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Photometric relationships between Gaia photometry and existing photometric systems

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reference: GAIA-C5-TN-UB-CJ-041

issue: 11

revision: 0

date: 2018-02-19

status: Issued

Abstract

This document provides relationships among colours involving Gaia magnitudes (G, integrated $G_{\rm BP}$ and $G_{\rm RP}$ as well as $G_{\rm RVS}$) and Johnson-Cousins, Sloan and GSC-II magnitudes and colours. The shown dependences among colours can constitute a guide for planning on-ground observations and for building catalogues with auxiliary data for the Gaia data processing. The relationships can be used for predicting Gaia magnitudes in simulations. Relationships for different reddening values, range of colours, luminosity classes and metallicities will be needed for specific applications.

Document History

Issue	Revision	Date	Author	Comment
11	0	2018-02-19	CJ	Sec. 5 has been added
10	1	2016-03-21	CJ	Typos and minor corrections
10	0	2016-03-17	CJ	Johnson, Hipparcos and Tycho passbands and magnitudes for Vega updated from **?** Vega's reference spectrum changed to CALSPEC spectrum.
9	0	2014-06-16	CJ	Table 5 enlarged with other colour-colour combinations, Tables 6–8 added, Fig. 5 and 6 added
8	0	2013-08-30	CJ	Updating of pupil area, particulate and molecular contamination and RVS spectrometer transmissivity as in ParamDataBase current version (r.309252). Transformations using $B-R$ have been added. Transformations involving B_J and R_F of GSC-II have also been included, with corresponding table and figure.
7	0	2012-05-02	CJ	changes in mirror reflectivity, CCD-RP/RVS, contamination budget and RVS transmissivity as in ParamDataBase current version have been included
6	0	2011-08-29	CJ	changes in contamination budget and RVS transmissivity as in ParamDataBase current version have been included
5	0	2011-03-10	CJ	small changes in reflectivity of mirrors, QE of CCDs and transmission of filters as in ParamDataBase current version, included
4	0	2009-02-20	CJ	reviewed with the new BP/RP transmission curves in the ParamDataBase
3	0	2008-06-17	CJ	reviewed with the new QE curves in the ParamDataBase
2	0	2007-11-21	CJ	attenuation factor included; G_{RVS} passband changed; new relationships $G-R$ and $G-r$ included
1	3	2007-05-23	CJ	style correction; first version in Livelink
1	2	2007-05-14	CJ	Updated according to comments by C. Cacciari, E. Pancino, G. Altavilla
1	1	2007-05-08	CJ	Comments added, more transformations computed
1	0	2007-04-26	CJ	Preliminary version sent to B. Voss

Contents

1 Introduction

From the Astro measurements of unfiltered (white) light, Gaia will produce G-magnitudes, while the spectral energy distribution of each source will be sampled by a dedicated spectrophotometric instrument providing low resolution spectra in the blue (BP) and the red (RP). The integrated flux of these BP and RP spectra will yield $G_{\rm BP}$- and $G_{\rm RP}$-magnitudes as two broad passbands. In addition, the RVS instrument will disperse the light in the range 847–874 nm, for which it will include a dedicated filter. Therefore, four passbands and their corresponding magnitudes, can be associated with the Gaia instruments: G, $G_{\rm BP}$, $G_{\rm RP}$ and $G_{\rm RVS}$.

Figure 1 shows the four passbands, which have been derived including (a) the reflectivity of the mirrors `:Satellite:Telescope_MirrorReflectivity` (EADS-Astrium, June 2010), (b) the attenuation factor `:Satellite:Optics_Attenuation_ParticulateAndMolecularContamination`, and the rugosity `:Satellite:Optics_Rugosity_Effective` (GAIA.ASF.RP.SAT.00005), (c) the QE of the CCDs `:Satellite:AF:CCD_QE_160K`, `:Satellite:BP:CCD_QE_160K`, `:Satellite:RP:CCD_QE_160K`, `:Satellite:RVS:CCD_QE_160K` (by R. Kohley and A. Mora, 2010), (d) the transmissivity of the prism plus filter-coatings `:Satellite:BP:Photometer_Transmissivity` and `:Satellite:RP:Photometer_Transmissivity`, with the prism plus filter-coating transmission as provided by EADS-Astrium on 4-Dec-2008, and (e) the spectrometer transmissivity OMA `:Satellite:RVS:Spectrometer_Transmissivity`. All these parameters are taken from the current version of the Gaia Parameter Data Base (**?**, **?**).

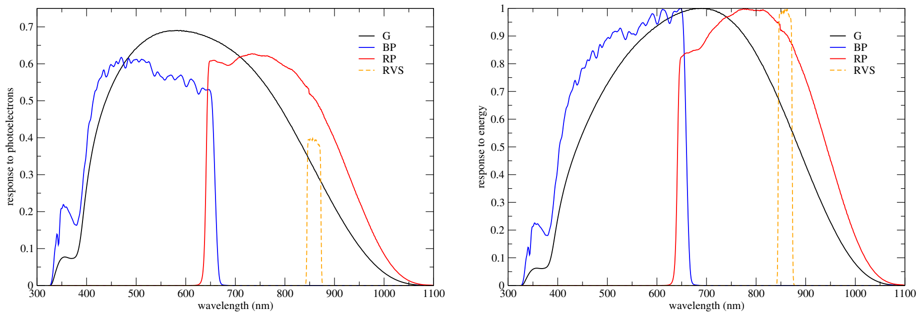

FIGURE 1: Response curves yielding G, $G_{\rm BP}$, $G_{\rm RP}$ and $G_{\rm RVS}$ passbands.

The relationship of these four magnitudes with existing photometry is needed for several purposes: a) many of the simulations by CU2 do not need an extreme degree of realism and thus it is desirable to avoid the use of spectral energy distribution libraries in order to reduce the computing time; b) the phase of commissioning at the beginning of the mission will need the comparison of Gaia measurements with already existing information for a set of sources (an initial catalogue, **?**); c) the photometric calibration will be based on a set of bright SpectroPhotometric Standard Stars (SPSS) and a large set of bright and faint Internal Reference Sources

(IRS), but an extensive check of the magnitude scale through the comparison with existing photometry is also required **?**; d) the effect of sources brighter than the Gaia bright limit need to be accounted for in the process of neighbouring sources; e) the use of existing photometry might help to disentangle overlapping images in crowded fields in the early phase of the mission when not enough Gaia data is collected; f) the comparison between Gaia measurements and external photometry may help the analysis of science alerts; etc.

For predicting Gaia magnitudes from magnitudes in well known and widely used photometric systems, several relationships have been computed and are presented here. Several of the relationships here are already in the Gaia Parameter Database **??** since long ago and have been widely used by CU2 and CU8. This document aims to compile all of them and to add several ones. We note that relationships with Sloan magnitudes are included.

2 Photometric systems and zero magnitudes

Johnson-Cousinsi, Hipparcos and Tycho passbands were taken from **?**. Sloan passbands were taken from the SDSS Data Release 5 site **?**. Guide Stars Catalogue passbands (GSC-II, **?**) were kindly provided by Torino's group with the indication of being response to energy (Spagna, private communication). Figure 2 shows the passbands of Johnson-Cousins, Sloan and GSC-II systems. For GSC-II the passbands are: IIIaJ+GG395 (B_J) and IIIaF+OG590 (R_F) for the Southern hemisphere, and IIIaJ+GG385 (B_J) and IIIaF+RG610 (R_F) for the Northern hemisphere.

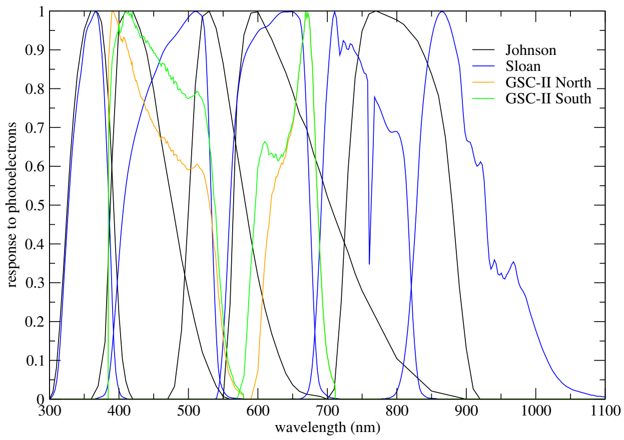

FIGURE 2: Passbands of $UBV(RI)_C$ Johnson-Cousins and $ugriz$ Sloan systems.

The Gaia G, $G_{\rm BP}$, $G_{\rm RP}$ and $G_{\rm RVS}$ magnitudes have been defined in the conventional Vega system here [1]. The zero magnitudes have been fixed through the precise energy flux measurement

[1] It has been decided to stick to Vega system for GDR1, at DPCE meeting March 2016, and postpone the shift

of Vega. The spectra of Vega is taken from CALSPEC (see **?**). The quoted monochromatic flux at 555.6 nm is the same as **?**. However, the apparent visual magnitude assigned to Vega is $V = 0.023 \pm 0.008$ instead of $V = 0.030$.

Integrated synthetic flux for a star like Vega has been computed for the G, $G_{\rm BP}$, $G_{\rm RP}$ and $G_{\rm RVS}$ passbands. A magnitude equal to 0.023 has been assumed for each synthetic flux. In that way, $G = G_{\rm BP} = G_{\rm RP} = G_{\rm RVS} = H_p = B_T = V_T = V = 0.023$ for Vega and $G = G_{\rm BP} = G_{\rm RP} = G_{\rm RVS} = H_p = B_T = V_T = V = 0.0$ for a Vega-like star (**?**).

For Johnson-Cousins magnitudes, the zero magnitudes are defined through Vega and they are $B = 0.019$, $V = 0.023$, $R_C = 0.023$, $I_C = 0.024$ (**?**).

These prescriptions for fixing the zero magnitude are the ones established by the Photometry WG long ago. Some of the relationships shown in the next section are widely used and so, we preferred to keep the same conventions for the time being. Please, notice that Vega's spectrum is only used to fix the zero magnitude and since the relationships are among colours, the change of Vega's spectrum or of its Johnson magnitudes does not change the shape of the relationships. It would only change the value of the independent coefficient.

Sloan magnitudes are in the AB system, so by definition $m_\nu = 0$ corresponds to a source with a flat spectrum of $3.631 \cdot 10^{-23}$ W m^{-2} Hz^{-1}, and so the absolute flux is independent of Vega.

From the colour-colour transformations computed by **?** for GSC-II (their Fig. 7), it looks that the zero points of $B_J - V$ and $V - R_F$ have been fixed to the zero points of $B - V$ and $V - R$. So, the assumption here is that $B_J = B = 0.028$ and $R_F = R_C = 0.037$.

3 Colour-colour relationships

The **?** spectral library containing 131 stellar spectra has been used as representative of true stars. The spectra have been reddened by several amounts ($A_{\lambda=550} = 0, 1, 3, 5$ mag) following **?** reddening law and assuming $R_V = 3.1$. Johnson-Cousins, SDSS and GSC-II magnitudes and colours have been derived from synthetic photometry. Several colour-colour diagrams are presented in Figs. 3 and 4.

Polynomial expressions of the form:

$$C_1 = a + b \cdot C_2 + c \cdot C_2^2 + d \cdot C_2^3$$

have been fitted to colours C_1 and C_2, being C_1 a colour involving at least one Gaia magnitude and C_2 a colour of Johnson-Cousins, SDSS systems or GSC-II. In many cases, the reddening vector runs almost parallel to the colour-colour relationships and so, a unique fit to the set of

to AB system in further releases.

$4{\times}131$ spectra has been computed. The results of such fittings are shown in Tables 1, 2 and 3. The 'j' and 's' letters in the last column mark the transformation with the lowest residual for Johnson-Cousins and Sloan systems, respectively. They are of the order of a few hundredths of a magnitude in almost all cases and of a few tenths in the others. The two stars with largest residuals in all cases are of M9III and M10III types.

Like for the Hipparcos H_p magnitude, the $V - I_C$ is the one that in general provides a transformation with lower residual. The diagrams with the $B - V$ colour show large scatter, specially for $G - V$ and $G{-}G_{\mathrm{BP}}$. The dispersion increase from $B - V \sim 0.5$ due to reddening and it is rather large for the coolest stars. For the Sloan passbands, the relationships with $g - i$ colour are slightly more sensitive to reddening than with $V - I_C$. The transformations from Sloan passbands yield residuals larger than with Johnson passbands.

Transformations using $B_T - V_T$ Tycho-2 colour are rather poor, mainly for red objects as it was expected. Example of the colour-colour relationship can be found in Fig. 5. The values can be found in Table 7.

Transformations using $B_J - R_F$ GSC-II colour are also rather poor, mainly for red objects as it was expected. Examples of the colour-colour relationships can be found in Fig. 6.

Transformation using two Johnson or two SDSS colours have also been computed in the form:

$$C_1 = a + b \cdot C_2 + c \cdot C_2^2 + d \cdot C_2^3 + e \cdot C_3 + f \cdot C_3^2 + g \cdot C_3^3 + h \cdot C_2 C_3$$

They are shown in Table 4. The residuals are lower than using only one colour. In the case of Johnson system, the residuals do not decrease much, but in the case of the SDSS system the improvement is substantial and makes them more similar to the ones using $V - I_C$. Thus, in the case of Sloan, transformations using two colours should be used.

The residuals can be still decreased if different transformations are considered for different ranges of colours, reddening values, luminosity classes and metallicities. For the case of unreddened stars (nearby stars and stars above the galactic plane), the fittings are those in Table 5, 6, 7 and 8. Further investigation can be done for specific cases.

4 Discussion

The fits show the dependences among colours and their scatter, which mainly depend on the reddening and range of colours and in second order on luminosity class and metallicity. The shown dependences can constitute a guide for planning on-ground observations and for building catalogues with auxiliary data for the Gaia data processing. The relationships can be used for predicting Gaia magnitudes in simulations. Relationships for different reddening values, ranges of colours, luminosity classes and metallicities will be needed for specific applications.

Once the convention for magnitudes and zero points will be established, the relationships will be reviewed.

The relationships can be considered as final because we do not expect updated values of the transmission curves (reflectivity of the mirrors, QE of CCD, transmission of filters) by Astrium. They will have to be recomputed again during the mission and the data processing once the true overall response is measured and calibrated.

5 Nominal curves from GAIA.ASF.RP.SAT.00005 (issue 5)

The colour-colour transformations in the previous sections have been repeated adopting the transmissivity of the filters as in GAIA.ASF.RP.SAT.00005 (issue 5), which are included in the GPDB (SVN revision is 592927) as `:Satellite:RP:Photometer_Transmissivity` and `:Satellite:BP:Photometer_Transmissivity`. The main change with respect to the previous transmissivity is the change of the blue cut-off in the RP filter.

The new coefficients to be included in the GPDB are listed in Tables 9 and 10 for Johnson and SDSS systems, respectively.

Acknowledgements

This work was supported by the MINECO (Spanish Ministry of Economy) - FEDER through grant ESP2013-48318-C2-1-R and ESP2014-55996-C2-1-R and MDM-2014-0369 of ICCUB (Unidad de Excelencia 'Mara de Maeztu').

TABLE 1: Coefficients of the colour-colour polynomial fittings using Johnson-Cousins passbands to the 4×131 spectra

		$(V-I)$	$(V-I)^2$	$(V-I)^3$	σ	Note
$G-V$	-0.0081	-0.1003	-0.1639	0.0086	0.03	
$G-G_{\rm RVS}$	0.0017	1.0810	-0.1694	0.0075	0.05	
$G-G_{\rm BP}$	0.0304	-0.4577	-0.0547	0.0003	0.04	
$G-G_{\rm RP}$	-0.0138	0.8084	-0.1481	0.0101	0.02	
$V-G_{\rm RVS}$	0.0098	1.1813	-0.0055	-0.0011	0.06	
$V-G_{\rm BP}$	0.0384	-0.3573	0.1092	-0.0083	0.03	
$V-G_{\rm RP}$	-0.0058	0.9087	0.0158	0.0015	0.04	
$G_{\rm BP}-G_{\rm RP}$	-0.0442	1.2661	-0.0934	0.0098	0.06	
$G-B$	0.1201	-1.2668	-0.0044	0.0020	0.23	
$G-R$	-0.0186	0.4133	-0.1814	0.0123	0.06	
$G_{\rm RVS}-B$	0.1184	-2.3478	0.1650	-0.0055	0.24	
$G_{\rm RVS}-R$	-0.0203	-0.6677	-0.0120	0.0048	0.08	
		$(V-R)$	$(V-R)^2$	$(V-R)^3$	σ	
$G-V$	-0.0028	-0.2368	-0.6894	0.0974	0.08	
$G-G_{\rm RVS}$	0.0287	2.1727	-0.7078	0.0693	0.09	
$G-G_{\rm BP}$	0.0190	-0.8891	-0.3097	0.0442	0.09	
$G-G_{\rm RP}$	0.0107	1.5717	-0.5445	0.0664	0.04	
$V-G_{\rm RVS}$	0.0315	2.4095	-0.0184	-0.0281	0.13	
$V-G_{\rm BP}$	0.0218	-0.6523	0.3796	-0.0532	0.03	
$V-G_{\rm RP}$	0.0134	1.8084	0.1449	-0.0311	0.11	
$G_{\rm BP}-G_{\rm RP}$	-0.0084	2.4607	-0.2347	0.0222	0.12	
$G-B$	0.1231	-2.6513	0.0248	0.0262	0.16	
$G-R$	-0.0028	0.7632	-0.6894	0.0974	0.08	
$G_{\rm RVS}-B$	0.0943	-4.8240	0.7326	-0.0431	0.19	
$G_{\rm RVS}-R$	-0.0315	-1.4095	0.0184	0.0281	0.13	
		$(R-I)$	$(R-I)^2$	$(R-I)^3$	σ	
$G-V$	0.0115	-0.3872	-0.3373	-0.0480	0.09	
$G-G_{\rm RVS}$	-0.0064	2.0999	-0.6047	0.0387	0.04	
$G-G_{\rm BP}$	0.0612	-1.1526	0.1532	-0.1286	0.08	
$G-G_{\rm RP}$	-0.0289	1.6620	-0.6613	0.1051	0.03	
$V-G_{\rm RVS}$	-0.0179	2.4870	-0.2674	0.0867	0.11	
$V-G_{\rm BP}$	0.0497	-0.7654	0.4905	-0.0806	0.04	
$V-G_{\rm RP}$	-0.0404	2.0492	-0.3240	0.1531	0.11	
$G_{\rm BP}-G_{\rm RP}$	-0.0901	2.8146	-0.8146	0.2337	0.10	
$G-B$	0.1048	-2.4556	0.0175	-0.0215	0.34	
$G-R$	-0.0113	0.7406	-0.5871	0.0486	0.04	
$G_{\rm RVS}-B$	0.1112	-4.5554	0.6222	-0.0602	0.37	
$G_{\rm RVS}-R$	-0.0049	-1.3593	0.0176	0.0099	0.05	

TABLE 1: Continued

		$(B-V)$	$(B-V)^2$	$(B-V)^3$	σ
$G-V$	-0.0127	-0.2924	-0.0285	-0.0842	0.53
$G-G_{\rm RVS}$	0.0841	1.1686	-0.1388	-0.0083	0.15
$G-G_{\rm BP}$	0.0161	-0.7385	0.1378	-0.0936	0.50
$G-G_{\rm RP}$	0.0348	0.9429	-0.1979	0.0181	0.12
$V-G_{\rm RVS}$	0.0968	1.4610	-0.1104	0.0760	0.62
$V-G_{\rm BP}$	0.0288	-0.4461	0.1663	-0.0094	0.04
$V-G_{\rm RP}$	0.0475	1.2354	-0.1694	0.1024	0.64
$G_{\rm BP}-G_{\rm RP}$	0.0187	1.6814	-0.3357	0.1117	0.60
$G-B$	-0.0127	-1.2924	-0.0285	-0.0842	0.53
$G-R$	0.0092	0.3818	-0.1690	-0.0154	0.24
$G_{\rm RVS}-B$	-0.0968	-2.4610	0.1104	-0.0760	0.62
$G_{\rm RVS}-R$	-0.0748	-0.7868	-0.0302	-0.0071	0.35
		$(R-I)$	$(R-I)^2$	$(R-I)^3$	σ
$G-R$	-0.0113	0.7406	-0.5871	0.0486	0.04
$R-G_{\rm RVS}$	0.0049	1.3593	-0.0176	-0.0099	0.05
$R-G_{\rm BP}$	0.0725	-1.8931	0.7403	-0.1772	0.10
$R-G_{\rm RP}$	-0.0176	0.9214	-0.0742	0.0564	0.04
		$(B-R)$	$(B-R)^2$	$(B-R)^3$	σ
$G-V$	-0.0337	-0.0105	-0.1148	-0.0003	0.28
$G-G_{\rm RVS}$	0.0658	0.7426	-0.0635	-0.0007	0.11
$G-G_{\rm BP}$	0.0021	-0.3036	-0.0411	-0.0046	0.27
$G-G_{\rm RP}$	0.0220	0.5867	-0.0769	0.0041	0.07
$V-G_{\rm RVS}$	0.0995	0.7530	0.0513	-0.0004	0.33
$V-G_{\rm BP}$	0.0358	-0.2931	0.0737	-0.0043	0.02
$V-G_{\rm RP}$	0.0557	0.5971	0.0379	0.0044	0.34
$G_{\rm BP}-G_{\rm RP}$	0.0199	0.8902	-0.0357	0.0087	0.33
$G-B$	-0.0092	-0.6769	-0.1107	0.0040	0.15
$G-R$	-0.0092	0.3231	-0.1107	0.0040	0.15
$G_{\rm RVS}-B$	-0.0751	-1.4195	-0.0472	0.0047	0.22
$G_{\rm RVS}-R$	-0.0751	-0.4195	-0.0472	0.0047	0.22

6 References

TABLE 2: Coefficients of the colour-colour polynomial fittings using SDSS passbands to the 4×131 spectra

						Note
		$(g-r)$	$(g-r)^2$	$(g-r)^3$	σ	
$G-g$	-0.0876	-0.8546	-0.1278	-0.0471	0.41	
$G-G_{\rm RVS}$	0.3062	1.0365	-0.1050	-0.0142	0.13	
$G-G_{\rm BP}$	-0.1191	-0.6143	0.0280	-0.0620	0.41	
$G-G_{\rm RP}$	0.2134	0.8162	-0.1672	0.0154	0.10	
$g-G_{\rm RVS}$	0.3939	1.8910	0.0228	0.0329	0.49	
$g-G_{\rm BP}$	-0.0315	0.2402	0.1558	-0.0149	0.01	
$g-G_{\rm RP}$	0.3010	1.6708	-0.0394	0.0625	0.50	
$G_{\rm BP}-G_{\rm RP}$	0.3325	1.4306	-0.1952	0.0774	0.50	
		$(g-i)$	$(g-i)^2$	$(g-i)^3$	σ	
$G-g$	-0.1115	-0.5263	-0.0869	0.0025	0.08	
$G-G_{\rm RVS}$	0.3497	0.6762	-0.0666	0.0004	0.08	
$G-G_{\rm BP}$	-0.1268	-0.3110	-0.0511	-0.0013	0.17	
$G-G_{\rm RP}$	0.2432	0.5081	-0.0675	0.0037	0.04	
$g-G_{\rm RVS}$	0.4611	1.2025	0.0203	-0.0022	0.11	
$g-G_{\rm BP}$	-0.0153	0.2153	0.0358	-0.0039	0.12	
$g-G_{\rm RP}$	0.3547	1.0344	0.0194	0.0011	0.11	
$G_{\rm BP}-G_{\rm RP}$	0.3700	0.8191	-0.0164	0.0050	0.21	
		$(r-i)$	$(r-i)^2$	$(r-i)^3$	σ	
$G-g$	-0.2043	-2.1613	0.2562	-0.0437	0.26	
$G-G_{\rm RVS}$	0.4433	1.9100	-0.6984	0.0787	0.05	
$G-G_{\rm BP}$	-0.1843	-1.2120	0.0543	-0.0279	0.08	
$G-G_{\rm RP}$	0.3129	1.3795	-0.5514	0.0785	0.03	
$g-G_{\rm RVS}$	0.6476	4.0713	-0.9546	0.1224	0.28	
$g-G_{\rm BP}$	0.0200	0.9493	-0.2019	0.0159	0.19	
$g-G_{\rm RP}$	0.5171	3.5408	-0.8076	0.1223	0.26	
$G_{\rm BP}-G_{\rm RP}$	0.4972	2.5915	-0.6057	0.1064	0.10	
		$(g-z)$	$(g-z)^2$	$(g-z)^3$	σ	
$G-g$	-0.1420	-0.4357	-0.0449	0.0016	0.06	
$G-G_{\rm RVS}$	0.3808	0.5300	-0.0449	0.0007	0.05	
$G-G_{\rm BP}$	-0.1450	-0.2491	-0.0299	0.0000	0.10	
$G-G_{\rm RP}$	0.2677	0.3925	-0.0417	0.0018	0.02	
$g-G_{\rm RVS}$	0.5228	0.9657	0.0000	-0.0009	0.06	
$g-G_{\rm BP}$	-0.0030	0.1866	0.0150	-0.0016	0.14	
$g-G_{\rm RP}$	0.4097	0.8282	0.0031	0.0002	0.05	
$G_{\rm BP}-G_{\rm RP}$	0.4127	0.6416	-0.0119	0.0018	0.12	
		$(r-i)$	$(r-i)^2$	$(r-i)^3$	σ	
$G-r$	-0.0487	0.1598	-0.5611	0.0628	0.06	
$r-G_{\rm RVS}$	0.4920	1.7502	-0.1373	0.0159	0.09	
$r-G_{\rm BP}$	-0.1356	-1.3718	0.6154	-0.0906	0.09	
$r-G_{\rm RP}$	0.3616	1.2197	0.0097	0.0158	0.07	

TABLE 3: Coefficients of the colour-colour polynomial fittings using GSC-II passbands to the 4×131 spectra

$\delta > 0$ deg		$(B_J - R_F)$	$(B_J - R_F)^2$	$(B_J - R_F)^3$	σ
$G - V$	-0.0219	-0.1236	-0.0338	-0.0356	0.39
$G - G_{\rm RVS}$	0.0549	0.7740	-0.0168	-0.0123	0.13
$G - G_{\rm BP}$	0.0191	-0.4445	0.0473	-0.0372	0.37
$G - G_{\rm RP}$	0.0118	0.6500	-0.0828	0.0046	0.09
$B_J - G_{\rm RVS}$	0.0654	1.4834	0.0192	0.0178	0.40
$B_J - G_{\rm BP}$	0.0296	0.2649	0.0833	-0.0071	0.04
$B_J - G_{\rm RP}$	0.0223	1.3594	-0.0467	0.0346	0.41
$R_F - G_{\rm RVS}$	0.0654	0.4834	0.0192	0.0178	0.40
$R_F - G_{\rm BP}$	0.0296	-0.7351	0.0833	-0.0071	0.04
$R_F - G_{\rm RP}$	0.0223	0.3594	-0.0467	0.0346	0.41
$G_{\rm BP} - G_{\rm RP}$	-0.0073	1.0945	-0.1300	0.0418	0.44
$\delta \leq 0$ deg		$(B_J - R_F)$	$(B_J - R_F)^2$	$(B_J - R_F)^3$	σ
$G - V$	-0.0207	-0.1331	-0.0495	-0.0400	0.40
$G - G_{\rm RVS}$	0.0575	0.8412	-0.0262	-0.0142	0.13
$G - G_{\rm BP}$	0.0190	-0.4787	0.0460	-0.0426	0.38
$G - G_{\rm RP}$	0.0138	0.7042	-0.0990	0.0060	0.09
$B_J - G_{\rm RVS}$	0.0722	1.5597	0.0276	0.0197	0.42
$B_J - G_{\rm BP}$	0.0337	0.2398	0.0998	-0.0087	0.03
$B_J - G_{\rm RP}$	0.0285	1.4227	-0.0452	0.0399	0.43
$R_F - G_{\rm RVS}$	0.0722	0.5597	0.0276	0.0197	0.42
$R_F - G_{\rm BP}$	0.0337	-0.7602	0.0998	-0.0087	0.03
$R_F - G_{\rm RP}$	0.0285	0.4227	-0.0452	0.0399	0.43
$G_{\rm BP} - G_{\rm RP}$	-0.0052	1.1830	-0.1450	0.0486	0.46

TABLE 4: Coefficients of the colour-colour polynomial fittings using two colours and to the 4×131 spectra

		$(V-I)$	$(V-I)^2$	$(V-I)^3$	$(B-V)$	$(B-V)^2$	$(B-V)^3$	$(V-I)(B-V)$	σ
$G-V$	-0.0046	-0.2667	-0.1463	0.0043	0.2565	-0.2278	0.0202	0.1178	0.02
$G-G_{\rm RVS}$	-0.0101	1.2750	-0.2491	0.0113	-0.1556	-0.0987	0.0148	0.1080	0.04
$G-G_{\rm BP}$	0.0248	-0.2650	-0.1430	0.0053	-0.2207	-0.0183	-0.0044	0.1095	0.03
$G-G_{\rm RP}$	-0.0167	0.7177	-0.1037	0.0066	0.1643	-0.0793	0.0189	-0.0337	0.01
$V-G_{\rm RVS}$	-0.0055	1.5417	-0.1028	0.0070	-0.4121	0.1290	-0.0053	-0.0097	0.05
$V-G_{\rm BP}$	0.0294	0.0016	0.0033	0.0011	-0.4771	0.2094	-0.0246	-0.0083	0.02
$V-G_{\rm RP}$	-0.0122	0.9843	0.0426	0.0024	-0.0922	0.1485	-0.0013	-0.1515	0.03
$G_{\rm BP}-G_{\rm RP}$	-0.0416	0.9827	0.0393	0.0013	0.3850	-0.0610	0.0233	-0.1432	0.04
		$(g-i)$	$(g-i)^2$	$(g-i)^3$	$(g-r)$	$(g-r)^2$	$(g-r)^3$	$(g-r)(g-i)$	σ
$G-g$	-0.1026	-0.5442	-0.2816	-0.0004	0.0614	-0.7819	0.0263	0.7748	0.04
$G-G_{\rm RVS}$	0.4156	1.5239	-0.3479	0.0086	-1.2953	-0.1284	-0.0137	0.4773	0.06
$G-G_{\rm BP}$	-0.1311	-0.4840	-0.2919	0.0011	0.2015	-0.5419	0.0052	0.7396	0.04
$G-G_{\rm RP}$	0.2690	0.8532	-0.1166	0.0061	-0.5139	0.0791	-0.0032	0.0033	0.02
$g-G_{\rm RVS}$	0.5182	2.0681	-0.0663	0.0090	-1.3567	0.6535	-0.0400	-0.2975	0.08
$g-G_{\rm BP}$	-0.0285	0.0602	-0.0103	0.0015	0.1401	0.2400	-0.0212	-0.0352	0.01
$g-G_{\rm RP}$	0.3716	1.3974	0.1650	0.0065	-0.5753	0.8610	-0.0296	-0.7715	0.05
$G_{\rm BP}-G_{\rm RP}$	0.4001	1.3372	0.1753	0.0049	-0.7153	0.6210	-0.0084	-0.7363	0.05
		$(r-i)$	$(r-i)^2$	$(r-i)^3$	$(g-r)$	$(g-r)^2$	$(g-r)^3$	$(g-r)(r-i)$	σ
$G-g$	-0.1110	-0.6997	-0.1735	-0.0207	-0.3858	-0.3274	0.0319	0.2005	0.03
$G-G_{\rm RVS}$	0.4254	1.6431	-0.5506	0.0553	0.1679	-0.0576	0.0118	-0.0170	0.05
$G-G_{\rm BP}$	-0.1391	-0.6437	-0.2033	-0.0139	-0.1804	-0.1505	0.0164	0.1805	0.03
$G-G_{\rm RP}$	0.2732	0.8870	-0.2264	0.0329	0.3281	-0.0893	0.0169	-0.0885	0.02
$g-G_{\rm RVS}$	0.5363	2.3427	-0.3772	0.0760	0.5537	0.2698	-0.0201	-0.2175	0.07
$g-G_{\rm BP}$	-0.0282	0.0560	-0.0298	0.0068	0.2054	0.1769	-0.0154	-0.0200	0.01
$g-G_{\rm RP}$	0.3842	1.5867	-0.0529	0.0536	0.7139	0.2381	-0.0149	-0.2890	0.05
$G_{\rm BP}-G_{\rm RP}$	0.4123	1.5307	-0.0231	0.0467	0.5084	0.0612	0.0005	-0.2690	0.05

TABLE 5: Coefficients of the colour-colour polynomial fittings using one colour Johnson-Cousins passbands to the unreddened 131 spectra

		$(V-I)$	$(V-I)^2$	$(V-I)^3$	σ
$G-V$	-0.0221	-0.0617	-0.1778	0.0097	0.03
$G-G_{\rm RVS}$	-0.0067	1.0460	-0.1611	0.0058	0.03
$G-G_{\rm BP}$	0.0295	-0.4904	-0.0330	-0.0031	0.04
$G-G_{\rm RP}$	-0.0238	0.8465	-0.1733	0.0142	0.02
$V-G_{\rm RVS}$	0.0154	1.1077	0.0166	-0.0039	0.04
$V-G_{\rm BP}$	0.0516	-0.4287	0.1448	-0.0128	0.03
$V-G_{\rm RP}$	-0.0017	0.9082	0.0045	0.0046	0.04
$G_{\rm BP}-G_{\rm RP}$	-0.0533	1.3369	-0.1403	0.0173	0.06
$G-B$	0.0359	-1.3803	0.1390	-0.0121	0.13
$G-R$	-0.0236	0.5379	-0.2636	0.0228	0.04
$G_{\rm RVS}-B$	0.0426	-2.4263	0.3002	-0.0179	0.12
$G_{\rm RVS}-R$	-0.0169	-0.5082	-0.1025	0.0170	0.06
		$(V-R)$	$(V-R)^2$	$(V-R)^3$	σ
$G-V$	-0.0227	0.1741	-1.2716	0.2514	0.06
$G-G_{\rm RVS}$	-0.0038	1.9670	-0.4911	0.0089	0.06
$G-G_{\rm BP}$	0.0282	-0.6728	-0.6906	0.1493	0.07
$G-G_{\rm RP}$	-0.0219	1.5680	-0.5095	0.0601	0.03
$V-G_{\rm RVS}$	0.0189	1.7929	0.7805	-0.2425	0.10
$V-G_{\rm BP}$	0.0509	-0.8470	0.5810	-0.1021	0.03
$V-G_{\rm RP}$	0.0008	1.3939	0.7622	-0.1913	0.09
$G_{\rm BP}-G_{\rm RP}$	-0.0500	2.2409	0.1812	-0.0892	0.10
$G-B$	0.0350	-2.4062	-0.0217	0.0691	0.09
$G-R$	-0.0227	1.1741	-1.2716	0.2514	0.06
$G_{\rm RVS}-B$	0.0389	-4.3732	0.4695	0.0602	0.10
$G_{\rm RVS}-R$	-0.0189	-0.7929	-0.7805	0.2425	0.10
		$(R-I)$	$(R-I)^2$	$(R-I)^3$	σ
$G-V$	-0.0203	-0.3956	-0.1968	-0.0816	0.06
$G-G_{\rm RVS}$	-0.0065	2.2396	-0.8564	0.1093	0.04
$G-G_{\rm BP}$	0.0311	-1.2828	0.4233	-0.1991	0.05
$G-G_{\rm RP}$	-0.0236	1.8314	-0.9139	0.1830	0.03
$V-G_{\rm RVS}$	0.0138	2.6352	-0.6596	0.1908	0.06
$V-G_{\rm BP}$	0.0514	-0.8872	0.6201	-0.1175	0.03
$V-G_{\rm RP}$	-0.0033	2.2270	-0.7171	0.2645	0.07
$G_{\rm BP}-G_{\rm RP}$	-0.0547	3.1142	-1.3371	0.3821	0.07
$G-B$	0.0299	-3.0155	0.9662	-0.2088	0.19
$G-R$	-0.0205	0.9482	-0.7872	0.0949	0.03
$G_{\rm RVS}-B$	0.0364	-5.2552	1.8226	-0.3180	0.20
$G_{\rm RVS}-R$	-0.0140	-1.2914	0.0692	-0.0143	0.03

TABLE 5: Continued

$G-V>-1.$		$(B-V)$	$(B-V)^2$	$(B-V)^3$	σ
$G-V$	-0.0346	-0.0618	-0.0949	-0.0833	0.08
$G-G_{\rm RVS}$	0.0859	1.1984	-0.6148	0.2385	0.08
$G-G_{\rm BP}$	-0.0139	-0.5605	0.2012	-0.1537	0.07
$G-G_{\rm RP}$	0.0407	0.9334	-0.4262	0.1420	0.05
$V-G_{\rm RVS}$	0.1205	1.2602	-0.5199	0.3217	0.16
$V-G_{\rm BP}$	0.0207	-0.4987	0.2961	-0.0704	0.01
$V-G_{\rm RP}$	0.0752	0.9952	-0.3313	0.2253	0.13
$G_{\rm BP}-G_{\rm RP}$	0.0545	1.4939	-0.6274	0.2957	0.12
$G-B$	-0.0346	-1.0618	-0.0949	-0.0833	0.08
$G-R$	-0.0013	0.4716	-0.1581	-0.0322	0.03
$G_{\rm RVS}-B$	-0.1205	-2.2602	0.5199	-0.3217	0.16
$G_{\rm RVS}-R$	-0.0872	-0.7269	0.4567	-0.2707	0.11
		$(R-I)$	$(R-I)^2$	$(R-I)^3$	σ
$G-R$	-0.0205	0.9482	-0.7872	0.0949	0.03
$R-G_{\rm RVS}$	0.0140	1.2914	-0.0692	0.0143	0.03
$R-G_{\rm BP}$	0.0516	-2.2310	1.2105	-0.2940	0.07
$R-G_{\rm RP}$	-0.0031	0.8832	-0.1266	0.0880	0.02
$G-V>-1.$		$(B-R)$	$(B-R)^2$	$(B-R)^3$	σ
$G-V$	-0.0376	-0.0505	-0.0118	-0.0311	0.05
$G-G_{\rm RVS}$	0.0661	0.8104	-0.2893	0.0719	0.06
$G-G_{\rm BP}$	-0.0062	-0.3823	0.1083	-0.0472	0.04
$G-G_{\rm RP}$	0.0248	0.6287	-0.1987	0.0430	0.03
$V-G_{\rm RVS}$	0.1037	0.8609	-0.2775	0.1031	0.11
$V-G_{\rm BP}$	0.0314	-0.3318	0.1201	-0.0161	0.02
$V-G_{\rm RP}$	0.0624	0.6792	-0.1869	0.0741	0.08
$G_{\rm BP}-G_{\rm RP}$	0.0310	1.0110	-0.3070	0.0902	0.07
$G-B$	-0.0128	-0.6936	-0.0520	-0.0139	0.02
$G-R$	-0.0128	0.3064	-0.0520	-0.0139	0.02
$G_{\rm RVS}-B$	-0.0789	-1.5040	0.2373	-0.0859	0.08
$G_{\rm RVS}-R$	-0.0789	-0.5040	0.2373	-0.0859	0.08

TABLE 6: Coefficients of the colour-colour polynomial fittings using one colour SDSS pass-bands to the unreddened 131 spectra

$G-g>-2.$		$(g-r)$	$(g-r)^2$	$(g-r)^3$	σ	Note
$G-g$	-0.0849	-0.6881	-0.0407	-0.1734	0.06	
$G-G_{\rm RVS}$	0.3176	0.9149	-0.5129	0.2989	0.07	
$G-G_{\rm BP}$	-0.1319	-0.4550	0.1793	-0.2243	0.06	
$G-G_{\rm RP}$	0.2205	0.7326	-0.3577	0.1759	0.04	
$g-G_{\rm RVS}$	0.4025	1.6031	-0.4722	0.4723	0.12	
$g-G_{\rm BP}$	-0.0469	0.2331	0.2201	-0.0509	0.01	
$g-G_{\rm RP}$	0.3054	1.4207	-0.3169	0.3493	0.09	
$G_{\rm BP}-G_{\rm RP}$	0.3523	1.1876	-0.5370	0.4003	0.09	
		$(g-i)$	$(g-i)^2$	$(g-i)^3$	σ	
$G-g$	-0.1130	-0.5216	-0.0834	0.0005	0.06	
$G-G_{\rm RVS}$	0.2948	0.6223	-0.0294	-0.0055	0.06	
$G-G_{\rm BP}$	-0.0980	-0.3048	-0.0771	-0.0018	0.12	
$G-G_{\rm RP}$	0.2218	0.4901	-0.0529	0.0028	0.04	
$g-G_{\rm RVS}$	0.4078	1.1439	0.0539	-0.0060	0.09	
$g-G_{\rm BP}$	0.0149	0.2168	0.0063	-0.0023	0.08	
$g-G_{\rm RP}$	0.3347	1.0117	0.0305	0.0023	0.09	
$G_{\rm BP}-G_{\rm RP}$	0.3198	0.7949	0.0243	0.0045	0.15	
$G-g>-2.$		$(g-i)$	$(g-i)^2$	$(g-i)^3$	σ	
$G-g$	-0.1020	-0.5314	-0.1121	0.0165	0.01	
$G-G_{\rm RVS}$	0.3501	0.6246	-0.1550	0.0429	0.04	
$G-G_{\rm BP}$	-0.1444	-0.3349	0.0181	-0.0244	0.01	
$G-G_{\rm RP}$	0.2504	0.4963	-0.1161	0.0246	0.01	
$g-G_{\rm RVS}$	0.4521	1.1560	-0.0429	0.0263	0.03	
$g-G_{\rm BP}$	-0.0424	0.1965	0.1301	-0.0409	0.02	
$g-G_{\rm RP}$	0.3524	1.0277	-0.0041	0.0080	0.01	
$G_{\rm BP}-G_{\rm RP}$	0.3948	0.8312	-0.1342	0.0489	0.02	
$G-g>-2.$		$(r-i)$	$(r-i)^2$	$(r-i)^3$	σ	
$G-g$	-0.2184	-1.9227	-0.9777	1.2153	0.07	
$G-G_{\rm RVS}$	0.4488	1.9432	-0.9340	0.1455	0.03	
$G-G_{\rm BP}$	-0.2033	-1.1745	-0.1556	0.2826	0.03	
$G-G_{\rm RP}$	0.3340	1.5134	-0.8337	0.1350	0.02	
$g-G_{\rm RVS}$	0.6671	3.8660	0.0436	-1.0698	0.09	
$g-G_{\rm BP}$	0.0151	0.7482	0.8221	-0.9327	0.04	
$g-G_{\rm RP}$	0.5523	3.4361	0.1440	-1.0803	0.08	
$G_{\rm BP}-G_{\rm RP}$	0.5372	2.6879	-0.6781	-0.1476	0.05	

TABLE 6: Continued

$G-g>-2.$		$(g-z)$	$(g-z)^2$	$(g-z)^3$	σ
$G-g$	-0.1356	-0.4632	-0.0861	0.0174	0.02
$G-G_{\rm RVS}$	0.3848	0.5016	-0.0789	0.0147	0.02
$G-G_{\rm BP}$	-0.1632	-0.2814	-0.0033	-0.0065	0.01
$G-G_{\rm RP}$	0.2786	0.3975	-0.0604	0.0074	0.01
$g-G_{\rm RVS}$	0.5205	0.9648	0.0072	-0.0027	0.01
$g-G_{\rm BP}$	-0.0275	0.1817	0.0828	-0.0239	0.02
$g-G_{\rm RP}$	0.4142	0.8607	0.0258	-0.0100	0.02
$G_{\rm BP}-G_{\rm RP}$	0.4418	0.6789	-0.0571	0.0139	0.02
		$(r-i)$	$(r-i)^2$	$(r-i)^3$	σ
$G-r$	-0.0307	0.3696	-0.7573	0.1053	0.04
$r-G_{\rm RVS}$	0.4728	1.5429	-0.0756	0.0164	0.06
$r-G_{\rm BP}$	-0.1982	-1.5442	1.0413	-0.2128	0.06
$r-G_{\rm RP}$	0.3602	1.1144	-0.0128	0.0432	0.04

TABLE 7: Coefficients of the colour-colour polynomial fittings using Tycho-2 passbands to the 4×131 spectra, and for the unreddened stars

All		(B_T-V_T)	$(B_T-V_T)^2$	$(B_T-V_T)^3$	σ	Note
$G-V_T$	-0.0211	-0.3603	-0.1364	-0.0092	0.61	
$G-G_{\rm RVS}$	0.1166	1.1440	-0.2233	0.0176	0.17	
$G-G_{\rm BP}$	-0.0037	-0.6325	0.0185	-0.0251	0.55	
$G-G_{\rm RP}$	0.0599	0.8819	-0.2008	0.0198	0.14	
$V_T-G_{\rm RVS}$	0.1377	1.5043	-0.0869	0.0269	0.72	
$V_T-G_{\rm BP}$	0.0174	-0.2722	0.1549	-0.0158	0.06	
$V_T-G_{\rm RP}$	0.0810	1.2422	-0.0644	0.0291	0.73	
$G_{\rm BP}-G_{\rm RP}$	0.0636	1.5144	-0.2193	0.0449	0.67	
unreddened		(B_T-V_T)	$(B_T-V_T)^2$	$(B_T-V_T)^3$	σ	Note
$G-V_T>-1.$						
$G-V_T$	-0.0245	-0.1876	-0.1500	0.0143	0.07	
$G-G_{\rm RVS}$	0.0958	1.0490	-0.4044	0.1005	0.07	
$G-G_{\rm BP}$	-0.0132	-0.4912	0.0653	-0.0313	0.05	
$G-G_{\rm RP}$	0.0488	0.8216	-0.2919	0.0601	0.04	
$V_T-G_{\rm RVS}$	0.1204	1.2366	-0.2544	0.0862	0.14	
$V_T-G_{\rm BP}$	0.0113	-0.3037	0.2152	-0.0455	0.02	
$V_T-G_{\rm RP}$	0.0733	1.0092	-0.1419	0.0458	0.11	
$G_{\rm BP}-G_{\rm RP}$	0.0620	1.3129	-0.3571	0.0913	0.09	

TABLE 8: Coefficients of the colour-colour polynomial fittings using GSC-II passbands for the unreddened stars with $B_J - R_F < 2$.

$\delta > 0$ deg		$(B_J - R_F)$	$(B_J - R_F)^2$	$(B_J - R_F)^3$	σ
$G - V$	-0.0394	-0.0345	0.0251	-0.0932	0.23
$G - G_{\rm RVS}$	0.0609	0.8622	-0.3474	0.1141	0.10
$G - G_{\rm BP}$	-0.0086	-0.3927	0.1821	-0.1229	0.22
$G - G_{\rm RP}$	0.0204	0.6669	-0.2355	0.0710	0.08
$V - G_{\rm RVS}$	0.1003	0.8967	-0.3725	0.2072	0.32
$V - G_{\rm BP}$	0.0308	-0.3582	0.1570	-0.0297	0.02
$V - G_{\rm RP}$	0.0599	0.7014	-0.2606	0.1642	0.31
$G_{\rm BP} - G_{\rm RP}$	0.0291	1.0596	-0.4175	0.1939	0.30
$G - B_J$	-0.0269	-0.6333	0.0198	-0.0837	0.20
$G - R_F$	-0.0269	0.3667	0.0198	-0.0837	0.20
$G_{\rm RVS} - B_J$	-0.0878	-1.4955	0.3672	-0.1978	0.29
$G_{\rm RVS} - R_F$	-0.0878	-0.4955	0.3672	-0.1978	0.29
$\delta < 0$ deg		$(B_J - R_F)$	$(B_J - R_F)^2$	$(B_J - R_F)^3$	σ
$G - V$	-0.0326	-0.0211	-0.0261	-0.0962	0.29
$G - G_{\rm RVS}$	0.0634	0.9243	-0.3963	0.1435	0.12
$G - G_{\rm BP}$	-0.0011	-0.4042	0.1379	-0.1217	0.28
$G - G_{\rm RP}$	0.0212	0.7136	-0.2613	0.0861	0.10
$V - G_{\rm RVS}$	0.0960	0.9454	-0.3701	0.2397	0.41
$V - G_{\rm BP}$	0.0315	-0.3831	0.1640	-0.0255	0.02
$V - G_{\rm RP}$	0.0538	0.7347	-0.2352	0.1823	0.39
$G_{\rm BP} - G_{\rm RP}$	0.0224	1.1178	-0.3992	0.2078	0.38
$G - B_J$	-0.0245	-0.6201	-0.0339	-0.0832	0.26
$G - R_F$	-0.0245	0.3799	-0.0339	-0.0832	0.26
$G_{\rm RVS} - B_J$	-0.0878	-1.5444	0.3624	-0.2266	0.38
$G_{\rm RVS} - R_F$	-0.0878	-0.5444	0.3624	-0.2266	0.38

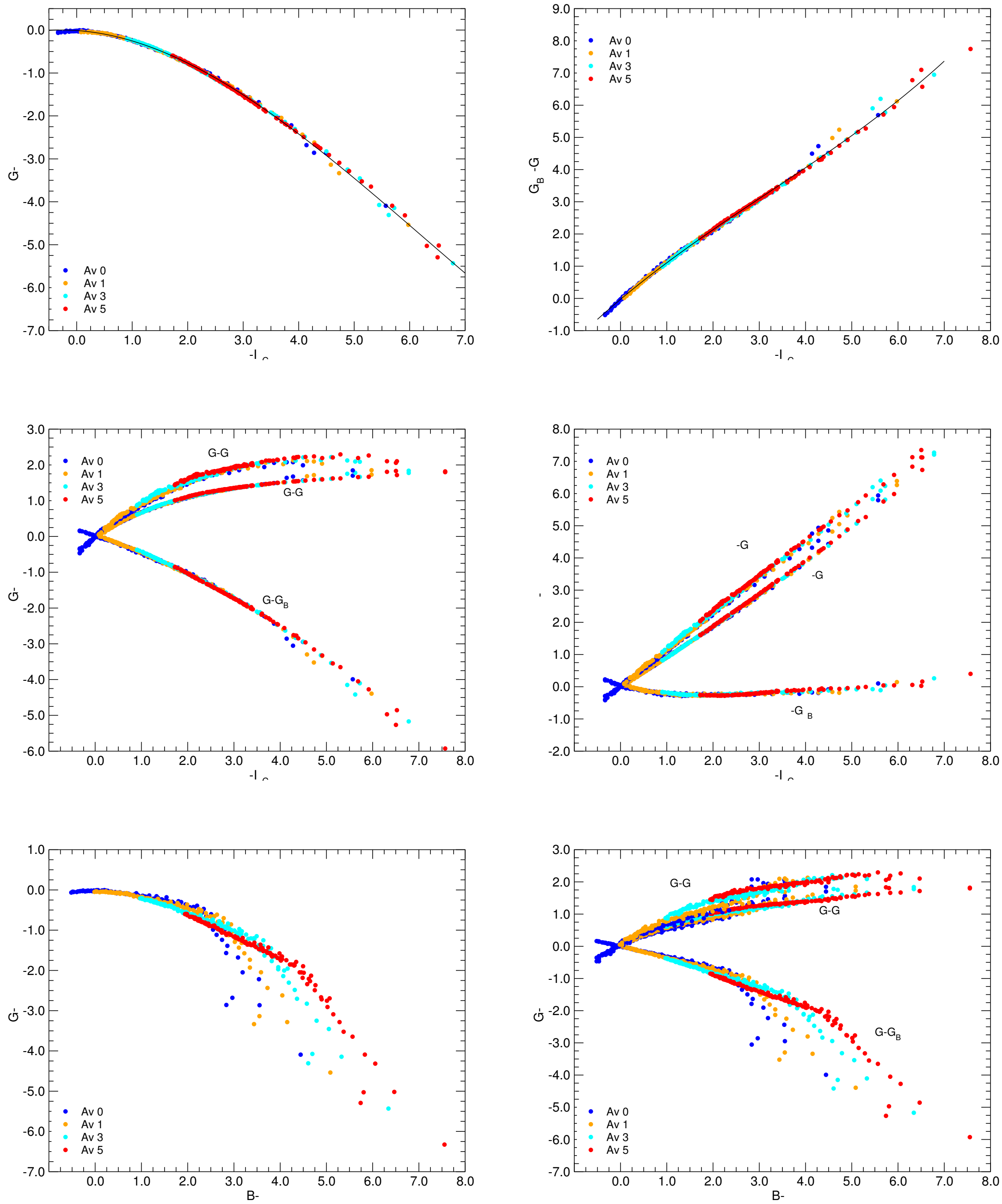

FIGURE 3: Colour-colour diagrams involving Gaia four passbands and Johnson-Cousins B, V and I_c passbands. Different colours are used for different absorption values.

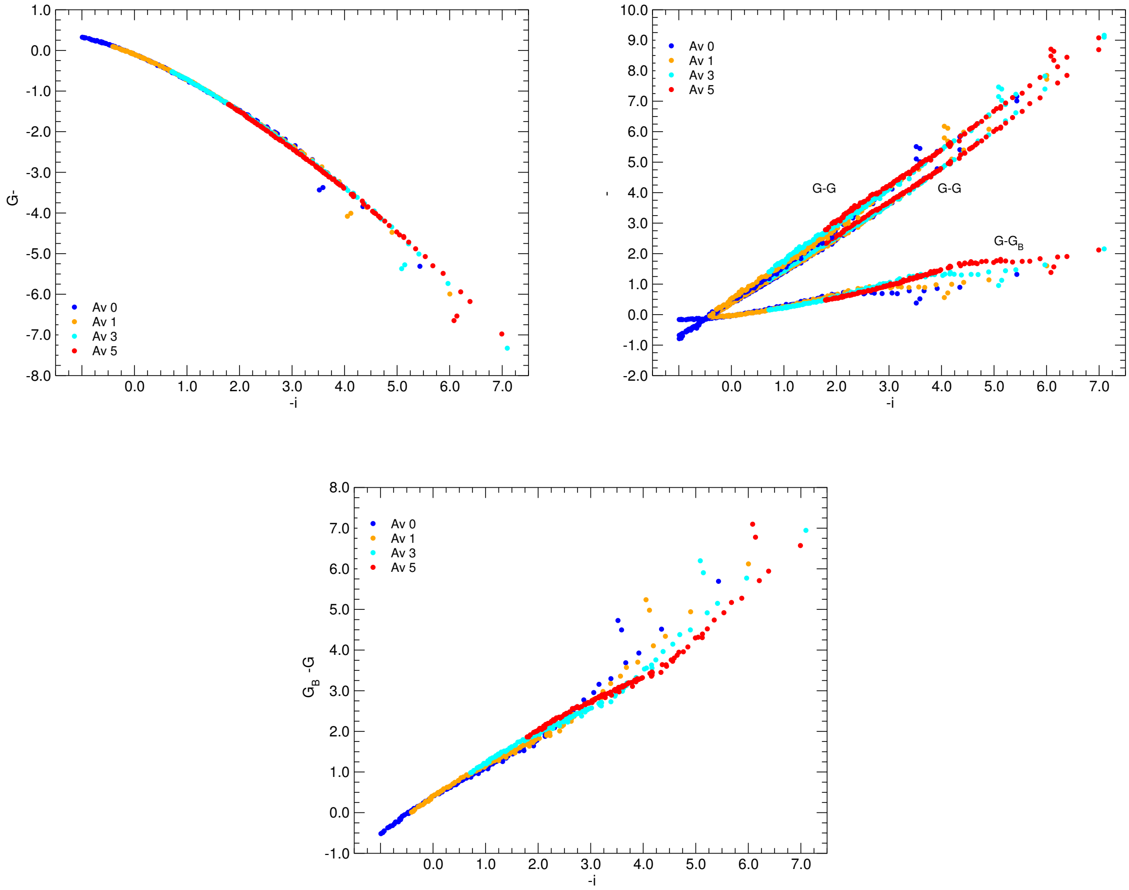

FIGURE 4: Colour-colour diagrams involving Gaia four passbands and SDSS passbands.

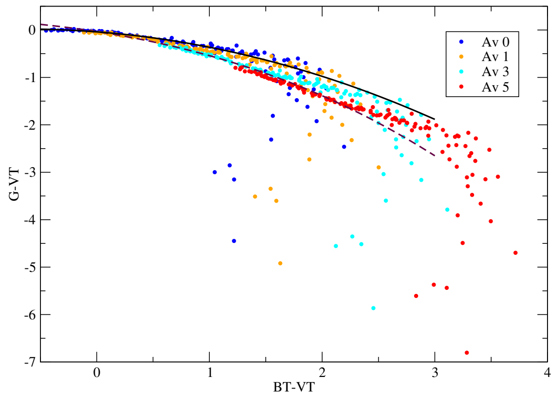

FIGURE 5: Colour-colour diagrams involving Gaia G passband and Tycho-2 passbands. The colour of symbols correspond to the different as in Fig.3. Solid line corresponds to the polynomial fit to unreddened stars with $G - V_T > -1$ and dashed line to all stars.

TABLE 9: Coefficients of the colour-colour polynomial fittings using Johnson-Cousins passbands to the 4×131 spectra, and using the transmissivity curves in Sec. 5.

		$(V-I)$	$(V-I)^2$	$(V-I)^3$	σ	Note
$G-G_{BP}$	0.0218	-0.4108	-0.0600	0.0005	0.05	
$G-G_{RP}$	-0.0122	0.7833	-0.1452	0.0100	0.02	
$V-G_{BP}$	0.0301	-0.3098	0.1038	-0.0081	0.04	
$V-G_{RP}$	-0.0040	0.8843	0.0186	0.0014	0.04	
$G_{BP}-G_{RP}$	-0.0341	1.1941	-0.0852	0.0095	0.07	
		$(V-R)$	$(V-R)^2$	$(V-R)^3$	σ	Note
$G-G_{BP}$	0.0114	-0.7913	-0.3338	0.0466	0.10	
$G-G_{RP}$	0.0102	1.5217	-0.5322	0.0653	0.04	
$V-G_{BP}$	0.0142	-0.5546	0.3556	-0.0508	0.04	
$V-G_{RP}$	0.0129	1.7585	0.1572	-0.0321	0.11	
$G_{BP}-G_{RP}$	-0.0012	2.3131	-0.1984	0.0188	0.13	
		$(R-I)$	$(R-I)^2$	$(R-I)^3$	σ	Note
$G-G_{BP}$	0.0529	-1.0693	0.1431	-0.1299	0.07	
$G-G_{RP}$	-0.0254	1.6115	-0.6502	0.1043	0.03	
$V-G_{BP}$	0.0422	-0.6808	0.4807	-0.0819	0.04	
$V-G_{RP}$	-0.0361	2.0000	-0.3126	0.1523	0.11	
$G_{BP}-G_{RP}$	-0.0783	2.6808	-0.7933	0.2342	0.09	
		$(BP-RP)$	$(BP-RP)^2$	$(BP-RP)^3$	σ	Note
$G-G_{RVS}$	0.0386	0.9457	-0.1149	0.0022	0.06	

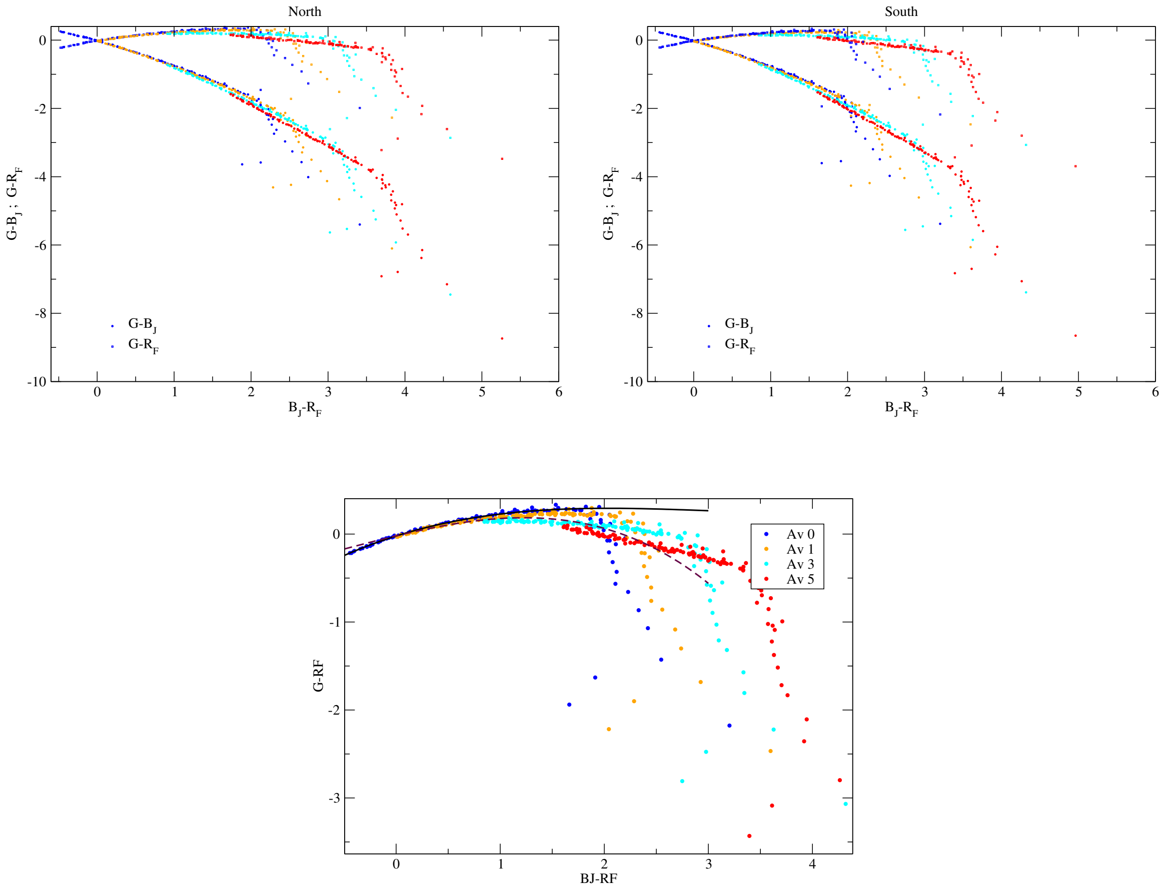

FIGURE 6: Colour-colour diagrams involving Gaia G passband and GSC-II passbands. Filled symbols correspond to B_J and open squares to R_F. The colour of symbols correspond to the different absorptions as in Fig.4. Solid line corresponds to the polynomial fit to unreddened stars with $B_J - R_F < 2.$ and dashed line to all stars.

TABLE 10: Coefficients of the colour-colour polynomial fittings using one colour SDSS pass-bands to the 4×131 spectra, and using the transmissivity curves in Sec. 5.

		$(g-r)$	$(g-r)^2$	$(g-r)^3$	σ	Note
$G-G_{\rm BP}$	-0.1133	-0.5728	0.0268	-0.0614	0.41	
$G-G_{\rm RP}$	0.2063	0.7922	-0.1662	0.0157	0.09	
$g-G_{\rm BP}$	-0.0257	-0.7182	0.1546	-0.0143	0.01	
$g-G_{\rm RP}$	0.2939	0.6468	-0.0384	0.0628	0.49	
$G_{\rm BP}-G_{\rm RP}$	0.3196	1.3651	-0.1930	0.0771	0.50	
		$(g-i)$	$(g-i)^2$	$(g-i)^3$	σ	
$G-G_{\rm BP}$	-0.1190	-0.2824	-0.0524	-0.0013	0.18	
$G-G_{\rm RP}$	0.2353	0.4927	-0.0667	0.0037	0.04	
$g-G_{\rm BP}$	-0.0076	0.2439	0.0345	-0.0039	0.12	
$g-G_{\rm RP}$	0.3467	1.0190	0.0202	0.0011	0.11	
$G_{\rm BP}-G_{\rm RP}$	0.3543	0.7751	-0.0143	0.0050	0.21	
		$(r-i)$	$(r-i)^2$	$(r-i)^3$	σ	
$G-G_{\rm BP}$	-0.1724	-1.1207	0.0267	-0.0247	0.08	
$G-G_{\rm RP}$	0.3027	1.3332	-0.5376	0.0770	0.03	
$g-G_{\rm BP}$	0.0319	1.0406	-0.2295	0.0190	0.20	
$g-G_{\rm RP}$	0.5070	3.4944	-0.7938	0.1207	0.26	
$G_{\rm BP}-G_{\rm RP}$	0.4751	2.4539	-0.5643	0.1017	0.09	
		$(g-z)$	$(g-z)^2$	$(g-z)^3$	σ	
$G-G_{\rm BP}$	-0.1359	-0.2262	-0.0309	-0.0000	0.10	
$G-G_{\rm RP}$	0.2590	0.3803	-0.0411	0.0018	0.02	
$g-G_{\rm BP}$	0.0061	0.2095	0.0140	-0.0016	0.15	
$g-G_{\rm RP}$	0.4010	0.8160	0.0038	0.0002	0.05	
$G_{\rm BP}-G_{\rm RP}$	0.3949	0.6065	-0.0103	0.0018	0.12	