Tosellini, Cecil Tranquille, Irren Tsu-Silva, Livio Tucci, Aileen Urwin, Jean-Baptiste Valet, Martin Vannier, Enrico Vassallo, David Verrier, Sam Verstaen, Rüdiger Vetter, José Villalvilla, Raffaele Vitulli, Mildred Vögele, Sandra Vogt, Sergio Volonté, Catherine Watson, Karsten Weber, Daniel Werner, Gary Whitehead[†], Gavin Williams, Alistair Winton, Michael Witting, Peter Wright, Karlie Yeung, Marco Zambianchi, and Igor Zayer, and finally Vincenzo Innocente from the Conseil Européen pour la Recherche Nucléaire (CERN).

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This work has made use of data from the European Space Agency (ESA) mission Gaia (`https://www.cosmos.esa.int/gaia`), processed by the Gaia Data Processing and Analysis Consortium (DPAC, `https://www.cosmos.esa.int/web/gaia/dpac/consortium`). Funding for the DPAC has been provided by national institutions, in particular the institutions participating in the Gaia Multilateral Agreement.

The LaTeX version is:

```
This work has made use of data from the European Space Agency (ESA) mission
{\it Gaia} (\url{https://www.cosmos.esa.int/gaia}), processed by the {\it Gaia}
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```

If you have used Gaia FPR data in your research, please cite the Gaia mission paper and the relevant Gaia FPR paper(s) that describe used Gaia FPR data products in more detail:

- Gaia Collaboration, Prusti, T., et al. (2016): The Gaia mission (provides a description of the Gaia mission including spacecraft, instruments, survey and measurement principles, and operations);
- Gaia Collaboration, Weingrill, K., et al. (2023d): Gaia Focused Product Release: Sources from Service Interface Function image analysis - half a million new sources in omega Centauri;
- Gaia Collaboration, Schultheis, M., et al. (2023b): Gaia Focused Product Release: Spatial distribution of two diffuse interstellar bands;
- Gaia Collaboration, Trabucchi, M., et al. (2023c): Gaia Focused Product Release: Radial velocity time series of long-period variables;
- Gaia Collaboration, David, P., et al. (2023a): Gaia Focused Product Release: Asteroid orbital solution;
- Gaia Collaboration, Krone-Martins, A., et al. (2024): Gaia Focused Product Release: A catalogue of sources around quasars to search for strongly lensed quasars.

If you have used Gaia DR3 data in your research, please refer to the Gaia DR3 citation instructions.

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Colophon

This documentation has been prepared by ESA and DPAC under work package 920 ‘Documentation’, lead by Małgorzata (Goska) van Leeuwen (Cambridge), in the DPAC ‘Catalogue Access’ Coordination Unit CU9, lead by Xavier Luri (Barcelona). Technical aspects, including the conversion from LaTeX to HTML, have been lead by Małgorzata (Goska) van Leeuwen (Cambridge) and Enrique Utrilla Molina (Aurora Technology B.V. for ESA). The other work-package members are, in alphabetical order, Jos de Bruijne (ESA), Claus Fabricius (Barcelona), Pedro García-Lario (ESA), Alex Hutton (Aurora Technology B.V. for ESA), Tineke Roegiers (HE Space for ESA), and Floor van Leeuwen (Cambridge). Martin Bremer (Telespazio UK for ESA) has provided technical support. The HTML version of this documentation has been produced with the LaTeX to XML/HTML/MathML converter LaTeXML developed by Bruce Miller at the US National Institute of Standards and Technology (NIST).

The names of contributors of chapters and (sub)sections are provided in the documentation.

Acronyms

The list of acronyms and abbreviations can be found on-line.

Documentation change log

- 2023-07-18, Version 1.0: first internal draft release.
- 2023-10-10, Version 1.1: first public release (full pdf version).
- 2024-06-25, Version 1.2: (full pdf version)
  - Made several corrections in the main text and datamodel description.
  - Updated references of Gaia FPR papers after their publication in A&A.

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