The Gaia mission status
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Gaia Summary

- ESA cornerstone mission building on the Hipparcos heritage
- Astrometry, Photometry and Spectroscopy
- Satellite, including the payload, by industry (Airbus DS), management and operations by ESA and data processing by scientists (DPAC)
- Launch 19 December 2013 with Soyuz from Kourou
- 5 years of operations in L2
- Gaia DR1 14 September 2016
  - Science Alerts started 2014
- Gaia DR2 April-2018
Gaia operations

- Gaia in routine operations since July 2014
- 1,000 days routine phase reached 20 April
- Operations: nominal
- 70 billion transits observed
- Nominal 5-year mission ends mid-2019
- Estimated end of mission due to cold gas exhaustion end-2023 (±1 year)
- Mission extension process started
Unwanted features

- Contamination
  - Last decontamination in August 2016; no sign of transmission loss yet
- Micro-clanks and micrometeoroids
  - Taken into account in data processing for Gaia DR2
- Basic Angle Variation
  - Corrected with Basic Angle Monitor data for Gaia DR1 and DR2; more sophisticated analysis planned for the future
- Stray light
  - Impact on faint sources; on-board software modified from read-out dominated to background dominated case for faint objects
- Radiation damage
  - First signs visible, but less than anticipated before launch; pre-launch calibration work will become relevant in the future
Gaia astrometry

- Astrometric measurements: 688 billion
- $G<20.7$ mag
- Bright limit around $G=2-3$ mag
- All bright stars covered with special measurements
- Selected crowded regions imaged with Gaia Sky Mapper
Gaia photometry

- Photometric measurements: 147 billion
  - G<20.7 mag
- Spectrophotometry
  - 330-680 nm BP
  - 640-1050 nm RP
  - Can also integrate BP and RP to get high precision measurements and a colour
- Astrometric measurements also photometric in G-band
Gaia spectroscopy

- Spectroscopic measurements: 13.7 billion
- $G_{RVS} < 16.2$ mag
- 845-872 nm with $R$ about 10,800
- Radial Velocity Spectrometer for >100 million radial velocities
- Spectroscopy till about $G_{RVS} = 11-14$ mag
Gaia DR1

Credits: ESA/Gaia/DPAC
Image acknowledgement: Moitinho & Barros
Video acknowledgement: de Bruijne
Gaia DR2

April 2018; details in other presentations in this symposium
Mission extension
Gaia extension

- Nominal mission end: mid-2019
- Likely end of mission: end-2023 ± 1 year
- GST prepared with the help of many the science case for the ESA advisory bodies
  - Science case was prepared for a 5 years extension, but ESA extension cycle is 2+2 years so Gaia is in for the preliminary, scientific, extension approval for mid-2019-20
- End-2018 definitive extension for mid-2019-20 and preliminary scientific extension approval for 2021-22
- Due to ministerial level decision December 2016 on ESA the science budget, the extension decision was postponed from November 2016 to June 2017
Improvement of scientific performance

- Basic mission results improve like $t^{0.5}$
- Position, parallax, photometry and radial velocities
- Rapidly increasing gain in kinematics and dynamics
- Proper motion improvement scales as $t^{1.5}$
- More complex systems scale quicker e.g. exoplanets
Reference frames

- Reference frame degradation is mainly due to proper motion errors
- Mission extension improves proper motions significantly
- Astrometric calibration of the past possible: photographs, CCD images
- Astrometric calibration of the future: extremely large telescopes
- Very long term e.g. GaiaNIR
Conclusions

- Gaia is on the way to fulfil its promise
- Gaia DR1 is just a starter, yet a huge leap forward
- Get ready for Gaia DR2
- Gaia DR2 processing: challenges and excellent results