Gaia module

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Outline

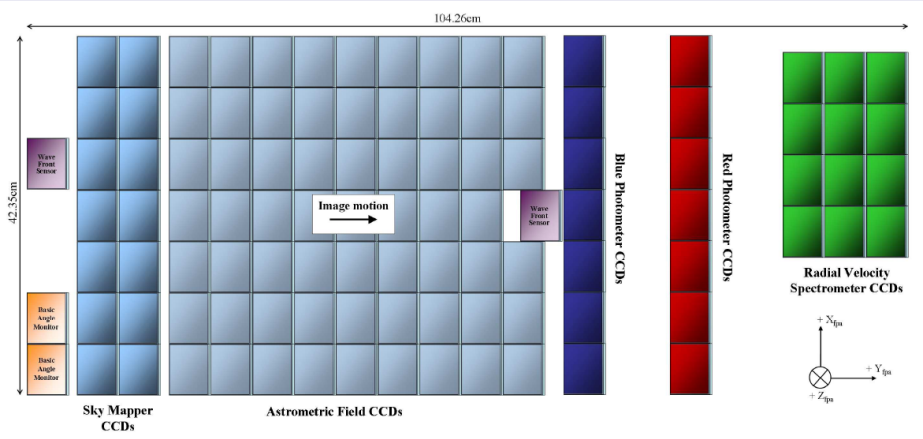
Motivation

Gaia module

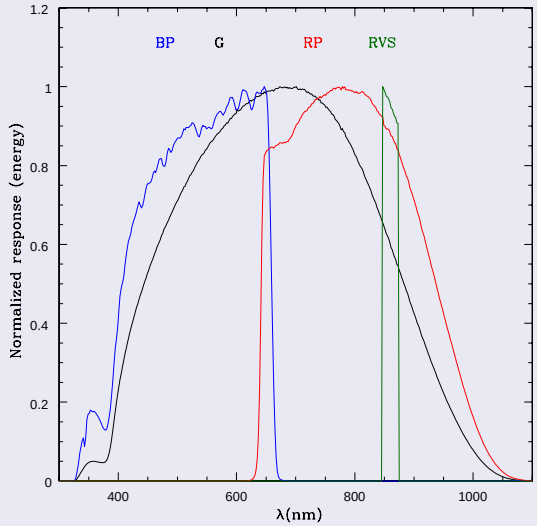
- The scientific community needs to be prepared to analyse the data from *Gaia*.
- We provide data in order to know in advance how *Gaia* photometry will be.
- We provide relationships among colours involving *Gaia* magnitudes (white light G, blue $G_{\rm BP}$, red $G_{\rm RP}$ and RVS bands) and colours from other commonly used photometric systems (Johnson-Cousins, Sloan, Hipparcos and Tycho).
- These relationships were obtained using sources with different reddening values, range of colours, luminosity classes and metallicities.
- We added an error model to obtain *Gaia* magnitudes and parallaxes affected by observational errors.

Ingredients

Gaia photometry



Focal plane (courtesy of ESA, A. Short).



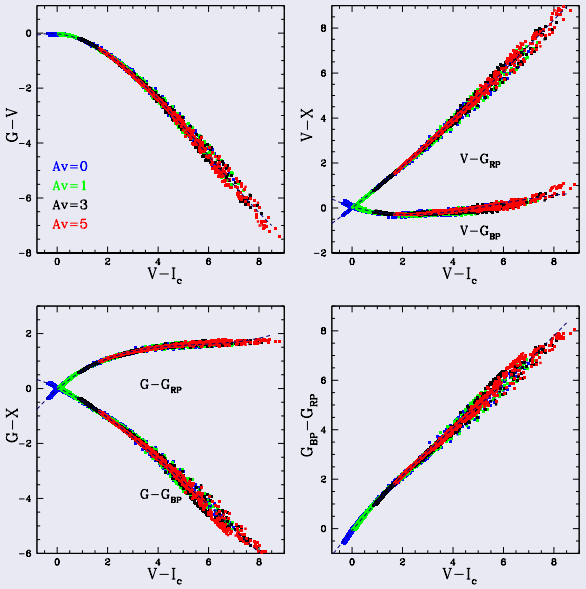
Gaia passbands.

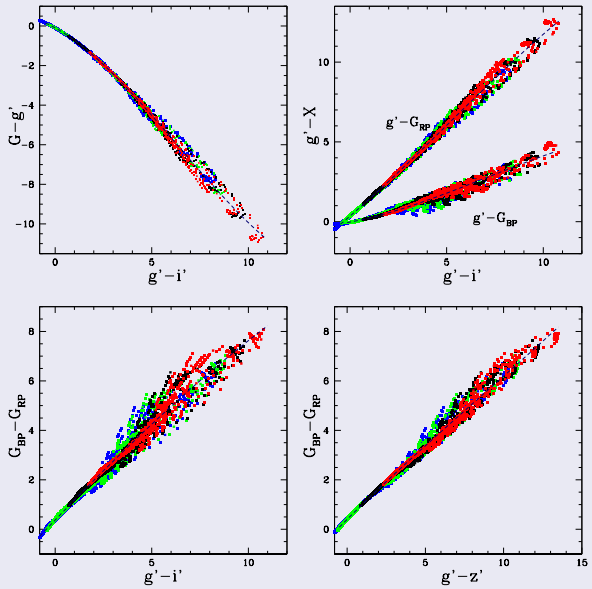
Band	G	$G_{\rm BP}$	$G_{\rm RP}$	G_{RVS}
$\lambda_{\rm min}$ (nm)	350	350	650	847
$\lambda_{\rm max}$ (nm)	1000	650	1000	874
$\lambda_{\rm o}$ (nm)	638	517	786	860
$\Delta\lambda$ (nm)	433	263	277	28

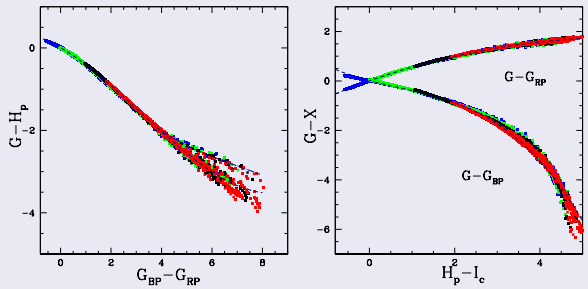
- spectrophotometry (BP/RP): chromaticity, astrophysics

Results (Jordi et al, 2010, A&A 523, 48)

Transformations







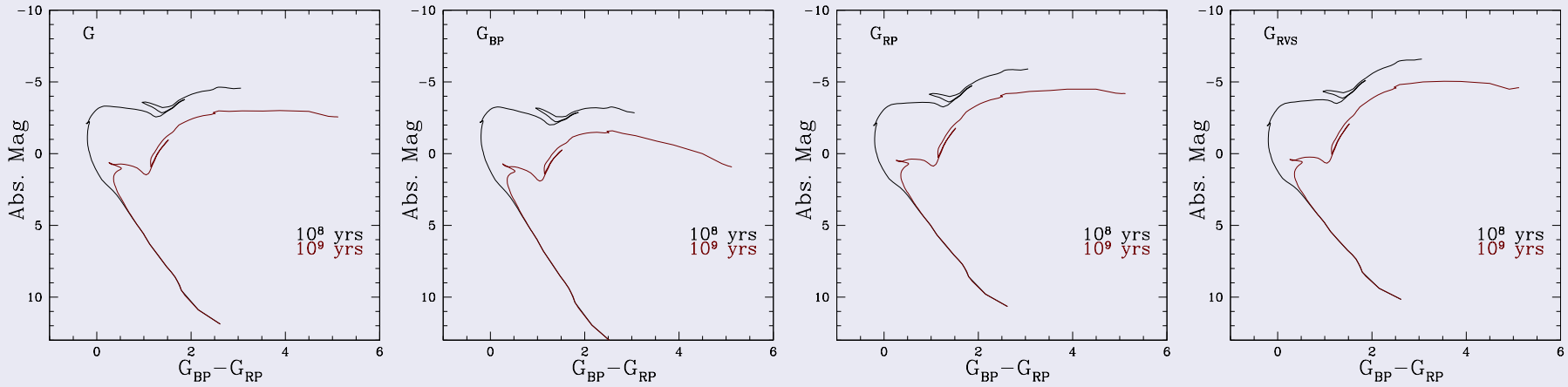
Johnson-Cousins: $V - I_c$ relationships have the lowest residuals. $B - V$ show large scatter. The residuals increase for $T_{\rm eff} < 4500$ K in all cases. Among cool stars, scattering exists due to the logg and [M/H].

SDSS: $g' - i'$ relationships more sensitive to reddening than $V - I_C$. $G_{\rm BP} - G_{\rm RP}$ correlates better with $g' - z'$ than with $g' - i'$. Larger residuals than with Johnson passbands. The dispersion increase for $T_{\rm eff} < 4500$ K (more present in $g' - r'$ than in $r' - i'$).

Hipparcos: Small deviation from the main trend for $G_{\rm BP} - G_{\rm RP} \gtrsim 4$ due to cool metal poor stars with $T_{\rm eff} < 2500$ K and [M/H]<-1.5 dex. It is preferable not to use the transformation with $B - V$ or $B_T - V_T$ for the cool stars.

Results (Jordi et al, 2010, A&A 523, 48)

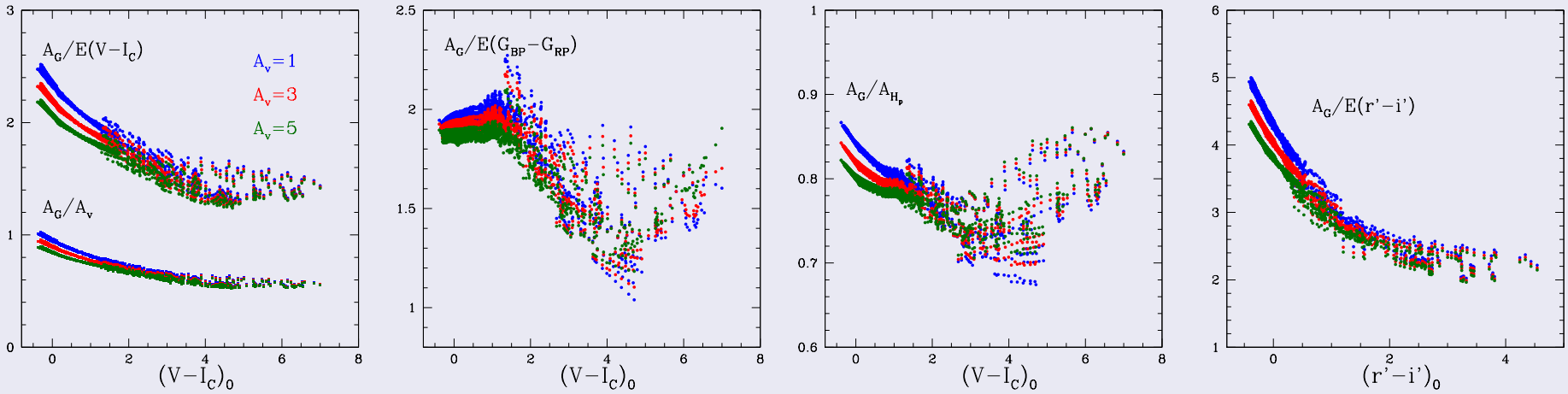
Isochrones



Padova isochrones (Marigo et al. 2008) computed in the *Gaia* passbands for solar metallicity and for different ages. Stellar tracks, isochrone files in the *Gaia* passbands are available as web interface at **(http://stev.oapd.inaf.it)**.

Results (Jordi et al, 2010, A&A 523, 48)

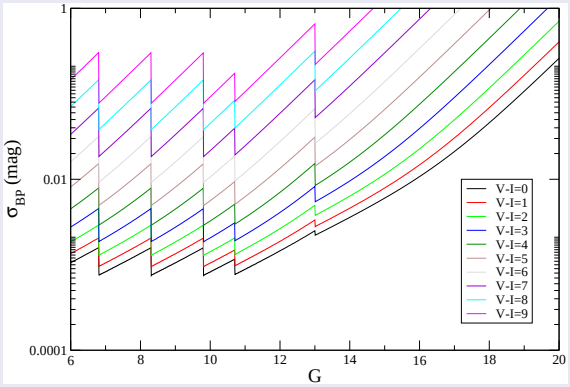
Reddening

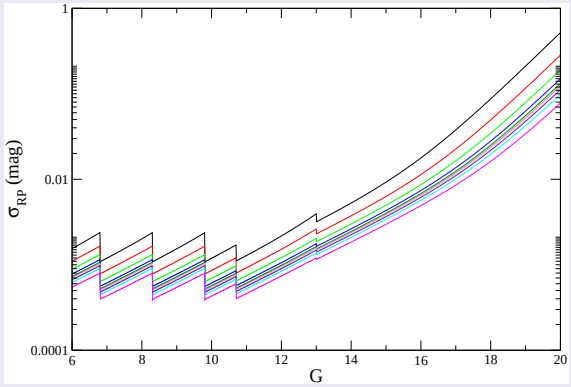


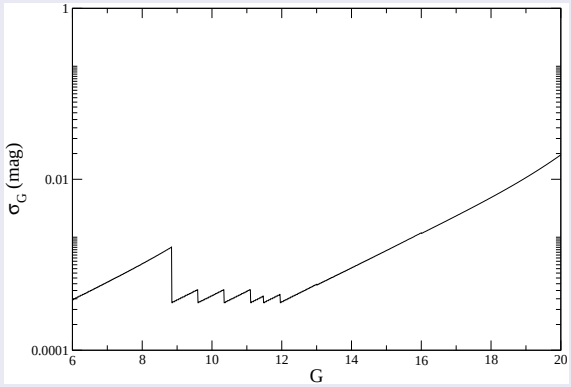
Absorption, A_G, and color excess, $E(G_{\rm BP}-G_{\rm RP})$, derived for *Gaia* magnitudes. The scattering that appears for $(V-I_C)_0 \gtrsim 1.5$ or $(r-i)_0 = 0.3$ (i.e. $T_{\rm eff} = 4500$ K) is due to the dependency in [M/H] and $\log g$.

Gaia performances (available in *Gaia* webpage at ESA)

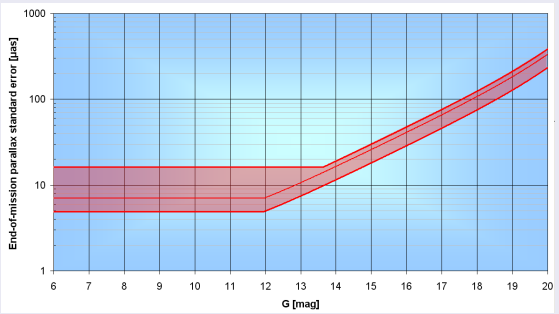
Magnitude error for a transit







Error in parallax



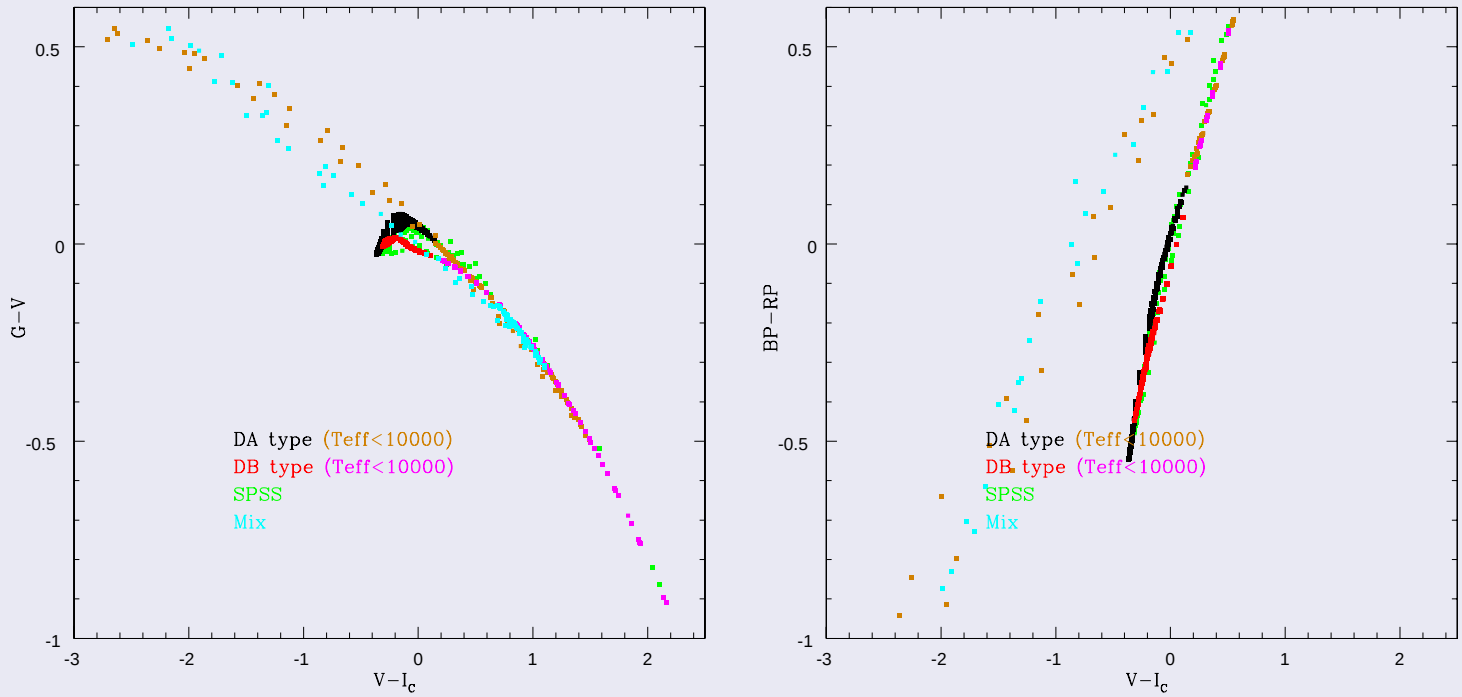
$$\sigma_\pi[\mu as] = (9.3 + 658.1 \cdot z + 4.568 \cdot z^2)^{1/2} \cdot [0.986 + (1 - 0.986) \cdot (V - I_C)],$$

where $z = MAX[100.4(12 - 15), 100.4(G - 15)]$.

Application to scientific exploitation

Cool White Dwarfs

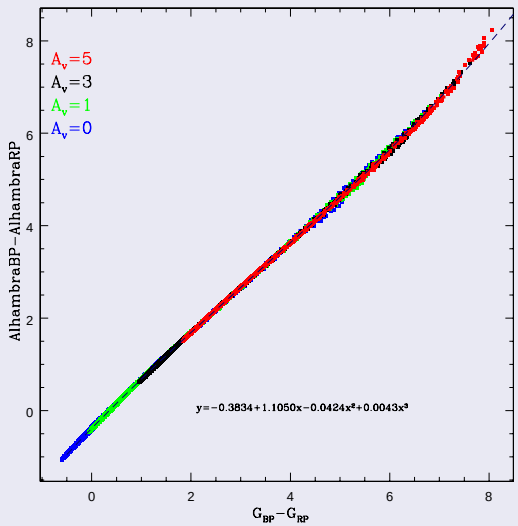
- Same study was repeated using WD library (S. Catalan & P.-E. Tremblay)

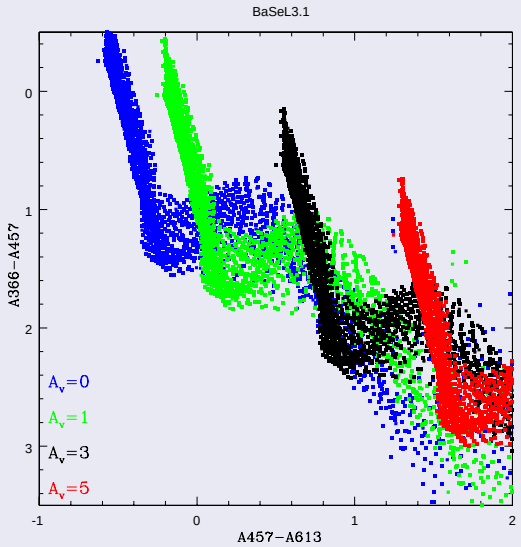


Application to scientific exploitation

ALHAMBRA passbands

- Same study was repeated using ALHAMBRA passbands and with NGSL stars (T. Aparicio & E. Alfaro)

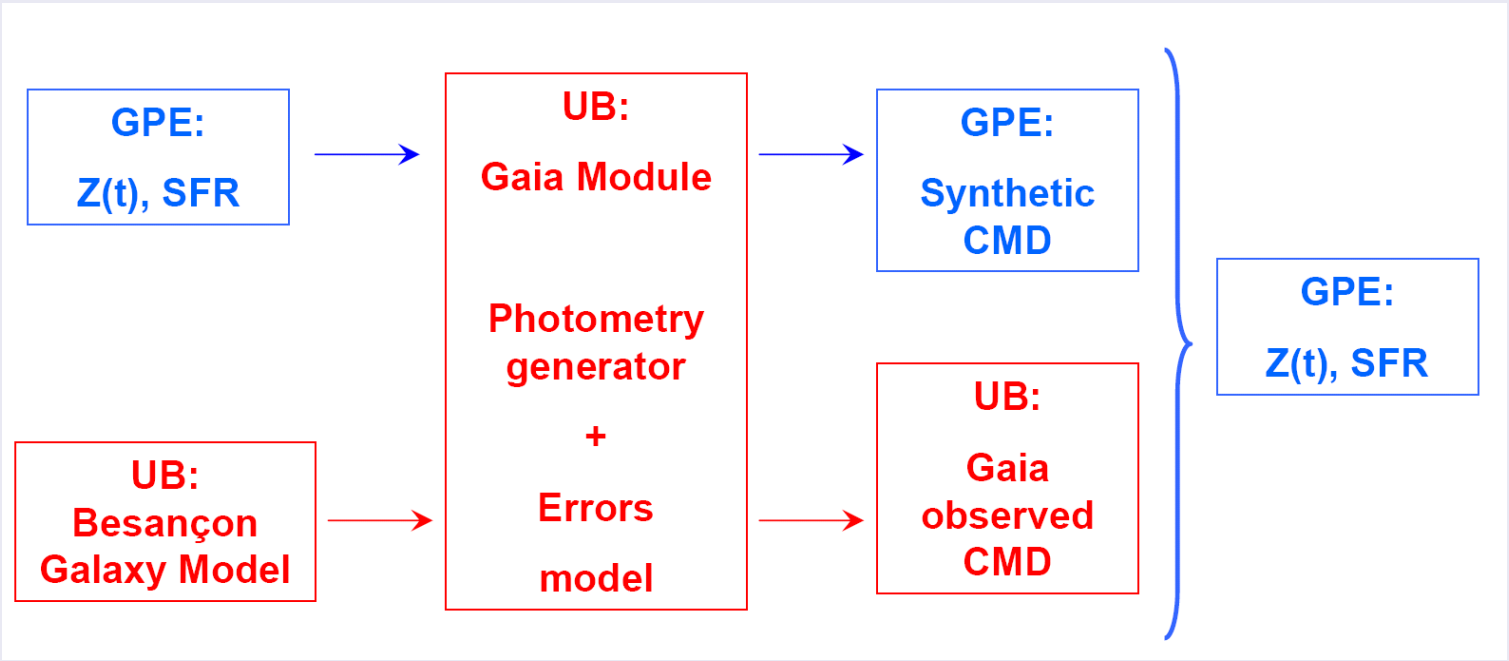




Application to scientific exploitation

Star-pop at IAC

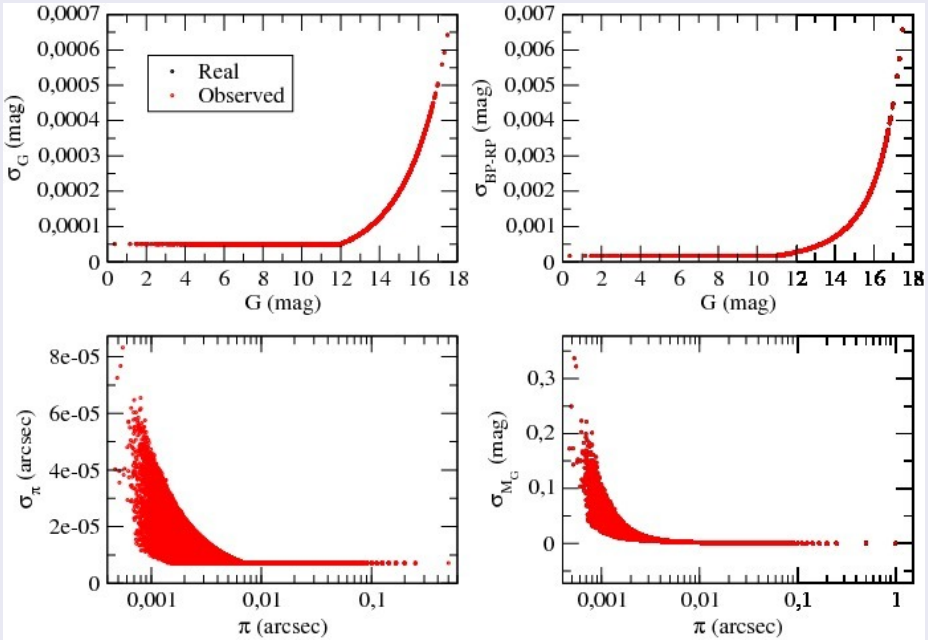
- *Gaia* photometry was computed from Besançon Output (see M. Czekaj) to be applied to Star-pop code from IAC (see A. Aparicio & S. Hidalgo).

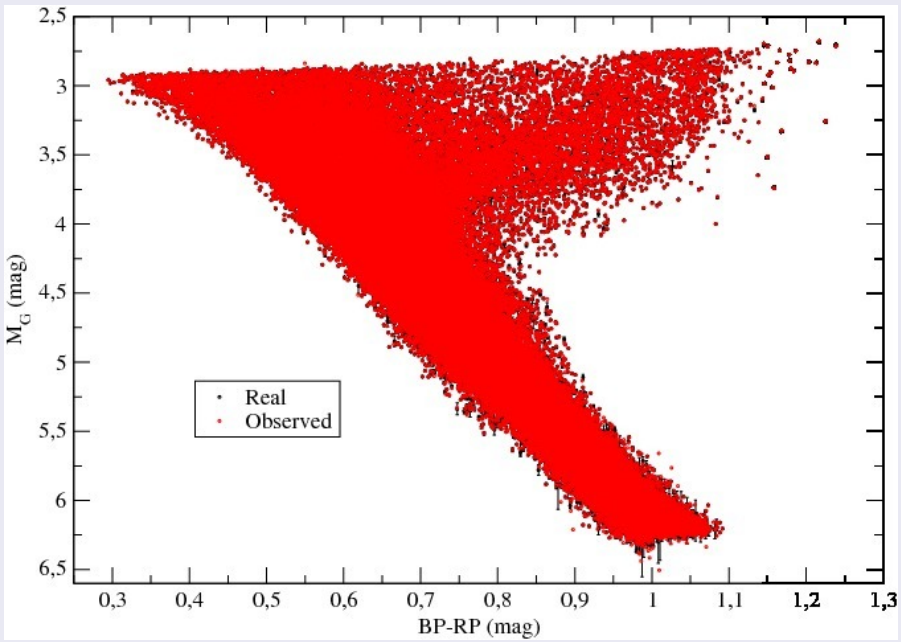


Application to scientific exploitation

Star-pop at IAC

Gaia observed CMD for the solar neighbourhood (100 pc):





Thank you

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Gaia photometry (Jordi et al, 2010, A&A 523, 48)

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   - Isochrones
   - Reddening
4. Gaia performances
5. Application to scientific exploitation
   - Cool White Dwarfs
   - ALHAMBRA passbands
   - Star-pop at IAC