

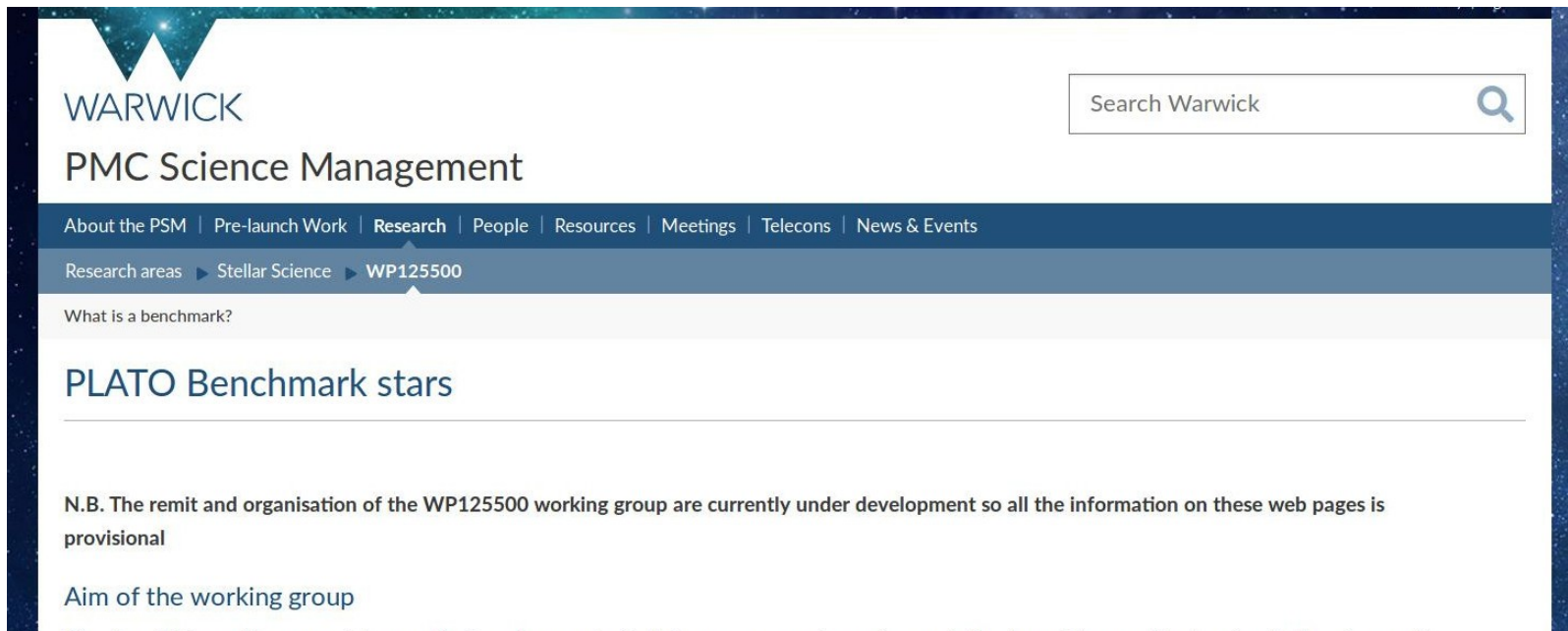
Gaia / DPAC – Astrophysical Parameters

Plato WP125500 : Benchmark stars

Orlagh Creevey
Valrose, 28 January 2019

Plato Benchmark Stars : WP125500

- New WP since 2018 : Orlagh Creevey, Pierre Maxted (Keele)
- Aim is to provide a list of (accurately & precisely) characterised stars (benchmarks) and to use these stars as stringent tests on codes and with different data sets
- In process of construction, first telecon next week with a small group of people to represent different topics and institutes



The screenshot shows the Warwick University website for the PLATO Benchmark stars project. The page features the Warwick logo, a search bar, and a navigation menu. The main content area includes a breadcrumb trail, a heading for 'PLATO Benchmark stars', and a disclaimer that the information is provisional.

WARWICK

PMC Science Management

About the PSM | Pre-launch Work | **Research** | People | Resources | Meetings | Telecons | News & Events

Research areas ▶ Stellar Science ▶ WP125500

What is a benchmark?

PLATO Benchmark stars

N.B. The remit and organisation of the WP125500 working group are currently under development so all the information on these web pages is provisional

Aim of the working group

Plato Benchmark Stars : WP125500

- To coordinate efforts
 - e.g., telescope proposals, hare-and-hounds exercises
- To centralize information
 - live database of benchmark stars
 - resources for telescope/grant applications
 - results of H&H exercises, etc.
 - On-going efforts
- To help prioritize efforts
- Documents and presentations available under Team Drive

Plato Benchmark Stars : WP125500

- Survey sent last year enquiring about 'benchmark' needs
- Summary of objects to study open clusters, binaries, single bright stars for limb-darkening, solartwins / analogues (less difficult)

Topics : limb-darkening, interferometry, asteroseismology, spectrophotometry, magnetic activity, high-resolution spectra (parameters and bisectors)

- What type of data do you need? (time series? stellar parameters? ...)
 1. interferometry
 2. fbol (spectrophotometry),
 3. parallax
 4. seismology
 5. binary orbits/photo/rv for r and m
 6. high quality spectra: spectral line bisectors + parameters+abundances
 7. Limb-darkening coefficients (interferometry)
 8. Activity Indices: Generally speaking, activity indexes from, e.g., spectropolarimetry or Ca II H & K measurements are needed to compile lists of active and inactive benchmark stars.
 9. For benchmark dM stars, near-IR (0.8-2.5 μm) spectrophotometry and high-resolution ($R \geq 50,000$) spectra are needed.

Plato Benchmark Stars : WP125500

- Will you require an observational effort to obtain new data on potential benchmark/calibrator stars. If so, what?
 - 1) 'Good' interferometry (parameters) including bright dwarf and giant stars resolved with pionier for 2nd/3rd lobe
 - 2) More data also needed for dM stars (spectra/interferometry/binaries).
 - 3) Might be necessary to gather
- What would you like to test/check/calibrate? (which parameters for example?)
 - R, Teff, logg, [Fe/H] and [X/Fe]
 - Absolute fluxes (for 1D/3D model atmospheres)
 - Spectral line bisectors (for 3D model atmospheres)
 - Limb-darkening coefficients
 - Impact of activity on stellar parameter derivation
 - masses and radii
 - ages (evolution state)... not stated specifically in anyone's email

Plato Benchmark Stars : WP125500

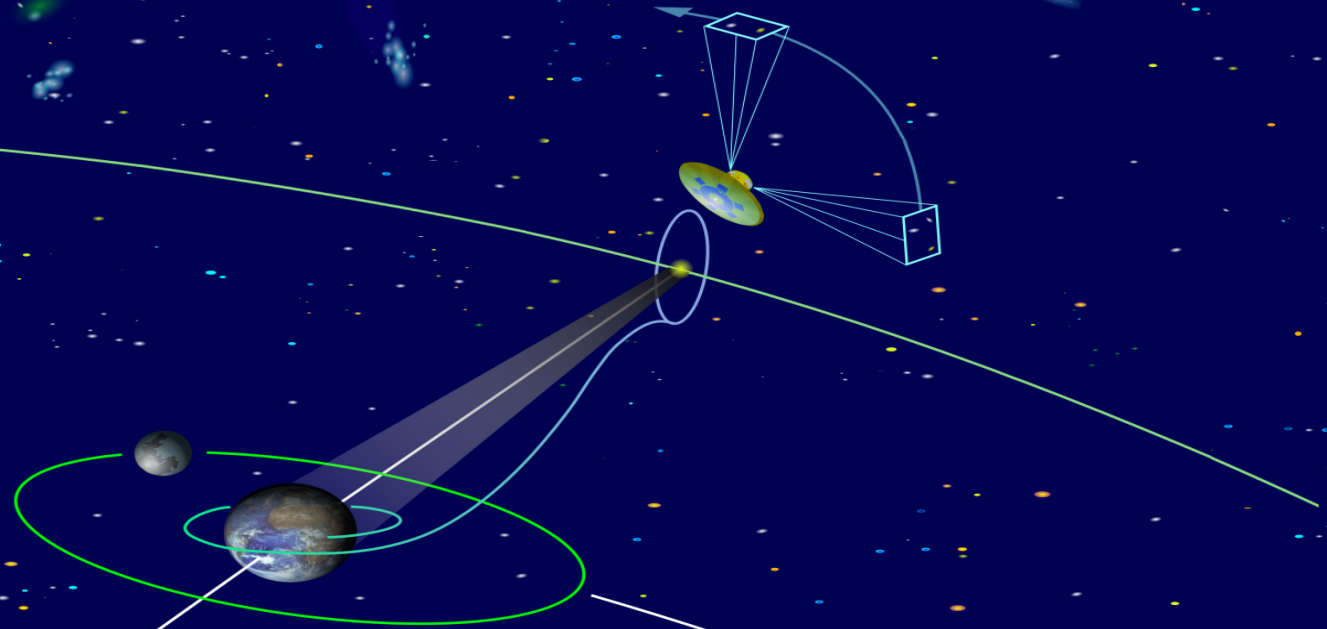
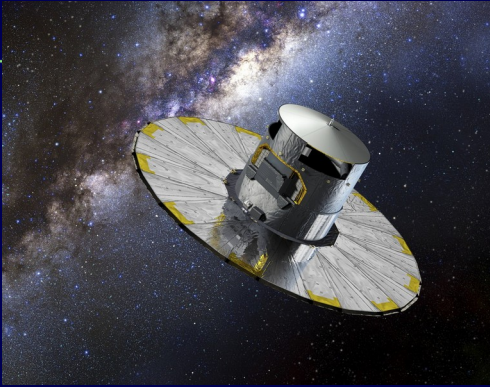
Gaia in orbit
(credit: EADS Astrium)

- Identify people for the different types of targets
- Construct a DB/list of benchmark stars
- For each star, list its use in plato e.g. mass, which type of target, available data (now and near future) and missing data (including what space missions will not provide soon)...
- Aim is to characterise a small sample of stars very well (e.g. mass, age....). These stars should be used to benchmark methods.
- <https://warwick.ac.uk/fac/sci/physics/research/astro/plato-science/research/researchareas/stellar/wp125500/>
- Job Offer :
<https://royalsociety.org/grants-schemes-awards/grants/newton-international/>

The Gaia spacecraft

Gaia in orbit

(credit: EADS Astrium)



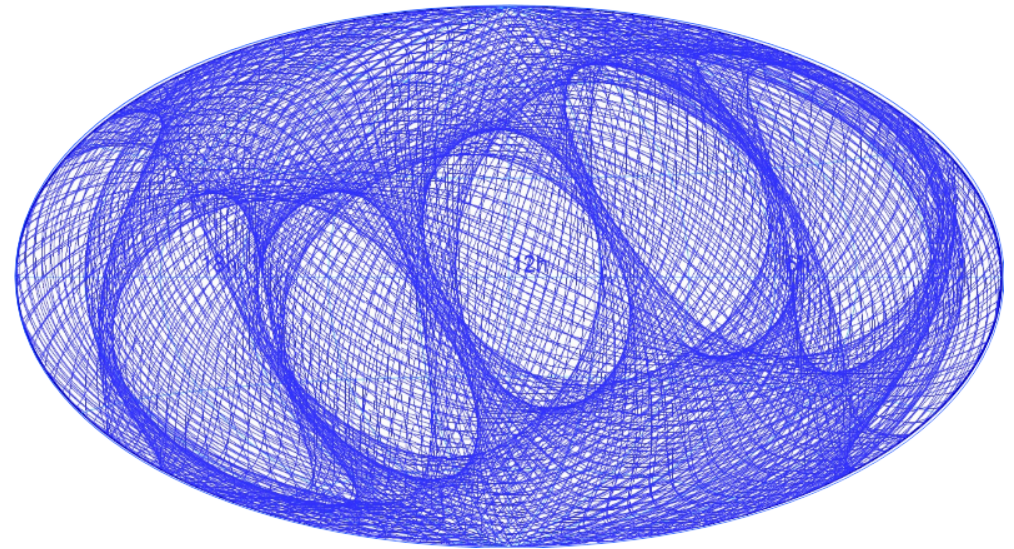
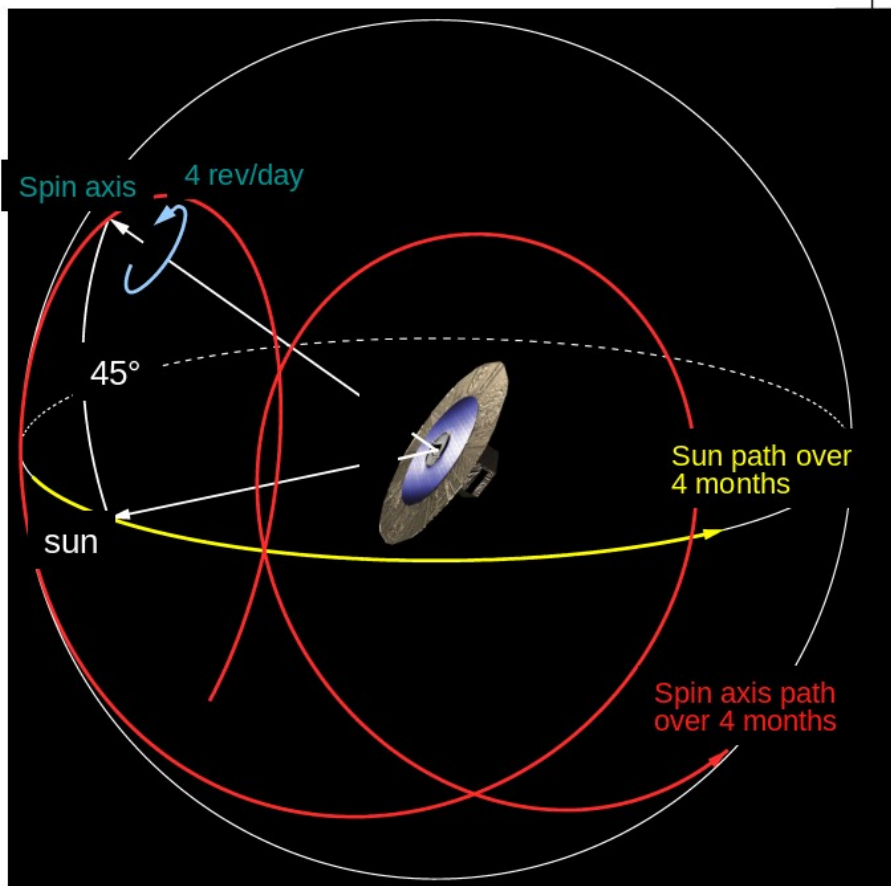
Launched 2013 for 5 year mission

450 scientists/engineers

Extension 2022

Sun - Earth line

The Gaia spacecraft and its orbit

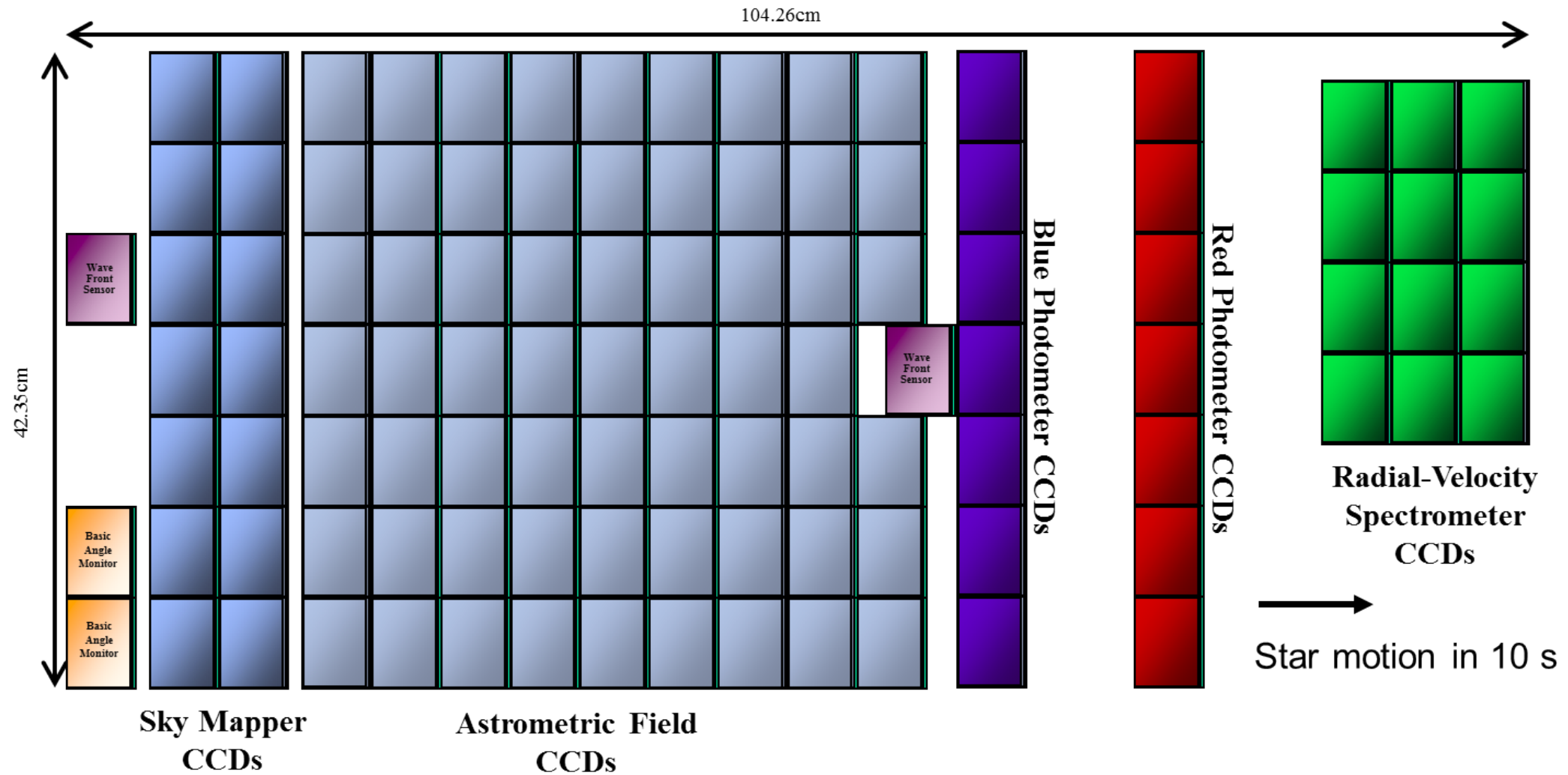


Measure the positions and motions of 2 billion stars (1% Milky Way)

Understand the formation and evolution of our Galaxy

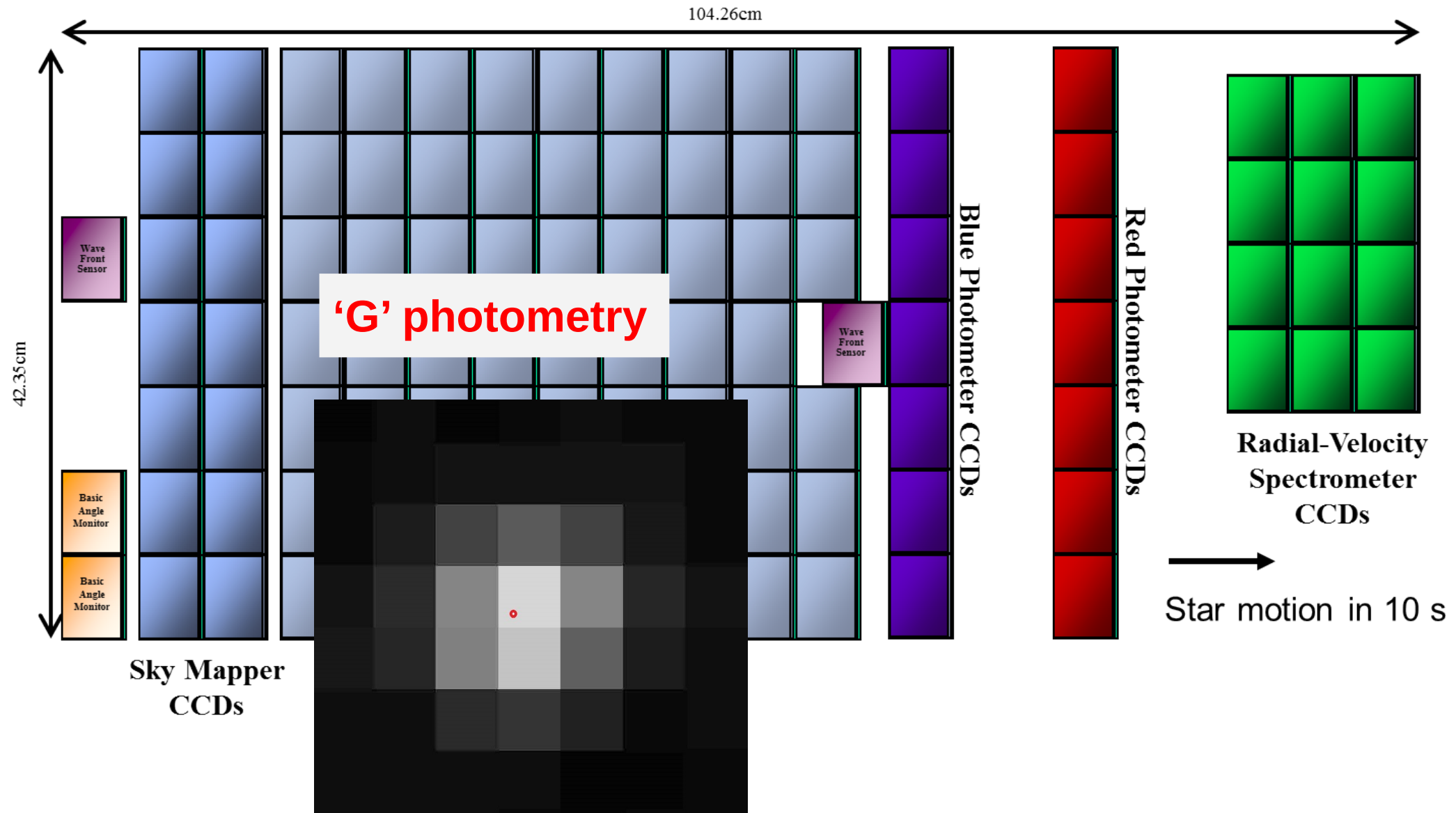
What does Gaia observe

Focal Plane



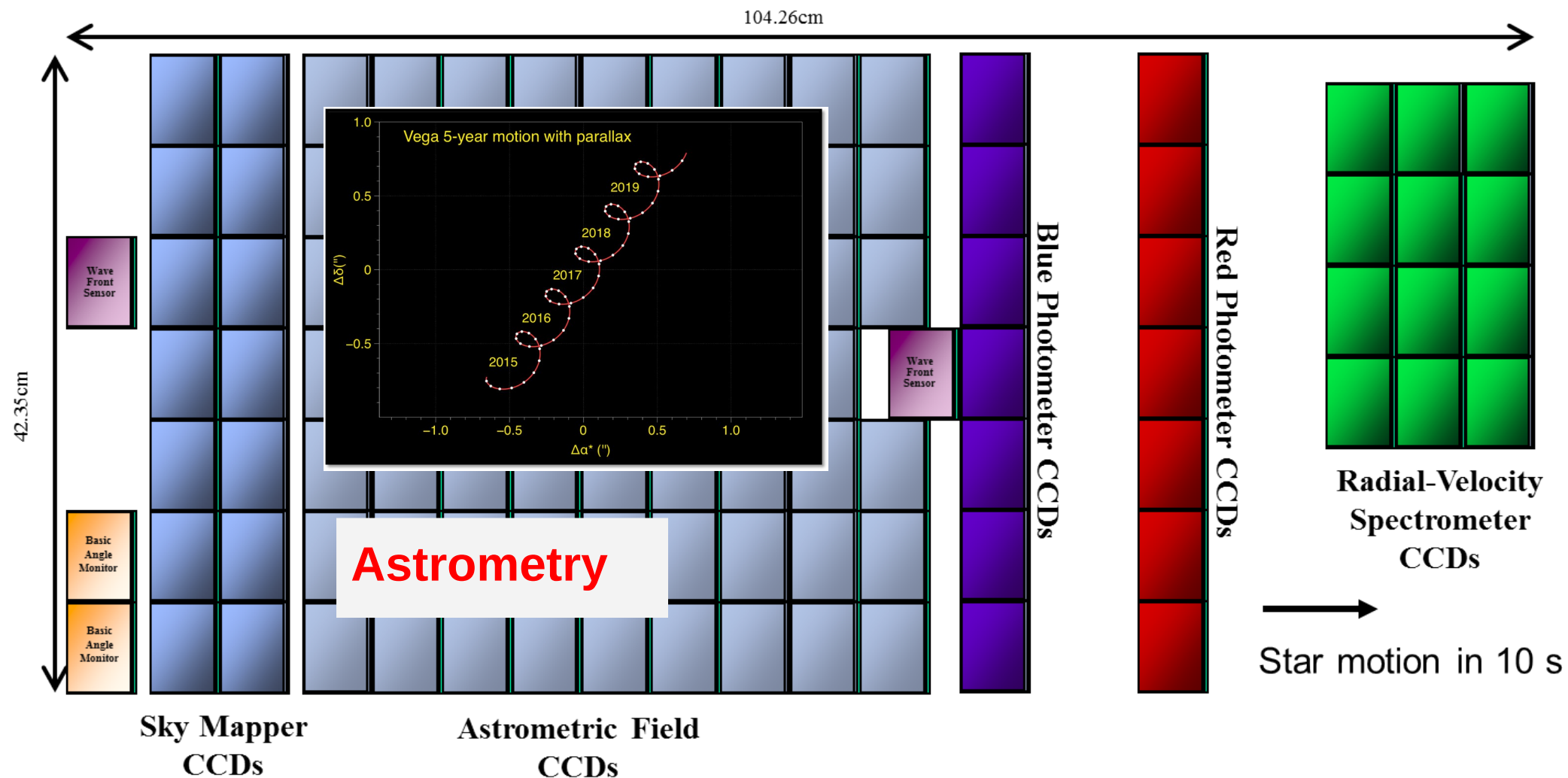
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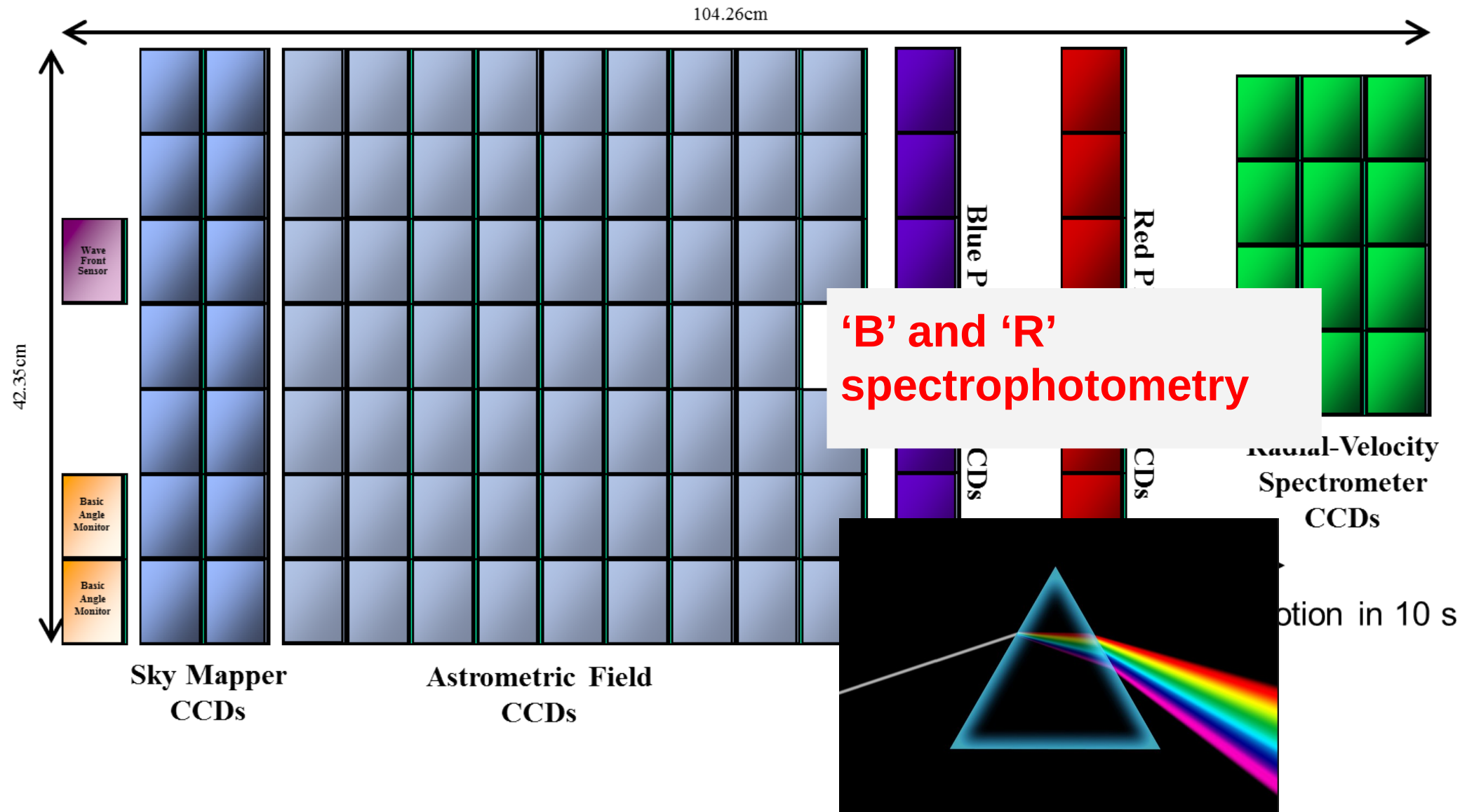
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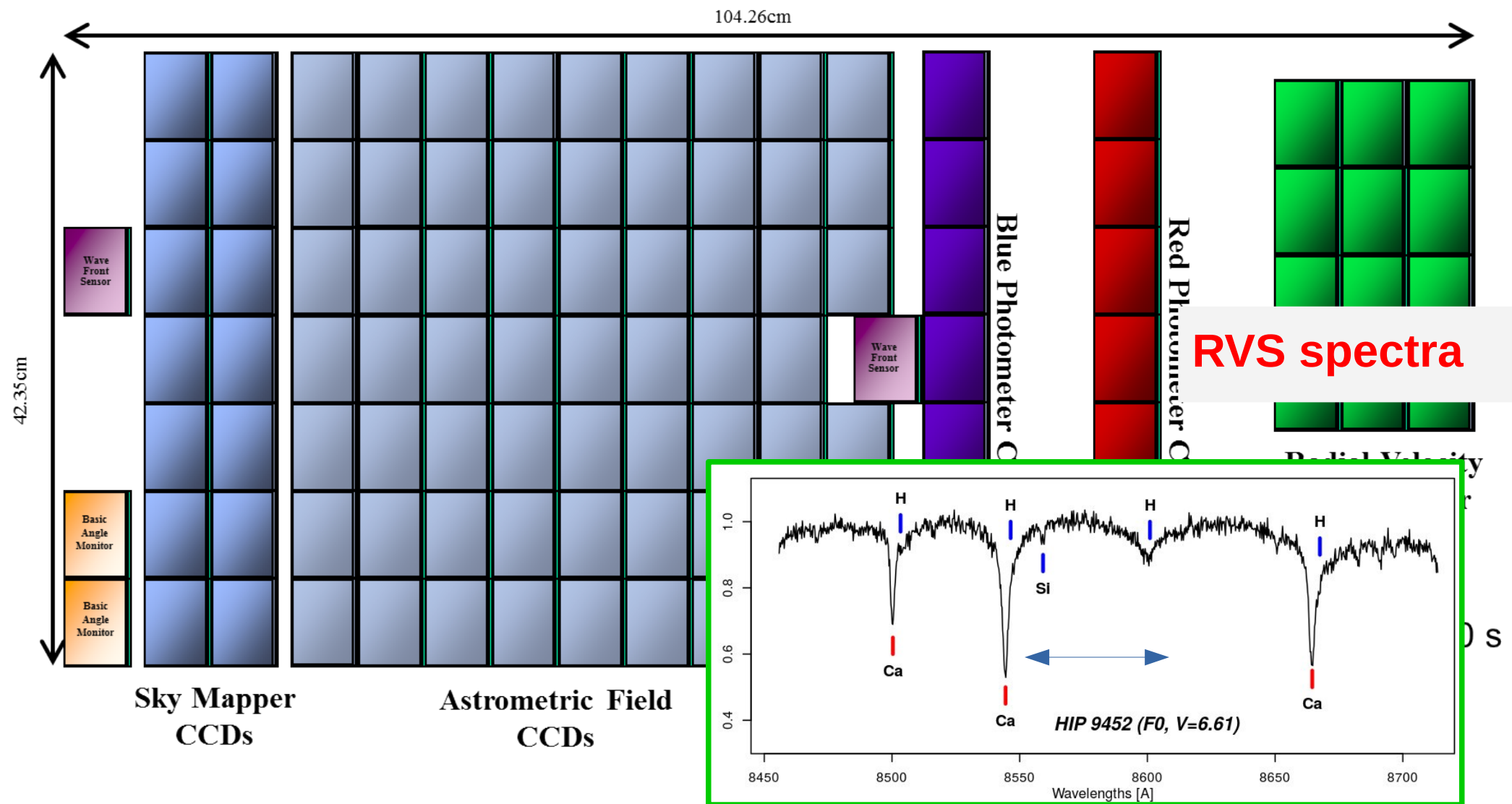
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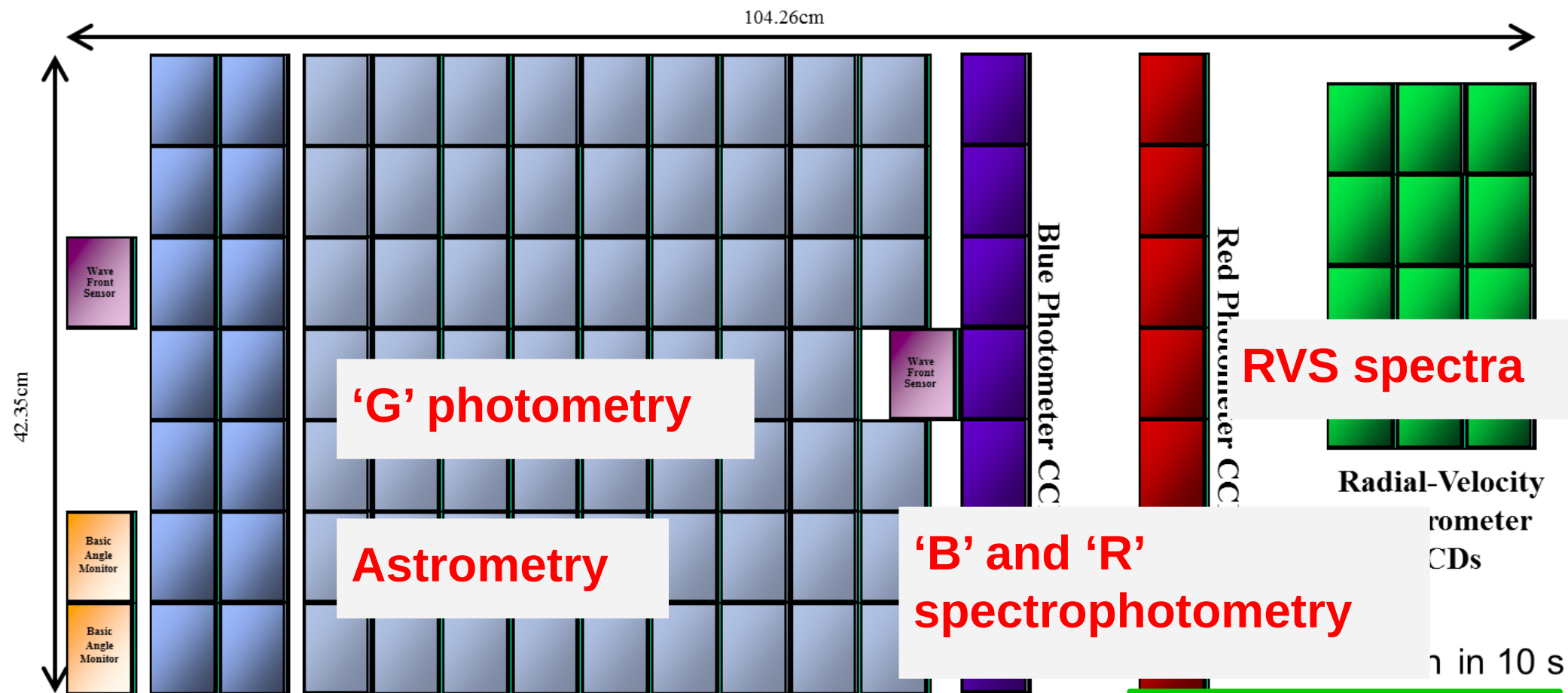
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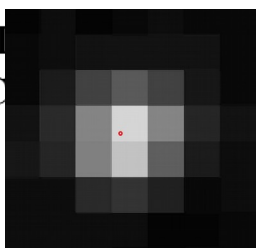


What does Gaia observe

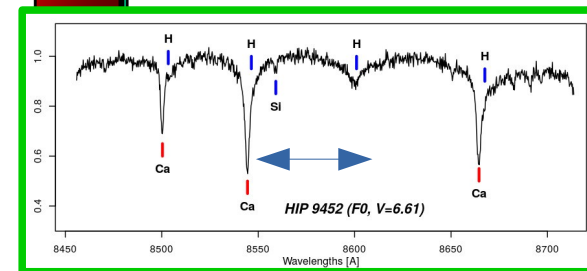
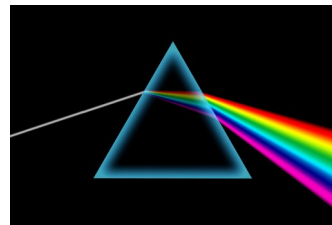
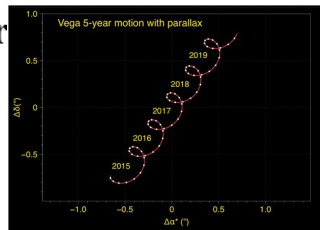
Focal Plane



Sky M
CC

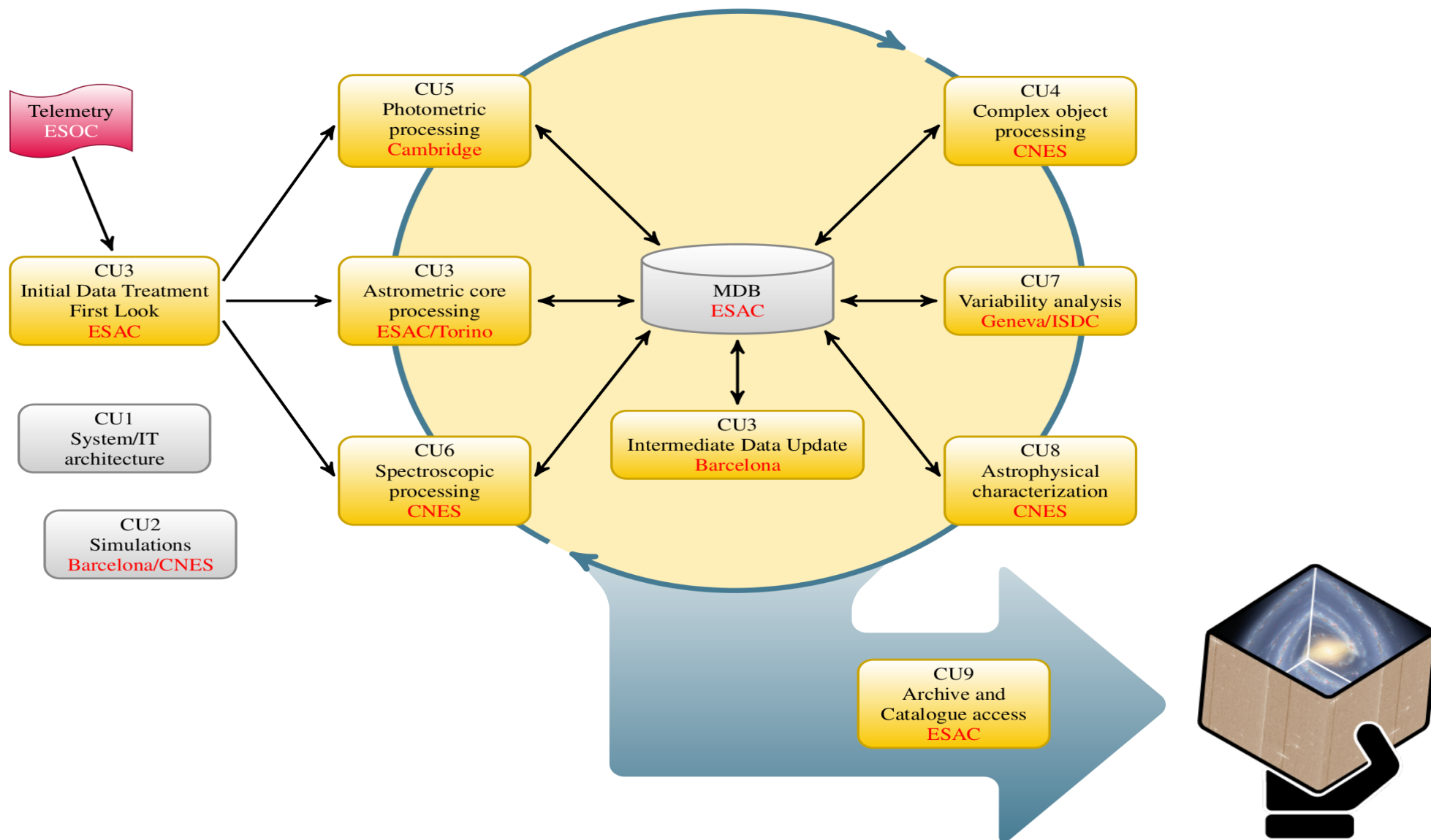


Astr



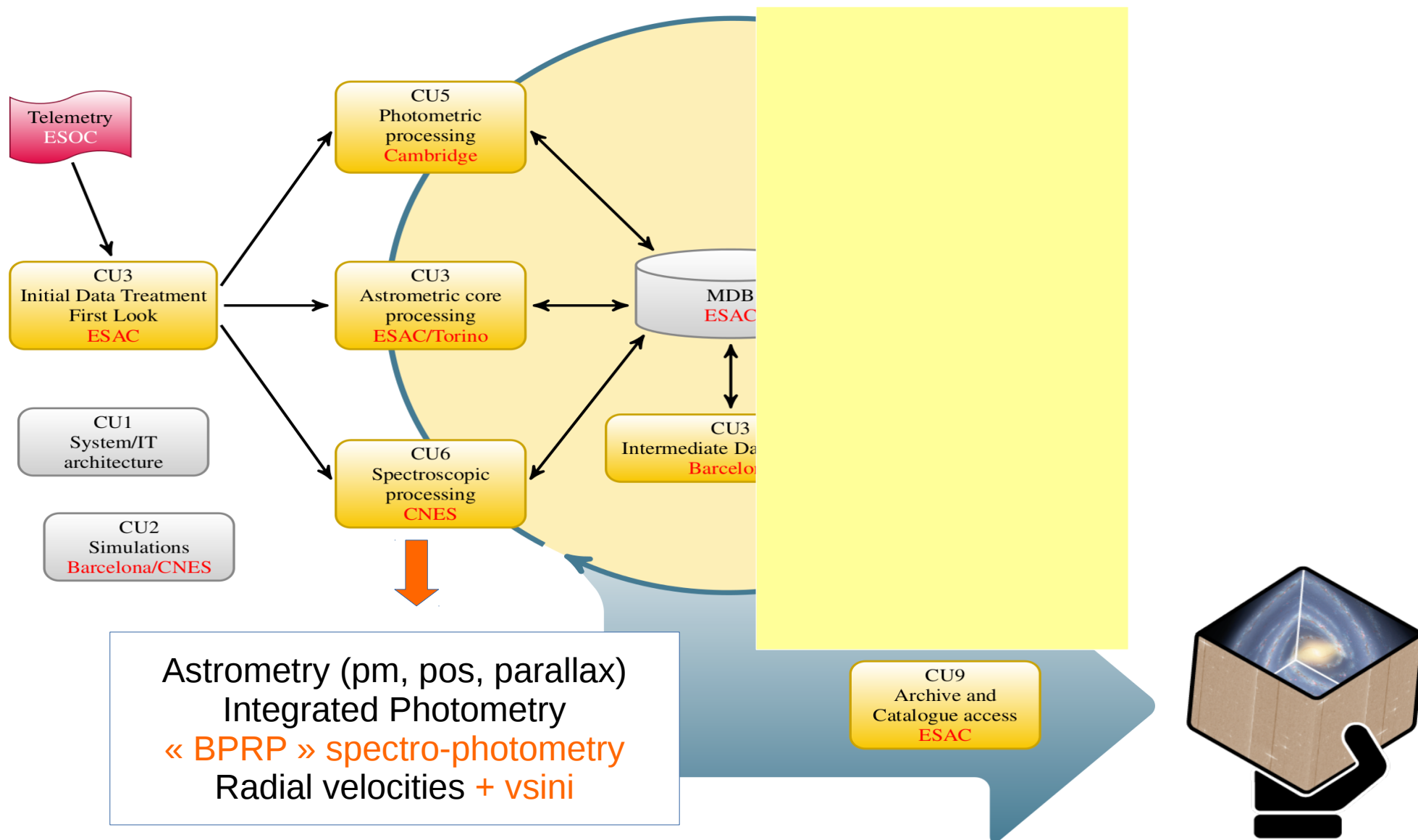
DPAC -- coordination units and processing

Upstream -----> Downstream



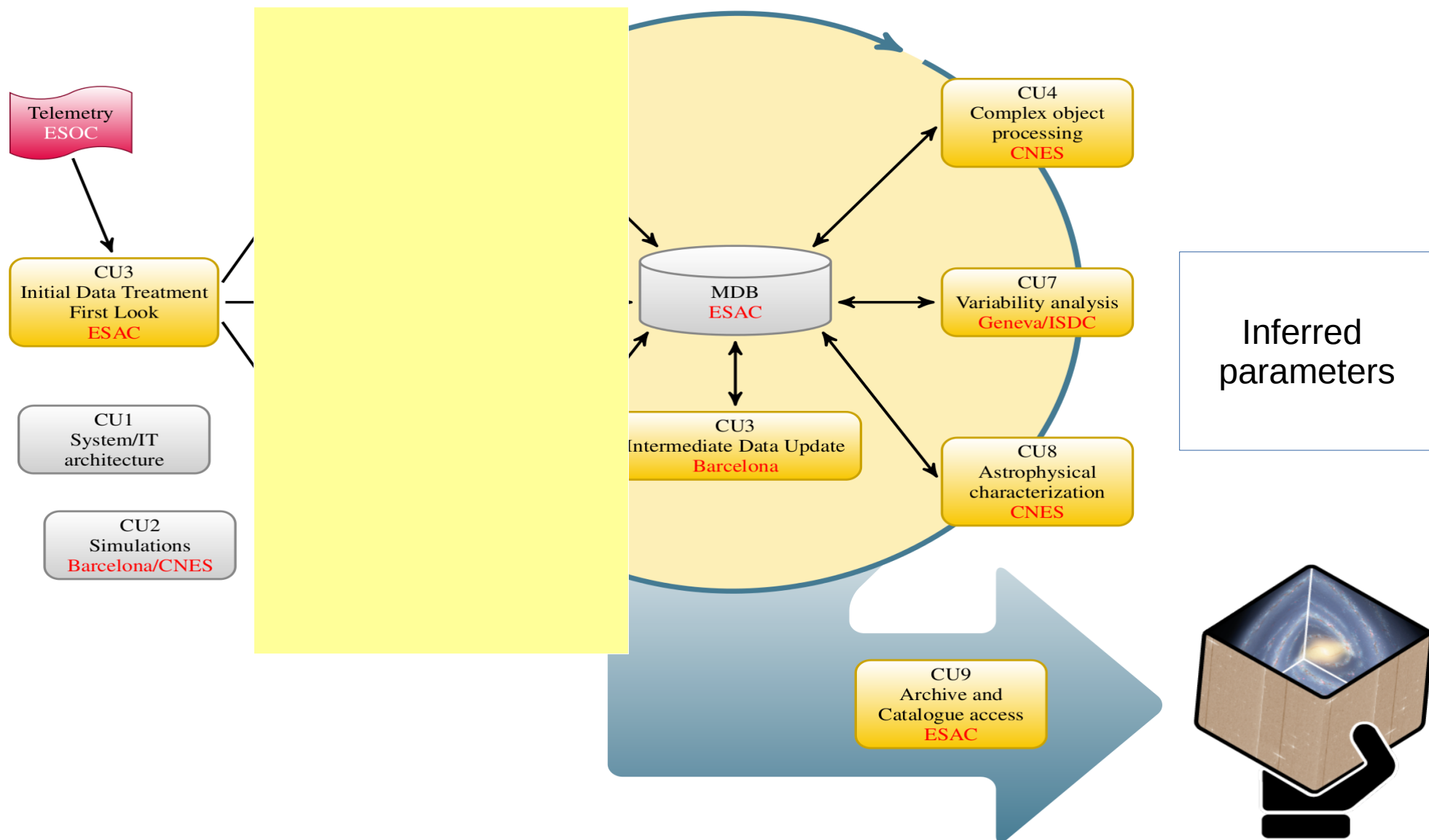
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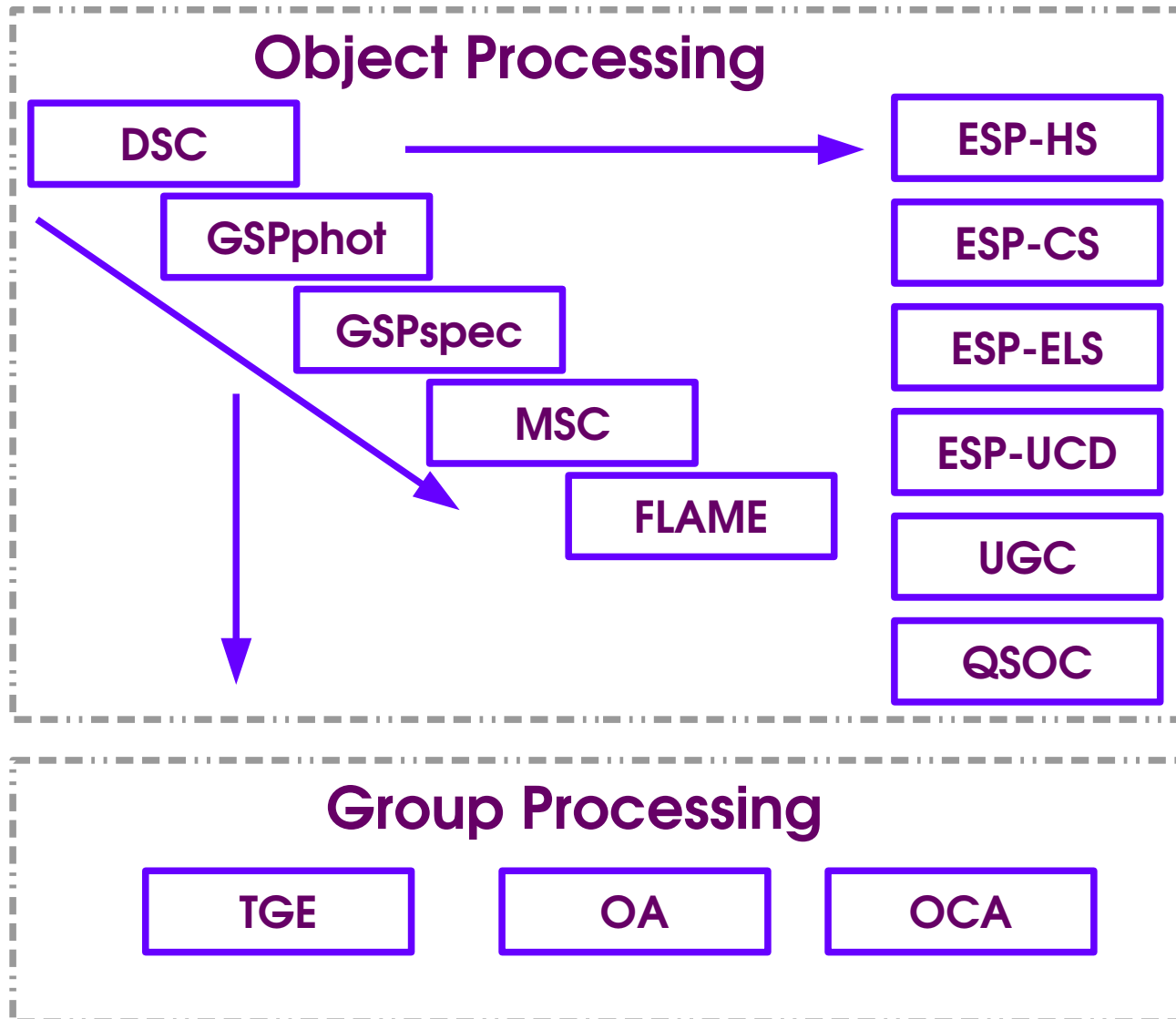
DPAC – summary of products

- Astrometry (positions, movements, parallax)
- Integrated photometry « G », « Bp » and « Rp »
- Spectrophotometry 120 « filters » between 350 and 1000 nm
- Radial velocities + $v \sin i$
- Non single stars (binaries ...)
- Solar system objects
- Extended objects / galaxies & quasars
- Variable stars using epoch data, e.g. Cepheids, RR Lyrae, periods, amplitudes, rotation periods
- Astrophysical parameters (mean spectra/data) Classification, T_{eff} , extinction, $\log g$, radii, luminosities, masses, ages, abundances, chromospheric activity, binary parameters, + non-stellar objects (galaxy, quasar, total extinction).

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« CU8 » or Astrophysical Parameters



Characteristics

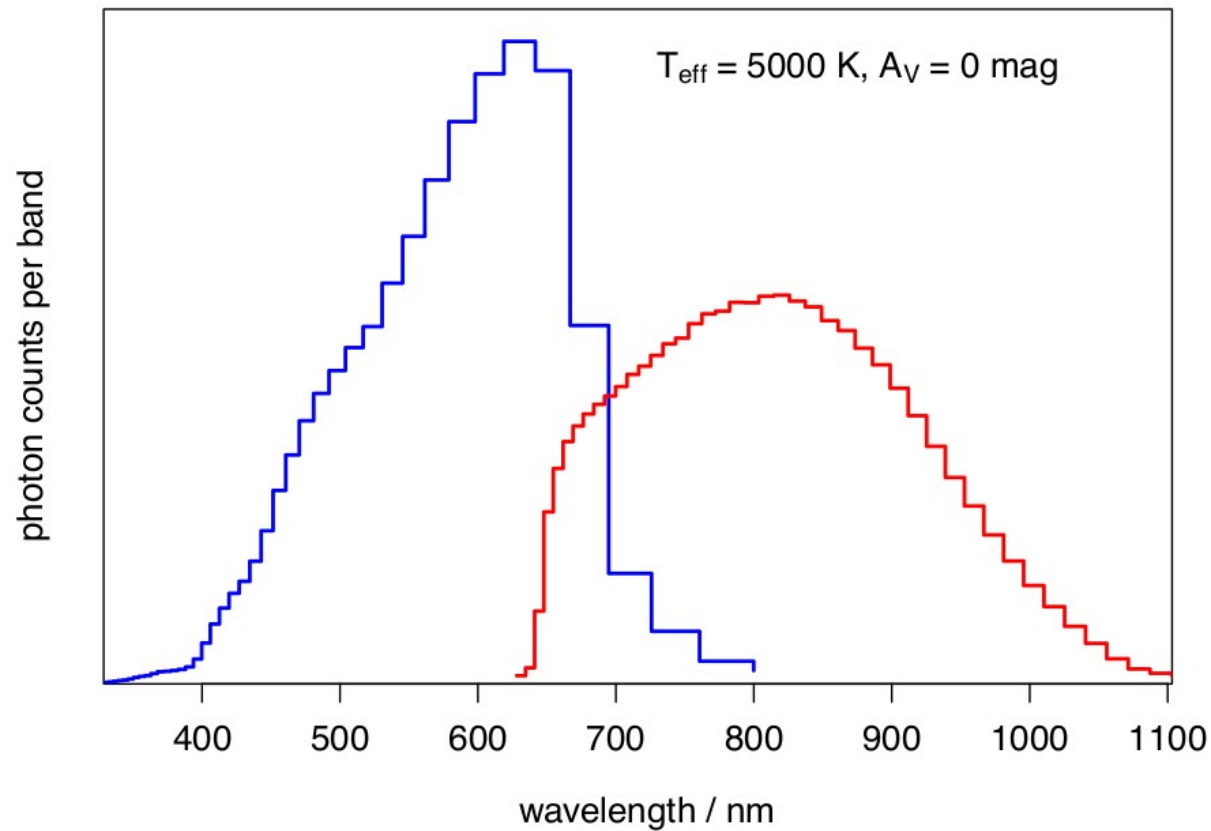
Stars
Galaxies
Quasars
Binaries

Line of sight
Extinction (dust)

**Object
Classification**

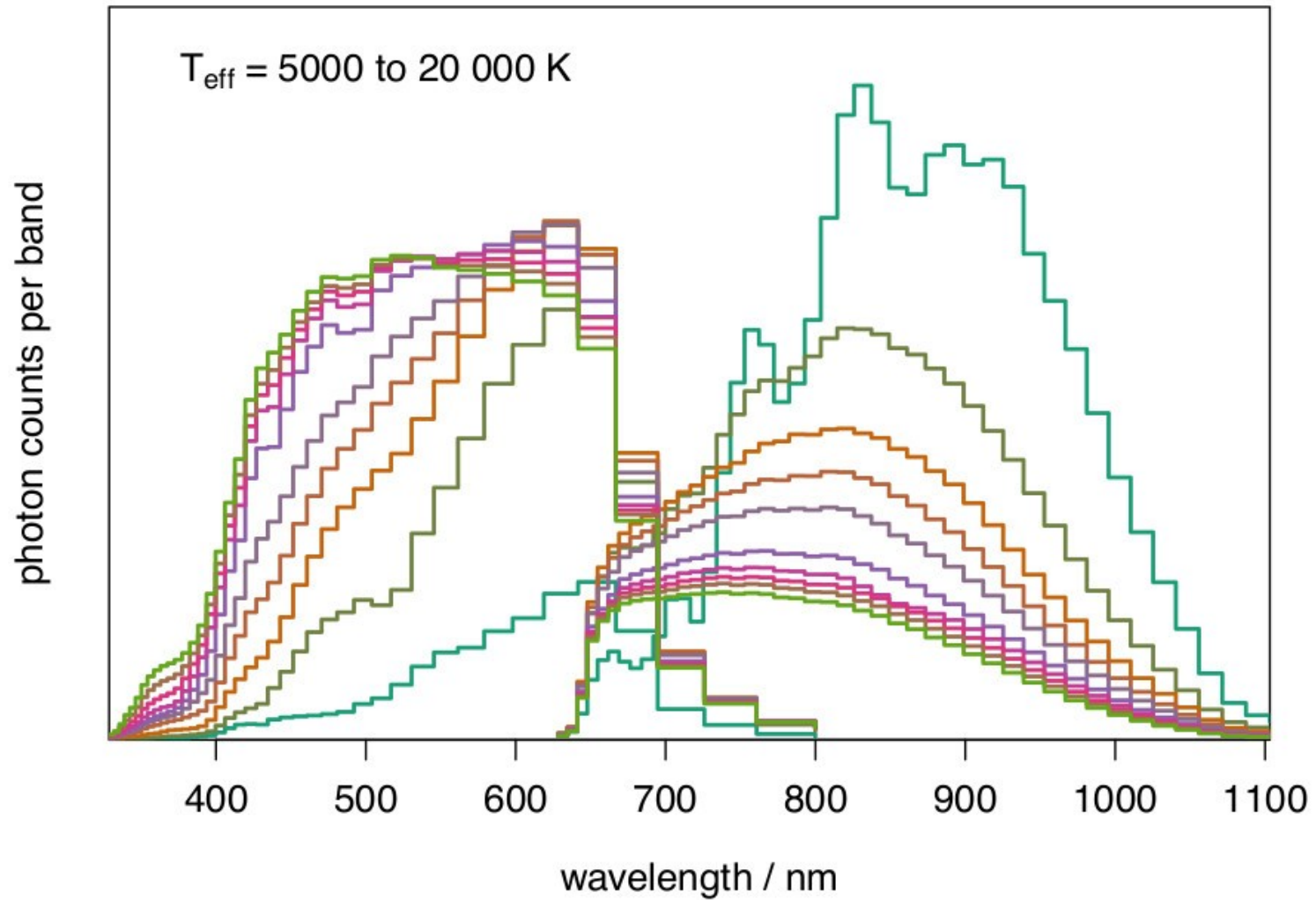
Dust map

BP/RP spectra

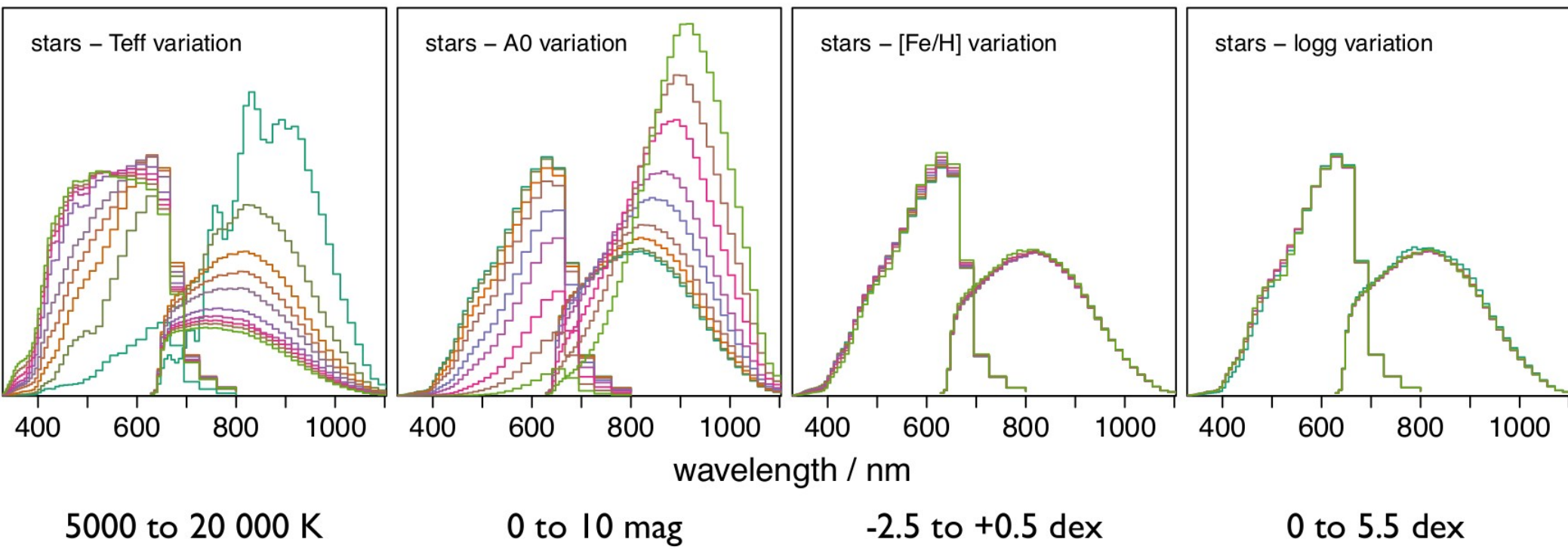


Note : integrated photometry is also produced « BP » and « RP » (e.g. DR2), Spectra will not appear till DR3

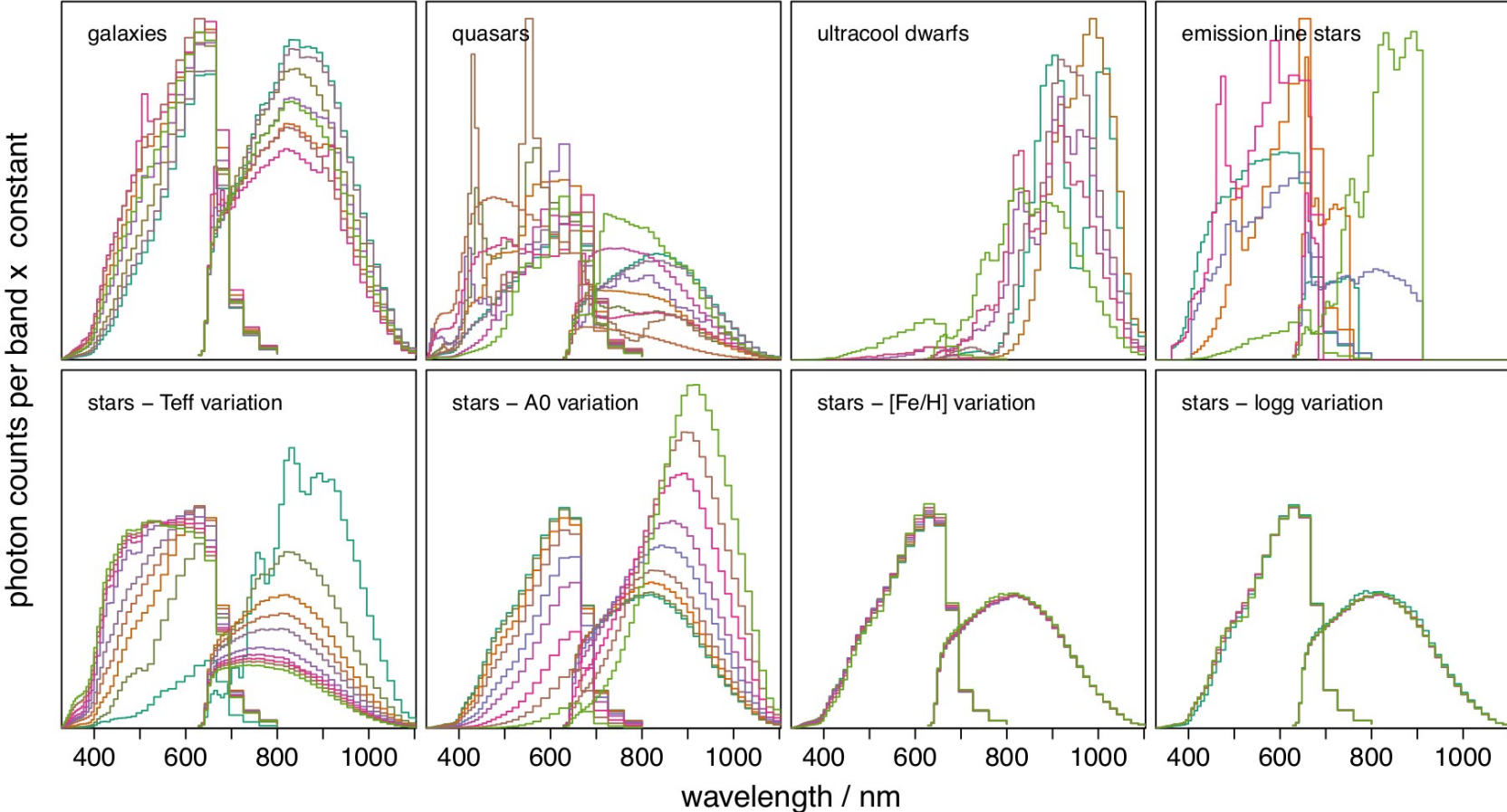
BP/RP spectra



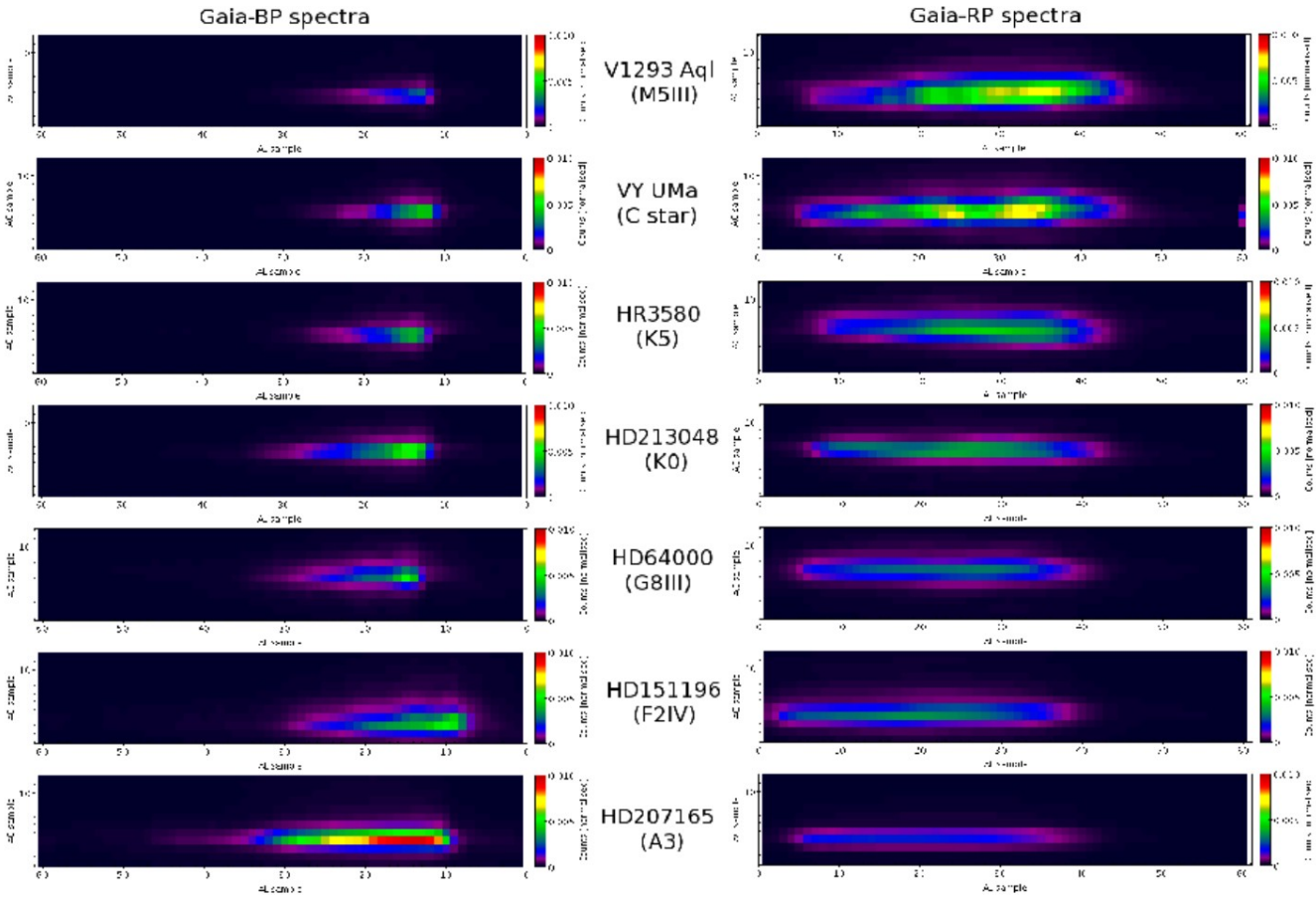
BP/RP spectra



BP/RP spectra

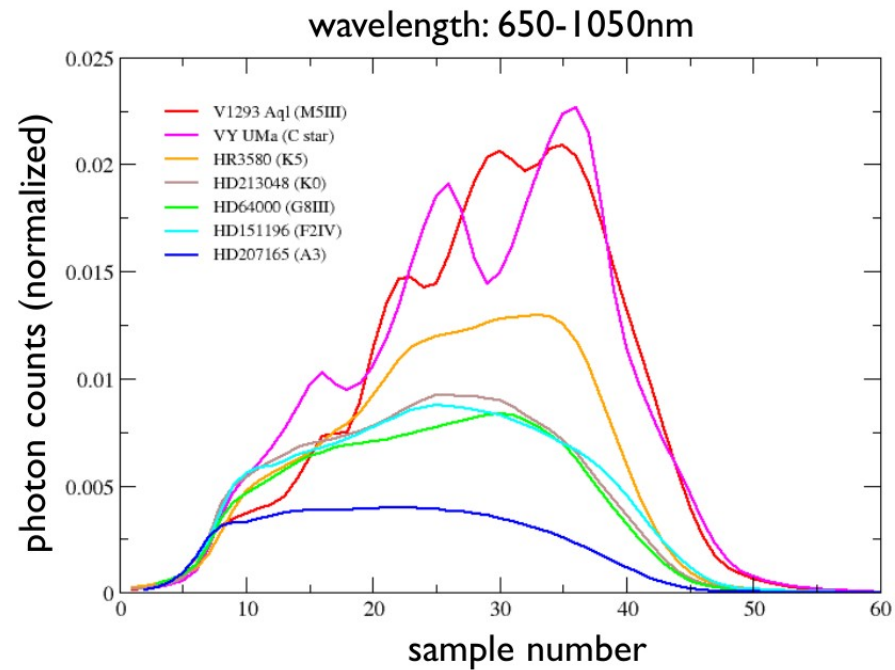
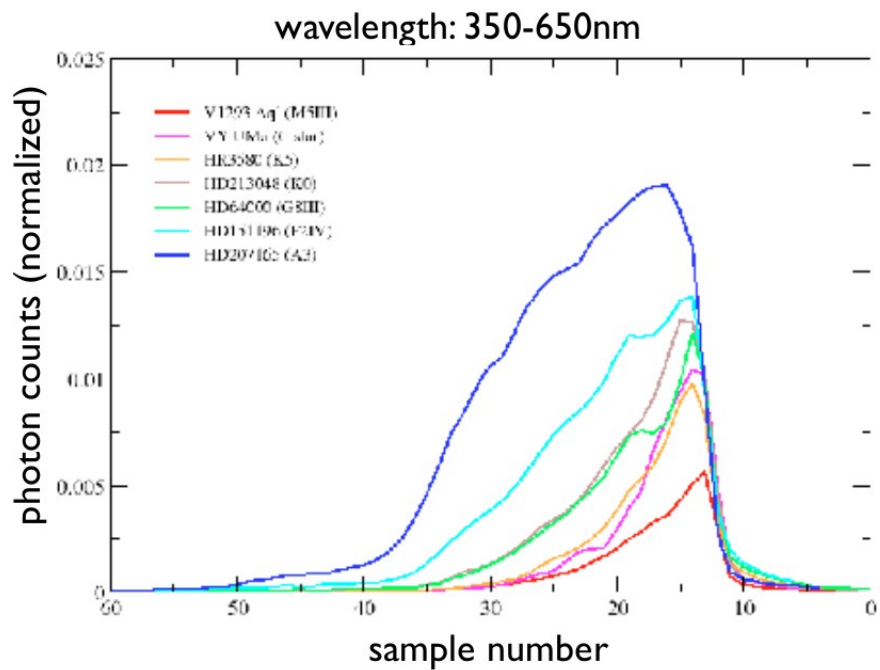


BP/RP spectra



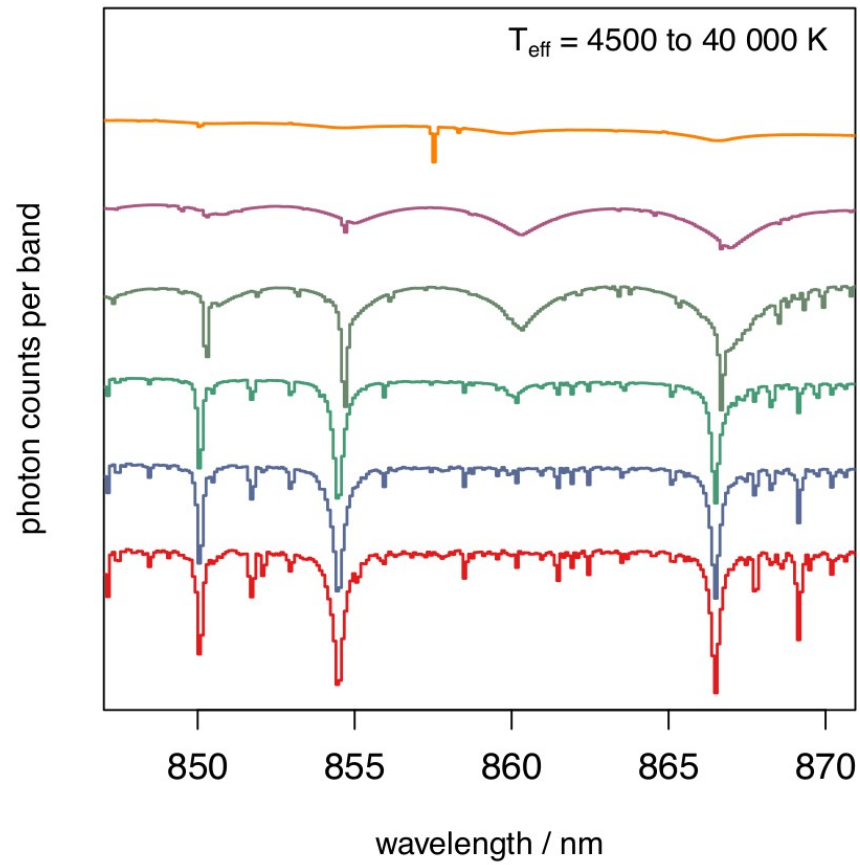
Graphics: ESA/DPAC/Astrium

BP/RP spectra

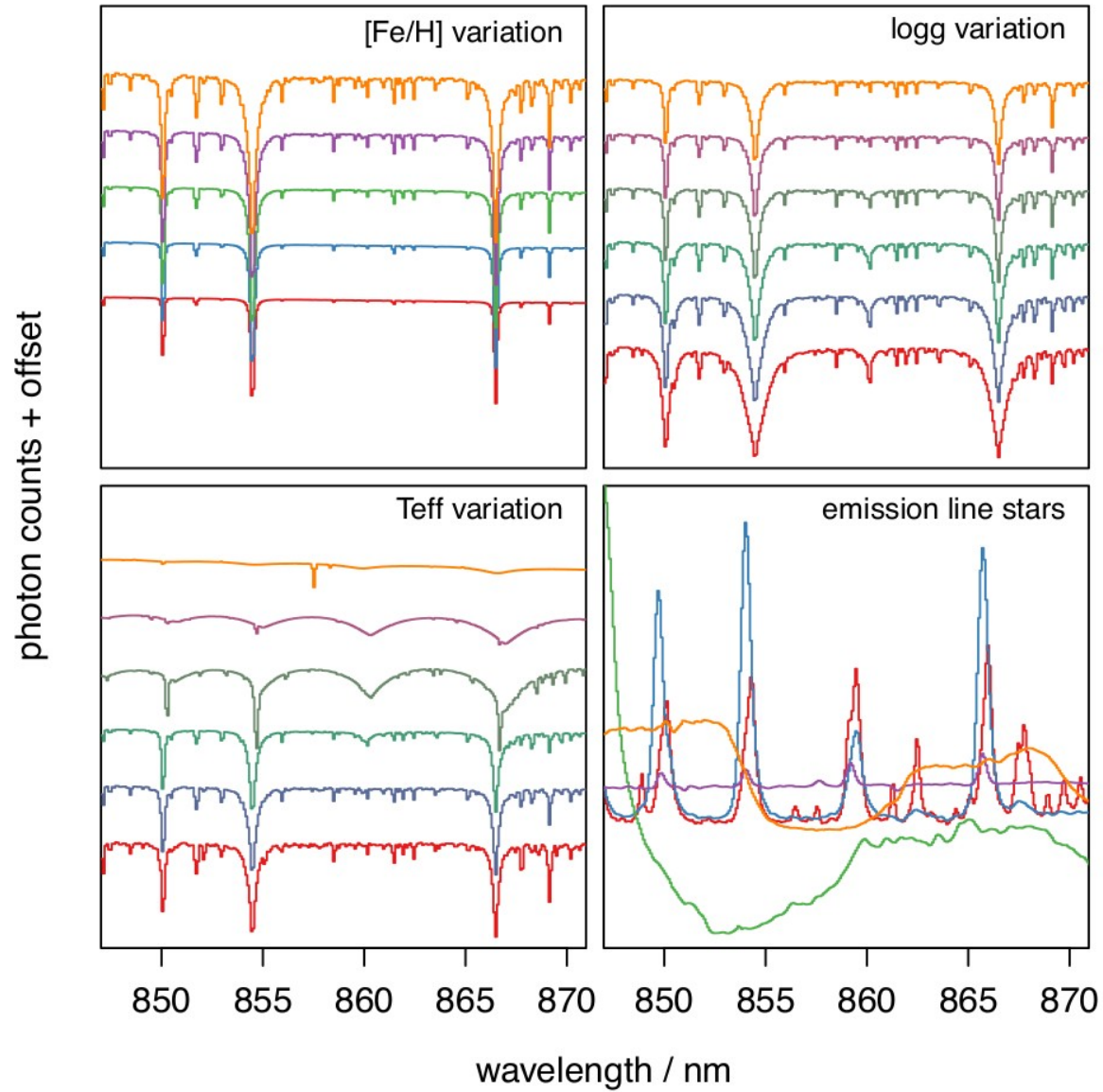


Graphics: ESA/DPAC/Astrium/ C. Jordi & J.-M. Carrasco

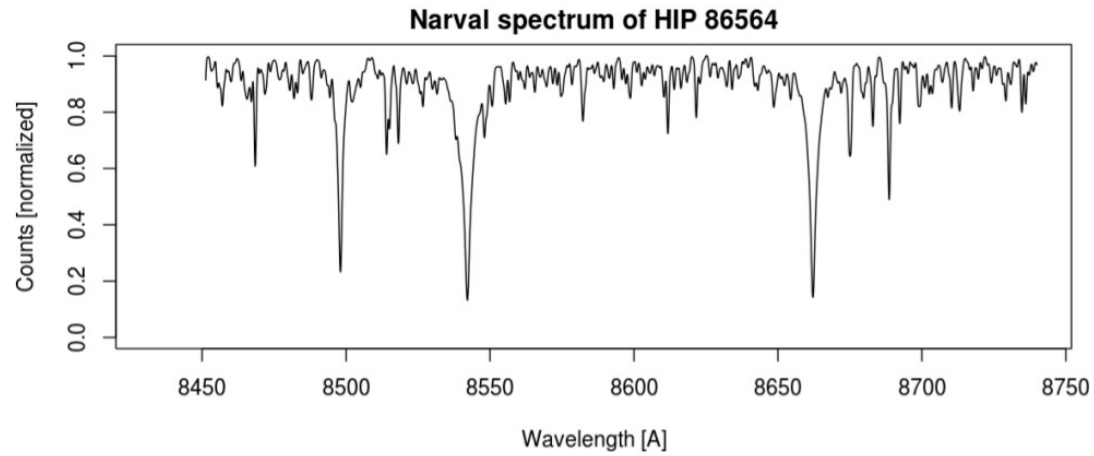
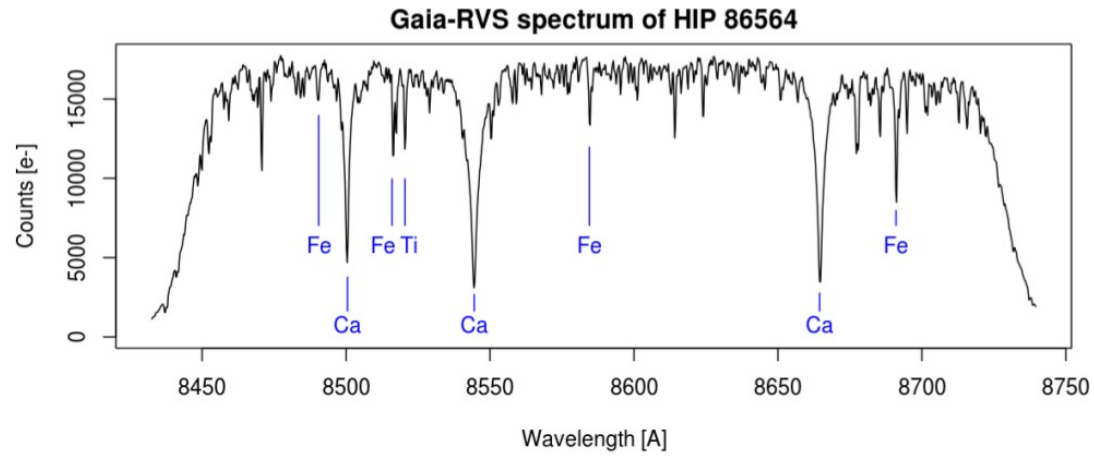
RVS spectra



RVS spectra



RVS spectra



DR2 – DR3 - DR4

- **2018 DR2** : Astrometry + Integrated photometry « G », « Bp » and « Rp » + Radial velocities + First Astrophysical parameters (Teff, Ag, R, L) + Variable
- **2021 DR3** : Improved astrometry and photometry
- Object classification and astrophysical parameters (Teff, R, L, Ag, Mass, Age, [Fe/H], [X/Fe], together with BP/RP spectra and/or RVS spectra they are based on, will be released for spectroscopically and (spectro-)photometrically well-behaved objects.
- Mean radial velocities will be released for those stars not showing variability and with available atmospheric-parameter estimates.
- Variable-star classifications will be released together with the epoch photometry used for the stars.
- Non-single star catalogues will be released.
- **202X DR4** : improved everything + actual data