Galactic Astronomy with Gaia

Gaia is an ESA cornerstone mission to be launched into an L2 orbit in 2013. Its aim is to measure the positions, distances, space motions and physical properties of more than 1 billion stars in the Milky Way and nearby satellite galaxies. Uppsala plays a key role in the astrophysical classification of >95% of these stars.

On top of the 6D phase-space information to be gathered via μarcsecond astrometry, Gaia will collect astrophysical information about all objects down to $V \approx 20$ via two (spectro-)photometers and a medium-resolution spectrometer (Fig. 1). Uppsala is one of the main providers of synthetic stellar observables for stars with surface effective temperatures between 2500 K and 18000 K (MARCS and LLmodels). These observables need to show variance in other physical parameters (e.g. surface gravity, composition) covering the parameter space of all known stellar objects. A basic grid of fluxes and spectra has already been assembled by us, the coming years will be spent in refining this grid in terms of input physics.

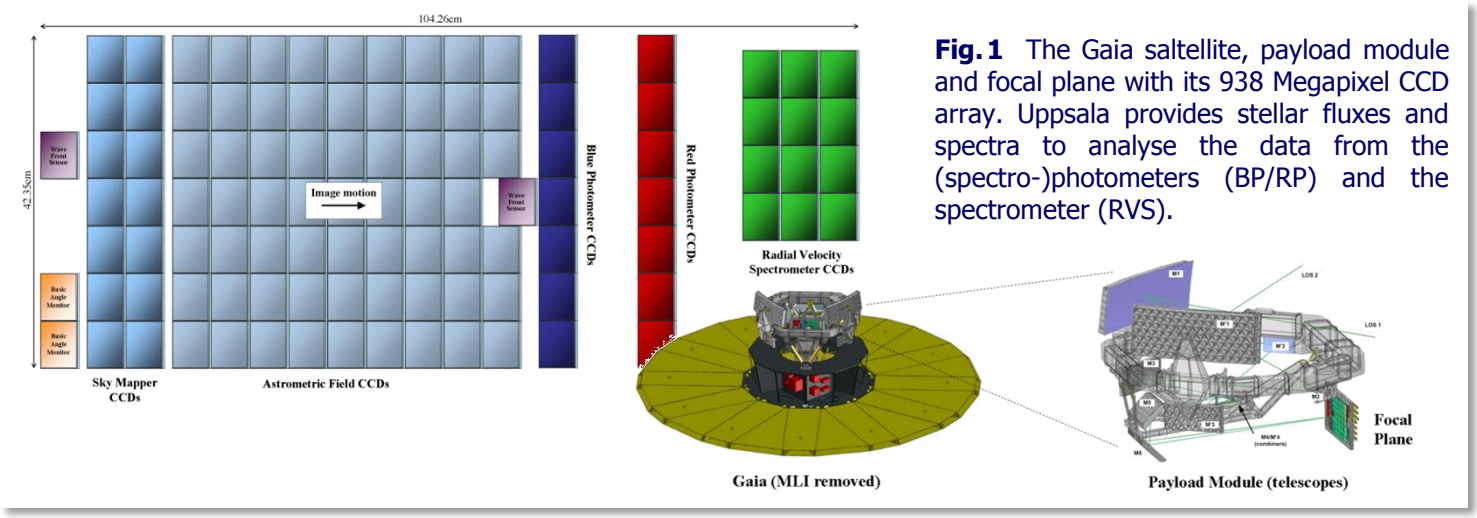
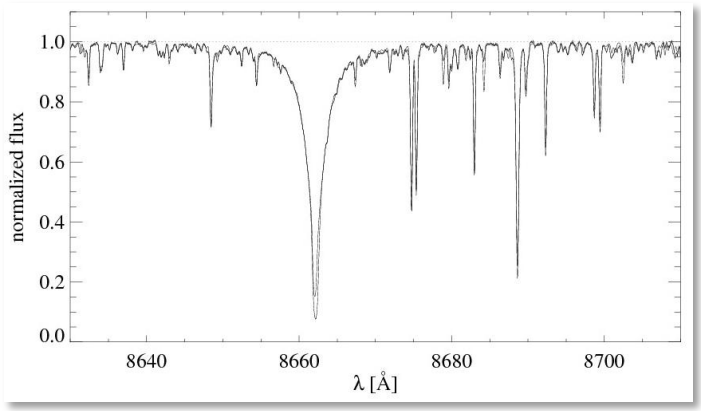


Fig. 1 The Gaia saltellite, payload module and focal plane with its 938 Megapixel CCD array. Uppsala provides stellar fluxes and spectra to analyse the data from the (spectro-)photometers (BP/RP) and the spectrometer (RVS).

Studies at high resolution (Fig. 2) help to uncover remaining limitations in the modelling. In general, accuracy in the derived astrophysical quantities is to be safeguarded by a) improved modelling of the microphysics and b) ground-based observations of stars with physical parameters known from independent measurements. Ground-based observations are also collected and analysed for the Southern Ecliptic Pole field, the first field to be observed by Gaia in 2013. We are currently teaming up with scientists around Europe to conduct a 300-night "Gaia-ESO" spectroscopic survey at the VLT, which will complement Gaia observations for faint stars.

Fig. 2 Example of the ability of MARCS models to reproduce the spectra of stars in the RVS spectral region (here of the giant star Arcturus, observed at a resolving power of $\lambda/\delta\lambda = 60{,}000$). Can you tell the two spectra apart?



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