Gaia and the Determination of Astrophysical Parameters

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Department of Astronomy and Space Physics, Uppsala University, Sweden. http://www.astro.uu.se
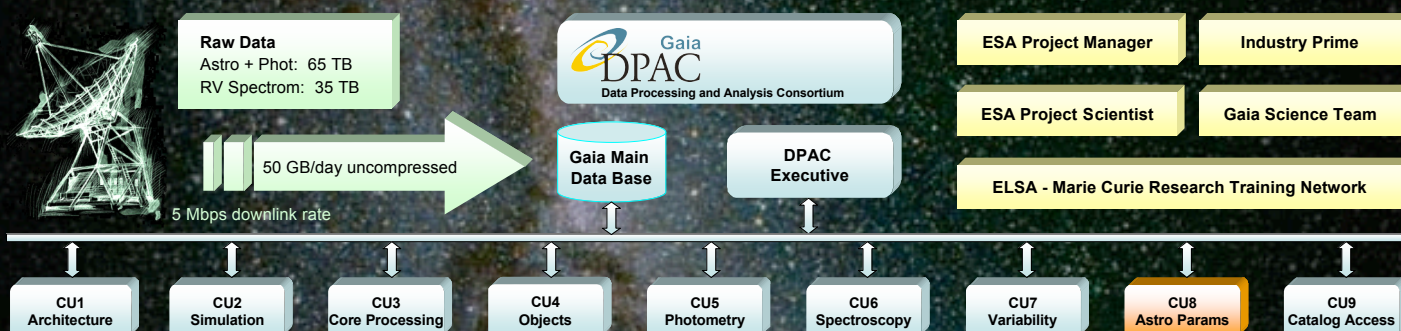Frédéric Thévenin and Lionel Bigot, Nice
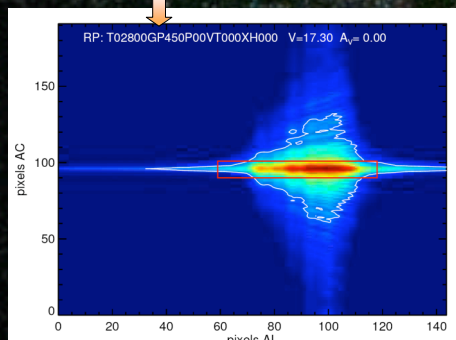Caroline Soubiran, Bordeaux

ABSTRACT: Gaia is the ESA space astrometry mission due for launch in late 2011. Its objective is to map a large part of our Galaxy and its surroundings by simultaneous positional, radial-velocity, and multi-colour photometric measurements. During a five-year period Gaia will survey approximately one billion Galactic stars, detecting and classifying tens of thousands of extra-solar planets, large numbers of Solar-System objects, galaxies in the nearby Universe and some half a million distant quasars. It will provide stringent new tests of general relativity and measure the acceleration of the Solar System in the cosmological frame.

The data reduction for Gaia is entrusted to the Gaia Data Processing and Analysis Consortium (DPAC), involving nearly 300 scientists and engineers throughout Europe, including teams in Lund and Uppsala. The work is organised in nine Coordination Units (CU1-CU9).

We describe part of the work carried out in CU8, namely the determination of physical parameters for all stars which Gaia will observe. This includes calculating synthetic stellar spectra for algorithm development, obtaining ground-based observations for calibration and testing purposes, and improving the physics of stellar atmosphere models.

Raw Data
Astro + Phot: 65 TB
RV Spectrum: 35 TB

50 GB/day uncompressed

5 Mbps downlink rate

Gaia DPAC — Data Processing and Analysis Consortium

Gaia Main Data Base

DPAC Executive

ESA Project Manager

Industry Prime

ESA Project Scientist

Gaia Science Team

ELSA - Marie Curie Research Training Network

CU1 Architecture	CU2 Simulation	CU3 Core Processing	CU4 Objects	CU5 Photometry	CU6 Spectroscopy	CU7 Variability	CU8 Astro Params	CU9 Catalog Access

Physical parameters for one billion stars from
spectrophotometry for V < 20, medium resolution *spectroscopy* for V < 16 and *astrometry*

Goals

Automatic determination of stellar surface *temperatures* to 2%, *gravities* to 0.3 dex, *metallicities* to 0.2 dex for most stars.

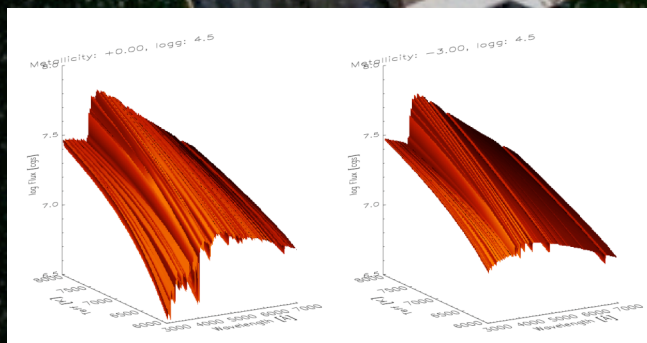**Simulated Gaia data**: Red Photometer spectrum of M dwarf.
Red box: data sent to ground, White contour: sky-background level,
Colour coding: signal intensity. Figure courtesy Anthony Brown (CU5)
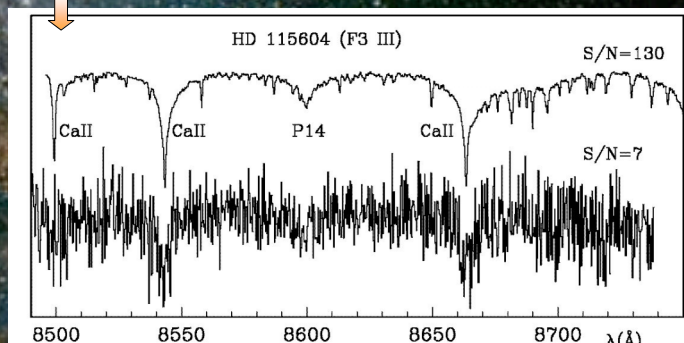
Simulated Gaia data: Radial Velocity Spectrometer spectra of F3 giant (V=16).
S/N = 7 (single measurement), S/N = 130 (summed over mission)
Figure courtesy David Katz (CU6)

Gaia Work Package *Training Data* provides
• *synthetic stellar spectra* for simulations, algorithm development and testing
• *observed spectra* at low and medium resolution of a set of well-studied *Reference stars* for algorithm and model testing
• improved *stellar atmosphere models* and high resolution spectra for a limited number of *Benchmark stars*

Synthetic stellar spectra:
Part of the MARCS library calculated at Uppsala.

Benchmark stars:
Line profiles for **α Cen A** (Figure by L. Bigot).

For more information on Gaia, visit http://www.rssd.esa.int/gaia