**Characterisation of the Gaia photometry**

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Our team at the University of Barcelona has contributed to the early phases of the mission to the definition, evaluation and calibration modelling of the Gaia photometry. To maximise the Gaia scientific exploitation, we have shared frequently many different tools and data with the astronomical community. Among this information we have defined several relationships among colours involving Gaia magnitudes and colours from other commonly used photometric systems (Johnson-Cousins, SDSS, Hipparcos, Tycho and 2MASS) for several types of stars (including white dwarfs). These relationships can be used for planning scientific exploitation of Gaia data, performing simulations of the Gaia-like sky, planning ground-based complementary observations and for building catalogues with auxiliary validation data. During the commissioning phase our team (as part of the Payload Experts group) has been intensively checking the first photometric data to analyse the health and properties of the real instrument. These preliminary analyses allowed us to monitor the throughput variations with time, assess the spectral resolution and re-evaluate the performances of the end-of-mission photometry. The Payload Experts group activities continue beyond the commissioning phase aiming to optimize the operations onboard for maximizing the scientific return. Some example of first spectra and photometry are shown.

**Design and characterisation of Gaia photometry**

From passbands to spectrophotometers

In the early designs of the mission a set of 14 medium + 5 broad band photometric filters, called C1 system, was defined to derive astrophysical information from Gaia photometry. The C1 system was finally implemented by the industrial partnership through two based silica prisms providing blue and red (BP and RP respectively) low resolution spectrophotometry. The Gaia photometric system is designed for its capability to measure low flux, faint, compact stars with a wide range of magnitudes and colours from other commonly used photometric systems (Johnson-Cousins, Sloan Digital Sky Survey, Hipparcos, Tycho and 2MASS) for several types of stars (including white dwarfs). These relationships can be used for planning scientific exploitation of Gaia data, performing simulations of the Gaia-like sky, planning ground-based complementary observations and for building catalogues with auxiliary validation data.

**Calibration scheme**

The proposed calibration is an iterative process where the predicted observations (according to the best known instrument and source parameters) are compared with the true observations to update consecutively the parameters of the source (orange arrows) and the parameters describing the instrument (blue arrows). After convergence is reached, the absolute fluxes and the wavelength scale are determined using external standard stars (SPSS), supported by on-ground observations.

**Gaia photometric calibrators**

Internal calibrators: Large (millions) set of constant sources. Large scale (CCD daily) + Small scale (groups of columns monthly), evenly distributed over magnitude, colour & sky position. Challenges: 1) wide range of magnitudes & colours, 2) Colour distribution = ±(magnitude), 3) Bright stars are less common.

External calibration: The final absolute fluxes will be derived from a comparison made on about 250 SpectroPhotometric Standard Stars (SPSS). Almost 5000 observations were awarded in several observatories (Calar Alto, La Palma, La Silla, San Pedro Martín, NTT, Loiano, Montsec, ...) to derive the absolute spectrophotometry of these SPSS.

**Predicting Gaia photometry**

Simulations of Gaia photometry can provide a first knowledge of how the stellar characteristics (top) and reddening effects (bottom) in Gaia passbands are.

**White dwarfs**

Gaia represents the most complete sample of WDs with very precise parallaxes up to now. Even with uncertainties of 10% or 20% in parallaxes, one could easily distinguish a WD from other objects for a given colour. Especially interesting will be the very cold WDs providing information on the earlier stages of the formation of the Milky Way.

**Gaia photometric observations**

Using BP and RP spectra we can distinguish among different stellar spectral types. The 2D spectra obtained (right) can be vertically collapsed into 1D spectra (top) for stars with different spectral type. As expected, cool sources have more flux in RP than in BP (and the opposite for hot sources). The shape and relative fluxes allow the classification of the sources and also the determination of their properties (temperature, surface gravity, metallicity, ...).