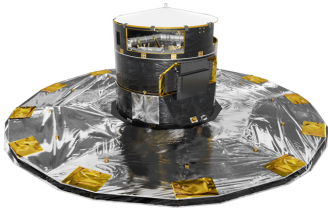


Gaia Information



Mission: Gaia is a space observatory of the European Space Agency (ESA), launched in 2013 and expected to operate until 2025. The spacecraft is designed for astrometry: measuring the positions, distances and motions of stars with unprecedented precision

Gaia was launched on 19 December 2013 and reached its designated orbit around the Sun-Earth L2 Lagrange point (a very similar orbit to JWST) on 8 January 2014.

Detectors: Gaia has the largest camera ever to be launched into space. It is 104 x 42 cm in size and contains 1 billion pixels divided among 106 CCDs. Each star that Gaia detects will be observed and measured approximately 70 times. Data is collected using 2 telescopes that focus and direct incoming light onto Gaia's 3 scientific instruments.

Scientific Instruments

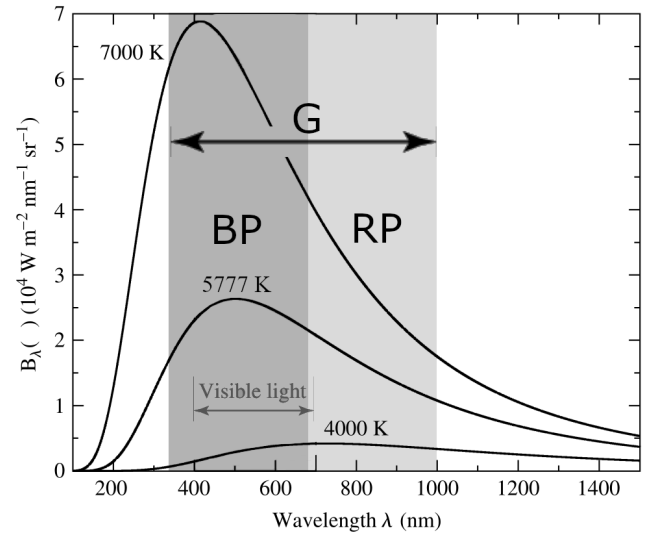
- Astrometric Instrument (ASTRO): Determines the position, parallax, and proper motion of stars.
- The Photometric Instrument (BP/RP): A low-resolution spectrometer with a wavelength band of 330-1050 nm.
- Radial Velocity Spectrometer (RVS): Measures the velocity of stars along Gaia's line of sight by calculating the Doppler Shift of calcium lines.

In this class we will mostly be using the parallax data from ASTRO and the spectra from the Photometric Instrument.

Gaia Parallax: Gaia precisely determines the parallax of all stars brighter than magnitude 20 by measuring their angular position over the five-year mission.

Gaia reports the parallax of stars in milliarcseconds (mas).

$$\text{Distance in pc } (d_{\text{pc}}) \approx \frac{1}{p(\text{mas})/1000}$$



Gaia Photometry: The flux of an object observed over the entire Gaia bandpass (330-1050 nm) is referred to as the G Magnitude.

Absolute G magnitude (M_G) is related to apparent G magnitude (m_G) via:

$$M_G = m_G - 5 \log_{10}(d_{\text{pc}}) + 5$$

Gaia color index (G_{CI}) The G bandpass is divided into two bandpasses - The Blue Photometer (BP 330–680 nm) and the Red Photometer (RP 640–1050 nm).

$$G_{\text{CI}} = \text{BP} - \text{RP}$$

Gaia color magnitude diagram: The Gaia CMD is shown on the next page.

Galactic Coordinates: a coordinate system based on the plane of the galaxy. It is centred on the Sun, and longitude and latitude 0 point directly towards the centre of the galaxy. Galactic longitude (l) is measured with primary direction from the Sun to the center of the galaxy in the galactic plane, while the galactic latitude (b) measures the angle of the object above the galactic plane.

