citic

gaia

GAIA DR3

CONTENIDO DE LOS PRODUCTOS DE CU8: ASTROPHYSICAL PARAMETERS

75 personas

8 países

15 equipos

Minia Manteiga en nombre del equipo de CU8

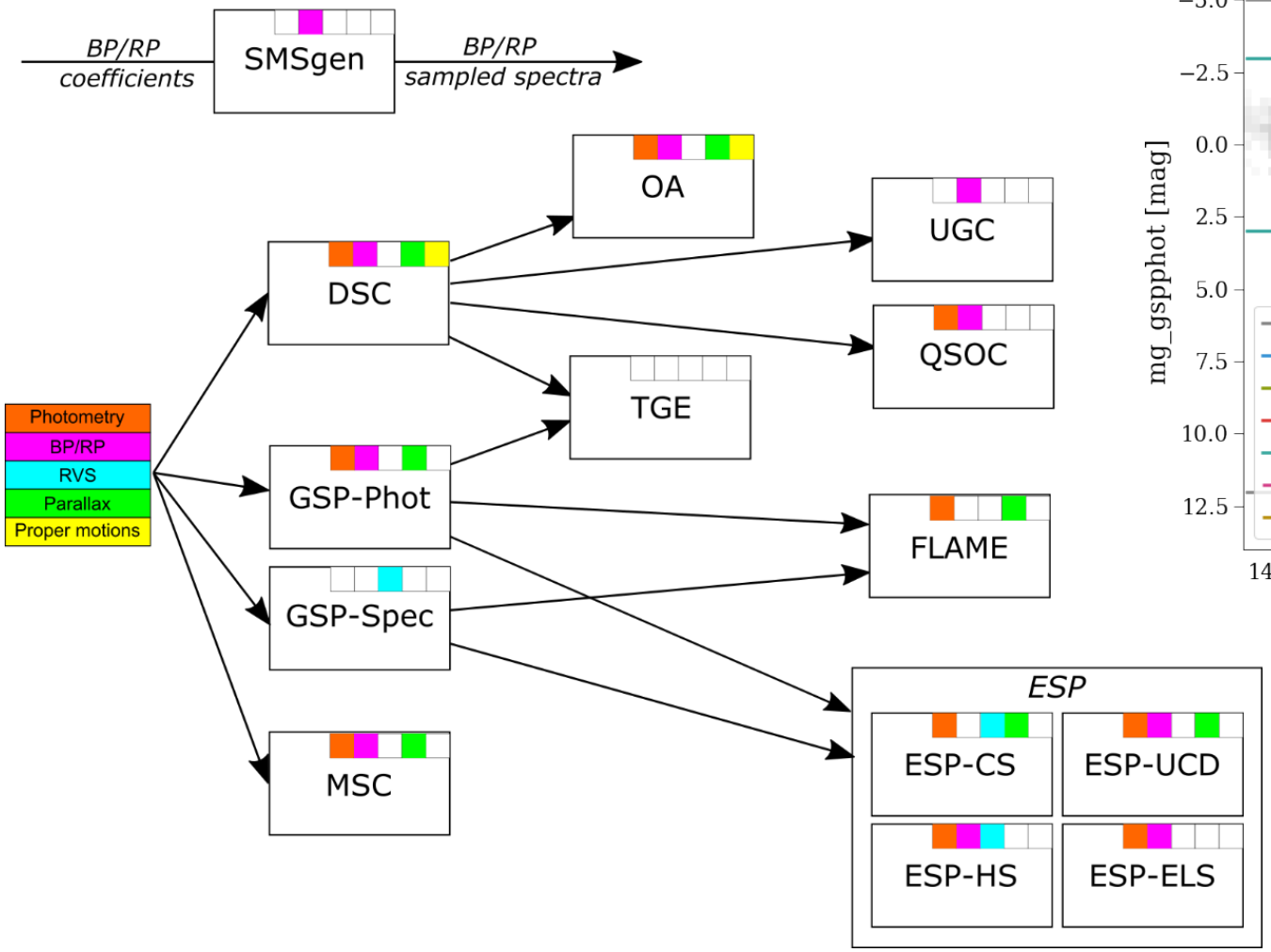
O.L. Creevey[1], R. Sordo[2], F. Paillet[3], Y. Frémat[4], U. Heiter[5], F. Thévenin[1], R. Andrae[6], M. Fouesneau[6], A. Lobel[4], C.A.L. Bailer-Jones[6], D. Garabato[7], I. Bellas-Velidis[8], E. Brugaletta[9], A. Lorca[10], C. Ordenovic[1], P.A. Palicio[1], L.M. Sarro[11], L. Delchambre[12], R. Drimmel[13], J. Rybizki[6], G. Torralba Elipe[7], A.J. Korn[5], A. Recio-Blanco[1], M.S. Schultheis[1], F. De Angeli[14], P. Montegriffo[15], A. Abreu Aramburu[16], S. Accart[3], M.A. Álvarez[7], A. Bijaoui[1], N. Brouillet[17], A. Burlacu[18], R. Carballo[19], L. Casamiquela[17,20], A. Chiavassa[1], G. Contursi[1], W.J. Cooper[21,13], C. Dafonte[7], A. Dapergolas[8], P. de Laverny[1], T.E. Dharmawardena[6], B. Edvardsson[23] Y. Le Fustec[18], P. García-Lario[24], M. García-Torres[25], A. Gavel[5], A. Gomez[7], I. González-Santamaría[7], D. Hatzidimitriou[26,8], A. Jean-Antoine Piccolo[3], M. Kontizas[26], G. Kordopatis[1], A.C. Lanzafame[9,27], Y. Lebreton[28,29], E.L. Licata[13], H.E.P. Lindstrøm[13,30,31], E. Livanou[26], A. Magdaleno Romeo[18], M. Manteiga[32], F. Marocco[33], D.J. Marshall[34], N. Mary[35], C. Nicolas[3], L. Pallas-Quintela[7], C. Panem[3], B. Pichon[1], E. Poggio[1,13], F. Riclet[3], C. Robin[35], R. Santoveña[7], A. Silvelo[7], I. Slezak[1], R.L. Smart[13], C. Soubiran[17], M. Süveges[36], A. Ulla[37], A. Vallenari[2], H. Zhao[1], J. Zorec[38], D. Barrado[39], A. Bijaoui[1], J.-C. Bouret[40], R. Blomme[4], I. Brott[41], S. Cassisi[42,43], O. Kochukhov[5], C. Martayan[44,4], D. Shulyak[45,46], and J. Silvester[5]

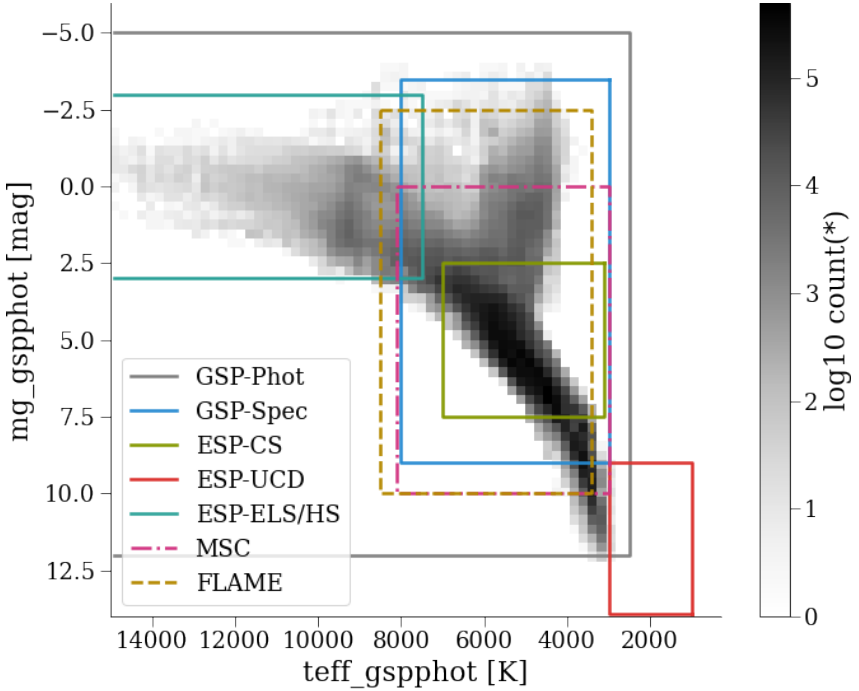
1- Resultados del análisis

LOS NÚMEROS DE CU8

1,6 billones	**de clasificaciones**
470 millones	**de temperaturas, radios, distancias**
130 millones	**de masas y edades**
3 millones	**de datos sobre actividad magnética, rotación**
2,5 millones	**de datos de composición química**
6,3 millones	**medidas de redshifts de quasares**
1,4 millones	**medidas de redshifts de galaxias no resueltas**

2- Paquetes de trabajo de CU8, datos de Gaia que utiliza y flujo de la información





Regiones de trabajo de los diferentes paquetes

3- GSP-Spec y ESP: Parámetros estelares con espectros de RVS

Ejemplos de uso de GSP-Spec, ESP-HS y ESP-CS

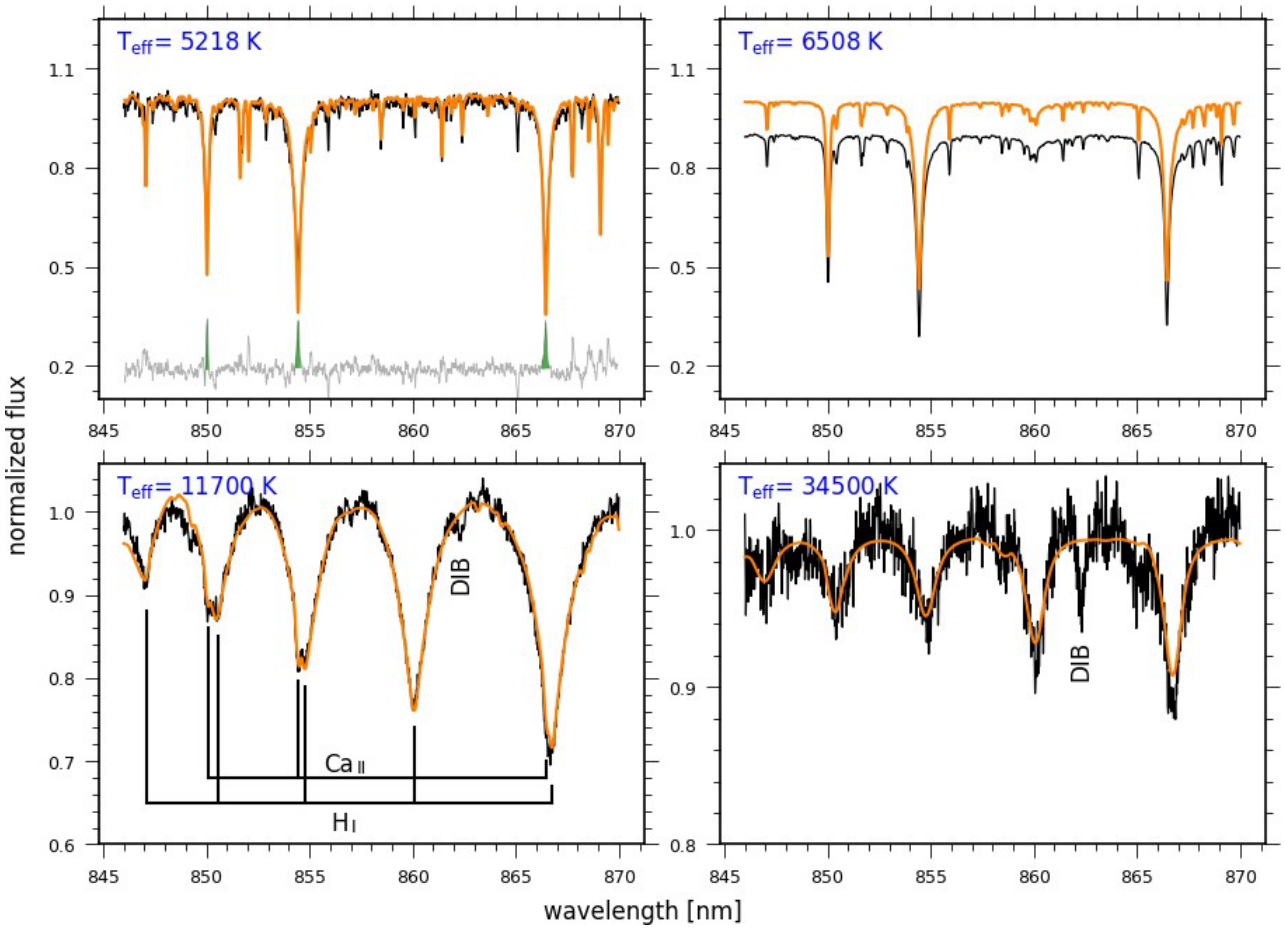
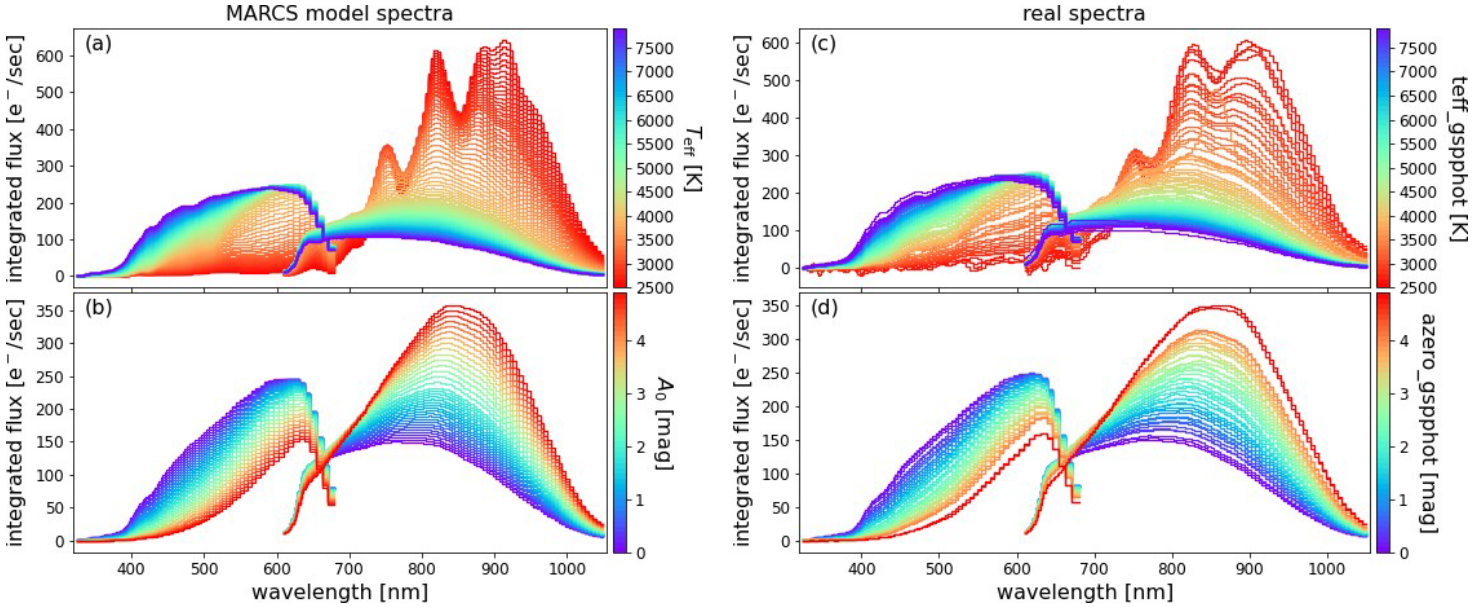


Fig. 3. Examples of the observed RVS spectra (black curve) analysed by various modules of the Apsis pipeline. The effective temperatures estimated by GSP-Spec (upper panels) and by ESP-HS (lower panels) are given in blue, while the best fitting synthetic spectrum is shown in orange. Upper left panel: adopting the APs by GSP-Spec (orange spectrum), ESP-CS derives an activity index from the residuals (gray lines), and DIB equivalent widths from ESP-HS

4- GSP-Phot y ESP: Parámetros estelares con espectrofotometría BP y RP

4-1. Ejemplos de uso de GSP-Phot

APs para 470 millones de estrellas



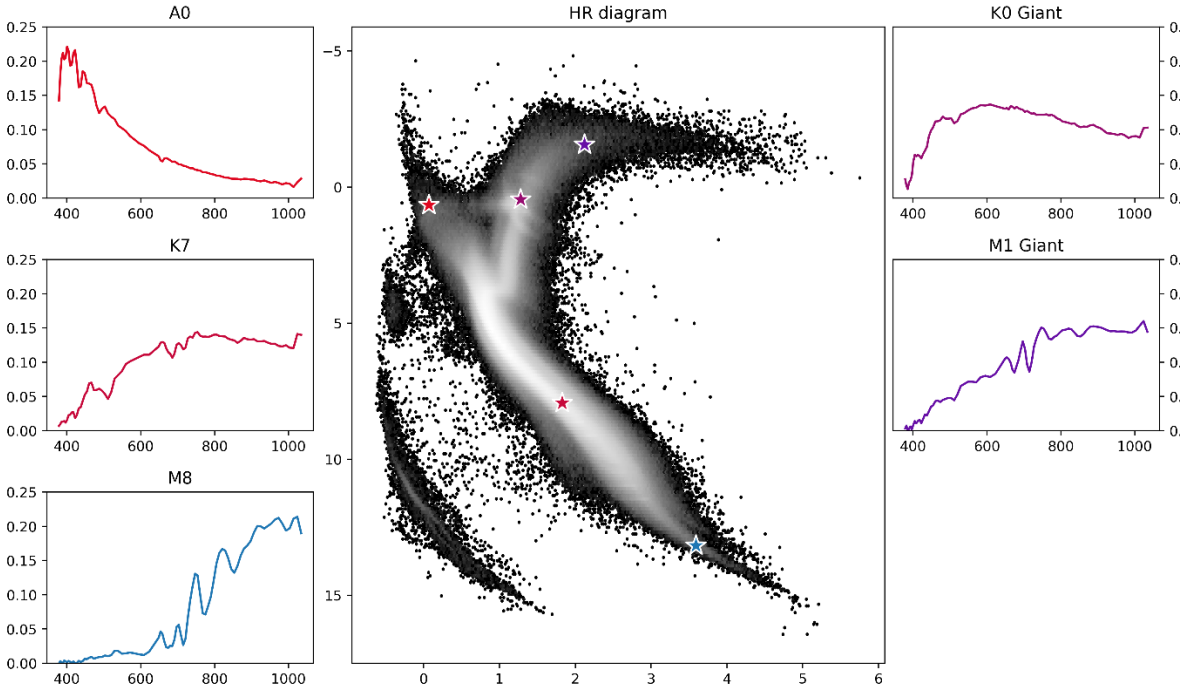
Flujo vs Teff

Flujo vs Extinción

Fig. 4. Example BP/RP model spectra (left) and real spectra (right). All BP/RP spectra have been rescaled to an apparent magnitude of G = 15 in order to make their flux levels comparable. Panels (a) and (c) show the variation with T_{eff}, panels (b) and (d) the variation with A_0. Panels (a) and (b) show synthetic BP/RP spectra based on MARCS models (see Sect. 4.1). Panels (c) and (d) show BP/RP spectra obtained by Gaia where the APs were produced by the GSP-Phot module in the Apsis pipeline. BP spectra approximately cover the wavelength range from 325 nm to 680 nm and RP spectra from 610 nm to 1050 nm, see Fig. 5.

4-2. El potencial de los espectros XP para mostrar las propiedades y estado evolutivo de las estrellas

https://www.cosmos.esa.int/web/gaia/iow_20220610



4-3. Otros productos: mapa 2D de la extición galáctica TGE

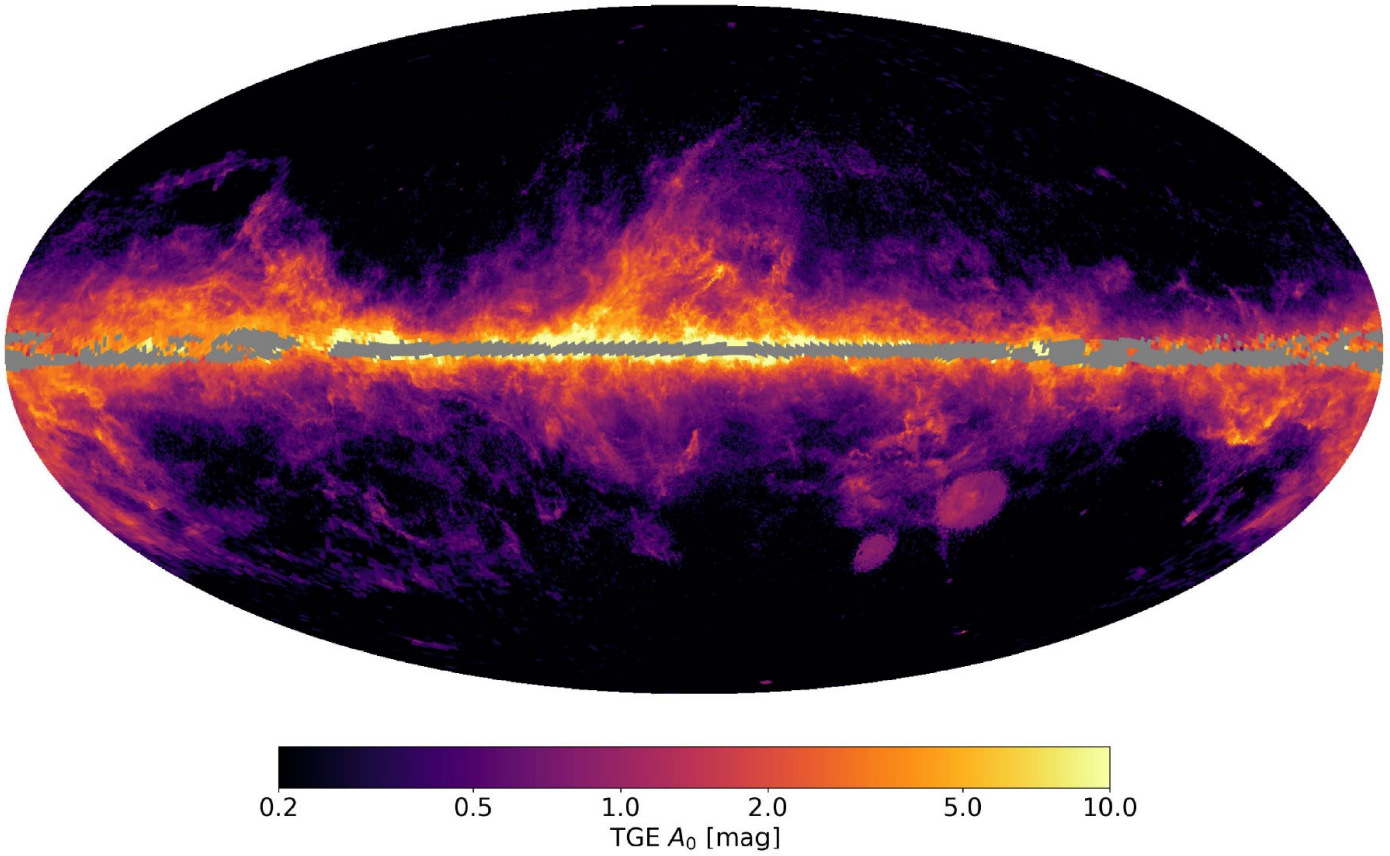


Fig. 24. HEALPix map of the total Galactic extinction, built from HEALPixes between levels 6 to 9 (0.839 to 0.013 deg^2) that are identified as being at the optimum resolution over their field-of-view.

4-4. Otros productos: análisis de los *outliers* de clasifiación

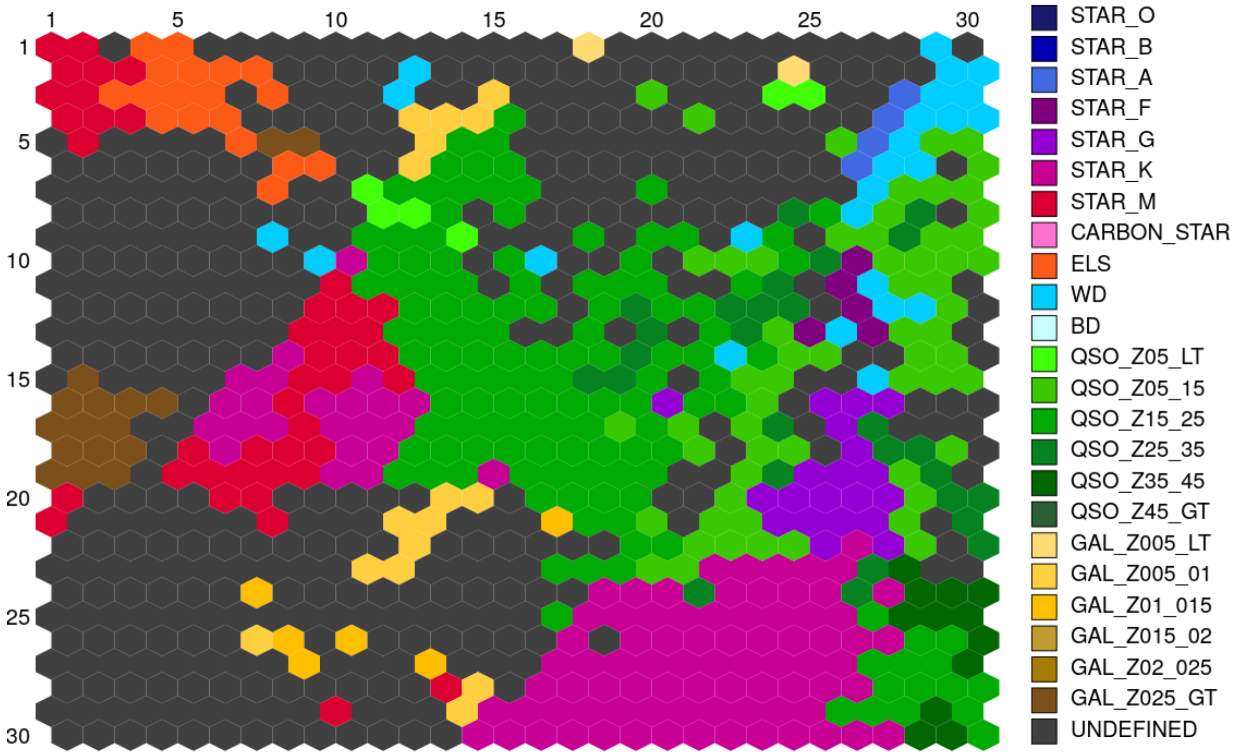


Fig. 12. SOM map lattice visualised using the GUASOM tool (Álvarez et al. 2021) representing the specific class labels assigned to each neuron by the OA module. The OA module analysed the 56 million sources with the poorest classification probabilities from DSC. Those neurons for which such a label can not be attributed remain as "undefined".

4-5. Otros productos: abundancias químicas individuales

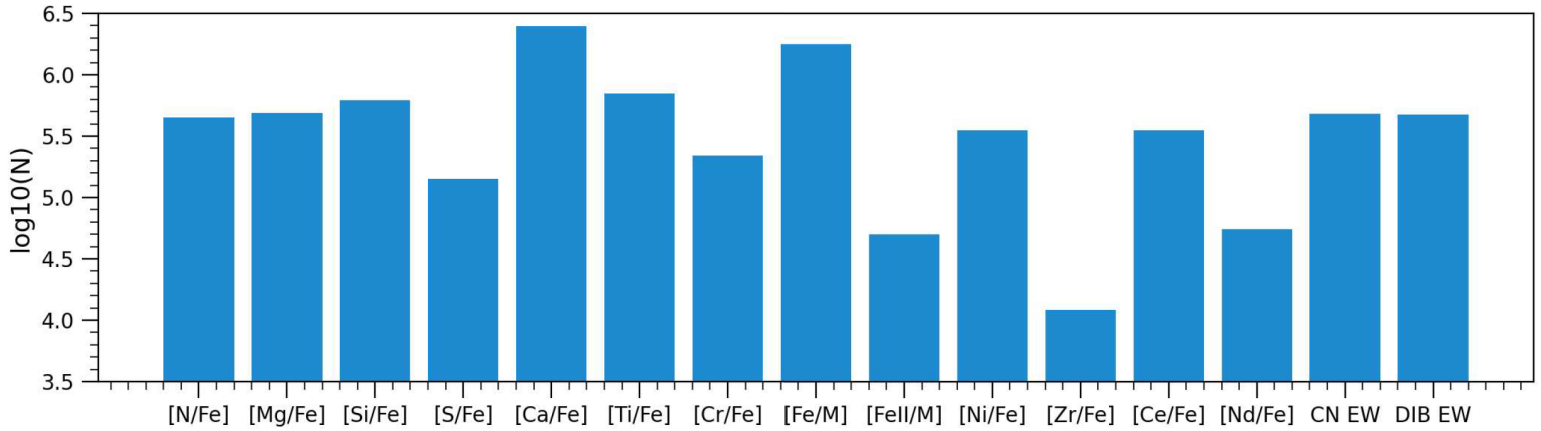


Fig. 17. Histogram showing the number of sources for each chemical species with abundances or equivalent widths in Gaia DR3 produced by the GSP-Spec Matisse-Gauguin method, in logarithmic scale. [α/Fe] is derived at the same time as the atmospheric parameters ($T_{\rm eff}$, log g, [M/H]) and is available for ~5 million sources. A quality flag `flags_gspspec` is provided for the best use of the elemental abundances.

5.Objetos extragalácticos: medida de redshifts en Galaxias y Quasares

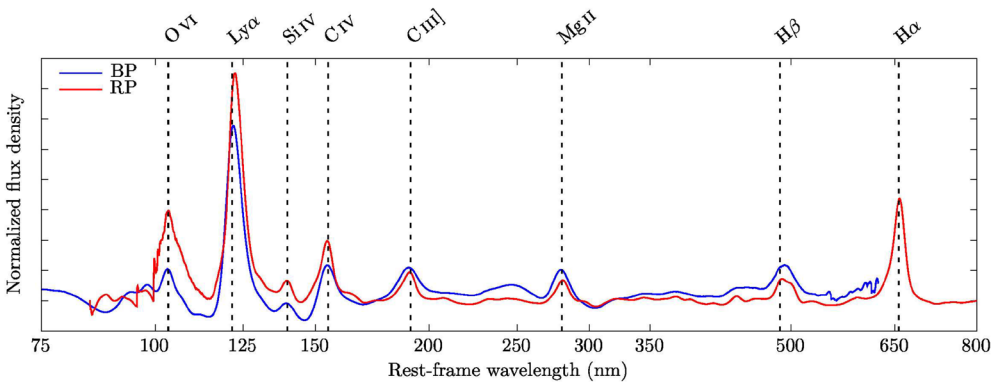


Fig. 14. Rest-frame quasar templates used by QSOC. These correspond to the dominant templates taken over the 32 templates that are computed based on the method described in Delchambre (2015) and applied to 297 264 quasars from the DR12Q catalogue that are converted into BP/RP spectra through the use of the BP/RP spectrum simulator provided by CU5.

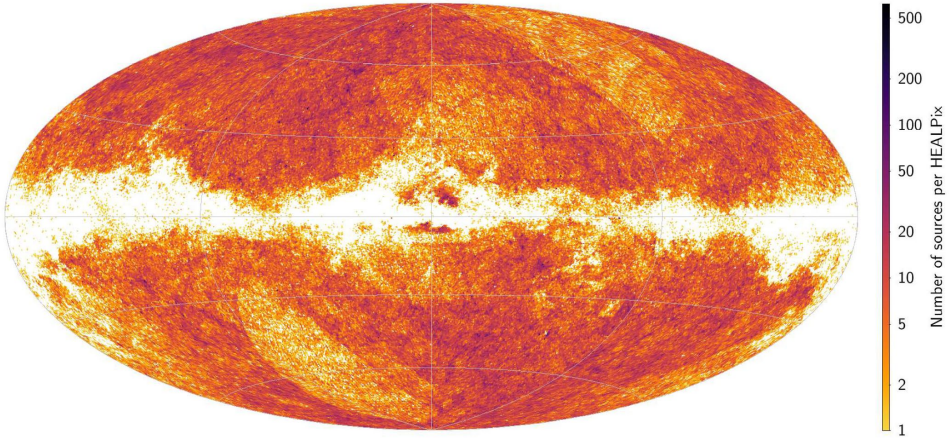


Fig. 19. Galactic sky distribution of the number of sources with redshifts estimated by UGC. The plot is shown at HEALPix level 7 (0.210 deg^2).

6. Datos de entrada, modelos, productos,algoritmos, magnitud límite y número de fuentes procesadas

Table 1. Input data, models, training data, data products, and dependencies of the Apsis algorithms.

module	category	object type	input data non-Apsis	input data Apsis	inference model models	inference model empirical	number (millions)	G
DSC	probabilities, classification	SEB	XP, ϖ, pm, G			ExtraTrees/ Gauss.Mix	1 591	< 21
OA	classification	O	XP	(DSC)		SOM	56	< 21
UGC	galaxy redshift	E	XP	(DSC)		SVM	2	< 21
QSOC	quasar redshift	E	XP	(DSC)			6	< 21
GSP-Phot	spectroscopic, interstellar, evolution	SI	XP, ϖ, G G_{BP},G_{RP}		MARCS/PHOENIX OB/A/PARSEC		470	< 19
GSP-Spec	spectroscopic, abundances, DIB	SI	RVS		MARCS		6	< 16
MSC	spectroscopic, interstellar	BI	XP	(GSP-Phot)		ExtraTrees	350	< 18.3
ESP-ELS	probabilities, classification, Hα pEW	S	XP	GSP-Phot		Random Forest	0.01 235	< 17.65
ESP-HS	spectroscopic	S	XP, RVS	ESP-ELS	A/OB		2	< 17.6
ESP-CS	spectroscopic	S	RVS	(GSP-Spec)	MARCS		2	< 15
ESP-UCD	spectroscopic	S	RP,ϖ, G			Gauss.Proc.	0.1	< 21
FLAME	evolution	S	ϖ, G	GSP-Phot	MARCS/BaSTI		280	< 18.3
				GSP-Spec	MARCS/BaSTI		5	< 13
TGE	map	I		GSP-Phot			–	< 19

Notes. The following notation is used: XP = BP/RP spectra (through sampled mean spectra), RVS = RVS spectra; ϖ = parallax, pm = proper motions, G = Gaia photometry which implies G, G_{BP}, and/or G_{RP}. Object Type is S, B, E, I, O for star, binary, extragalactic, interstellar, and outlier, respectively. Under Apsis Input Data, values in "()" mean that APs are used to initialise the analysis or as selection criteria only.

Table 2. CU8 synthetic stellar libraries list of BP/RP spectra. Minimum grid spacing is listed in parentheses.

LIBRARY NAME	N models	$T_{\rm eff}$ [K]	log g [dex]	[Fe/H] [dex]	provider/contact
A (LL models)	2332	6000 – 16000 (250)	2.5 – 4.5 (0.25)	−1.5 – +0.5 (0.5)	O. Kochukhov/D. Shulyak
MARCS	27951	2800 – 8000 (25)	−0.5 – 5.0 (0.5)	−5 – +1 (0.25)	B. Edvardsson
PHOENIX	4651	3000 – 10000 (100)	−0.5 – 5.5 (0.5)	−2.5 – +0.5 (0.5)	I. Brott/P. Hauschildt
OB	2162	15000 – 55000 (1000)	1.75 – 4.75 (0.25)	0.0 – 0.6 (0.1)	Y. Frémat
BTSettl	2084	400 – 3000	−0.5 – 5.5	−4.0 – +0.5	F. Allard[†] /L. Sarro
(HotSpot	31957	3000 – 7000	3 – 5	-0.5 – +1.0	A. Lanzafame)
(WD	186	6000 – 90000	7 – 9	+0.0	D. Koester)

Notes. [(†)] France Allard (1963-2020)

Librerías de espectros estelares utilizadas

7.- Tablas de los productos de CU8 en el archivo de DR3

Table 4. Overview of the contents of each table in the Gaia archive containing Apsis products, organised by product type. A subset of the products from DSC and GSP-Phot also appear in `gaia_source`.

product type	Gaia DR3 archive tables	overview content
classification	`astrophysical_parameters`	object class probabilities (quasar, galaxy, star, white dwarf, physical binary emission-line class probabilities and label, spectral types
	`galaxy_candidates`	galaxy and QSO class probabilities and label, outlier class label
	`qso_candidates`	galaxy and QSO class probabilities and label, outlier class label
interstellar	`astrophysical_parameters`	monochromatic extinction and extinction in G_{BP}, G_{RP}, G, colour excess, distances, diffuse interstellar band characteristics
	`astrophysical_parameters_supp`	monochromatic extinction and extinction in G_{BP}, G_{RP}, G, colour-excess, distances
	`total_galactic_extinction_map`[a]	total Galactic extinction 2D map at HEALpix levels 6, 7, 8, 9
	`total_galactic_extinction_map_opt`[a]	total Galactic extinction 2D map at HEALpix level 9 based on the optimal HEALPix level
stellar	`astrophysical_parameters`	atmospheric parameters for single and binary stars, chemical abundances, equivalent widths, rotation and activity parameters, evolutionary parameters
	`astrophysical_parameters_supp`	atmospheric and evolutionary parameters
	`mcmc_samples_gsp_phot`[a]	MCMC samples of stellar parameters from GSP-Phot
	`mcmc_samples_msc`[a]	MCMC samples of stellar parameters from MSC
extragalactic	`qso_candidates`	redshifts of qso candidates
	`galaxy_candidates`	redshifts of unresolved galaxy candidates
	`astrophysical_parameters`	class probabilities of a source being a galaxy or quasar
outlier analysis	`astrophysical_parameters`	neuron membership and distance between source and neuron prototype BP/RP spectra
	`oa_neuron_information`[a]	self-organising map (SOM, 30x30) of outlier sources
	`oa_neuron_xp_spectra`[a]	prototype BP/RP spectra corresponding to each SOM neuron
auxiliary	`astrophysical_parameters`	flags, convergence indicators, bolometric correction, library name
	`astrophysical_parameters_supp`	flags, convergence indicators, bolometric correction, library name
	`qso_candidates`	flags, quality indicators

Notes. The links in the table point directly to the online data model description. [(a)] Multi-dimensional table.

Table 3. Tables in the Gaia DR3 archive with parameters from CU8. The last six are multi-dimensional data tables. The number of sources is approximate to the nearest million.

table name	number of CU8 fields	number of sources [millions]
astrophysical_parameters	224	1 590
astrophysical_parameters_supp	173	470
galaxy_candidates	8	2
qso_candidates	11	6
gaia_source	29	1 800
		dimensions
oa_neuron_information	77	30x30
oa_neuron_xp_spectra	6	87x900
total_galactic_extinction_map	9	4xHP
total_galactic_extinction_map_opt	6	1xHP9
mcmc_samples_gsp_phot	14	100x480M
mcmc_samples_msc	10	100x480M

Notes. HP = 3 145 728 (= HP9), 786 432, 196 608, and 49 152 for HEALPix level 9, 8, 7, and 6, respectively. gaia_source contains a subset of parameters from the astrophysical_parameters table. The mcmc_samples_gsp_phot contains 2000 samples for sources with $G < 9$ and for a random 1% of all other sources.