GENIUS
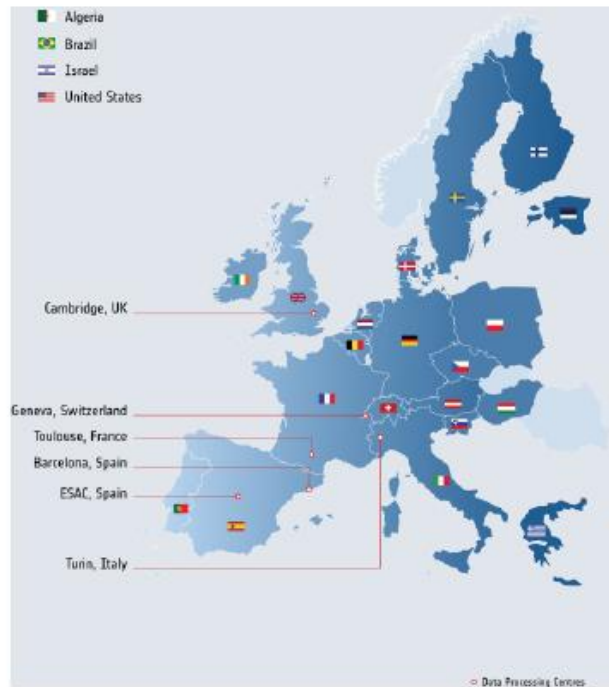
Gaia DR1 overview and future releases

X. Luri
Universitat de Barcelona

Teamwork to deliver the Gaia promise

- 10+ years of effort
- 450 scientists and engineers
- 160 institutes
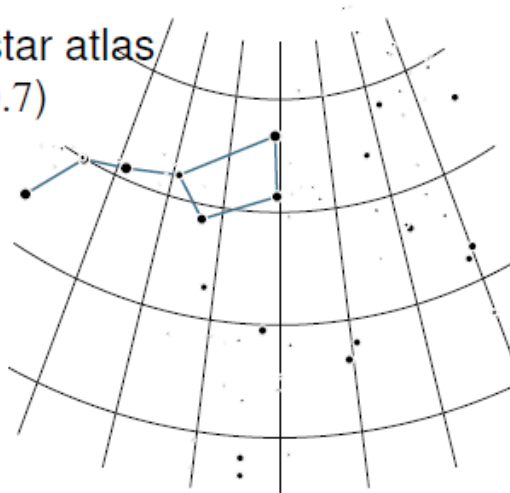- 24 countries and ESA
- Six data processing centres

- Algeria
- Brazil
- Israel
- United States

Cambridge, UK

Geneva, Switzerland
Toulouse, France
Barcelona, Spain
ESAC, Spain

Turin, Italy

○ Data Processing Centres

gaia

01000000110010011001101011001010
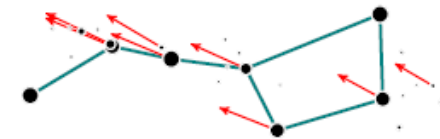
Gaia
DPAC
Data Processing & Analysis Consortium

α δ ϖ μ_α* μ_δ G …

Gaia DR1 contents

Billion star atlas
($G \lesssim 20.7$)

Positions and magnitudes
for $\sim$ 2000 ICRF quasars

Tycho-Gaia
Astrometric Solution
($\sim$ 2 million, $G \lesssim 12$)

D

5284240582308398080   P=0.607 d
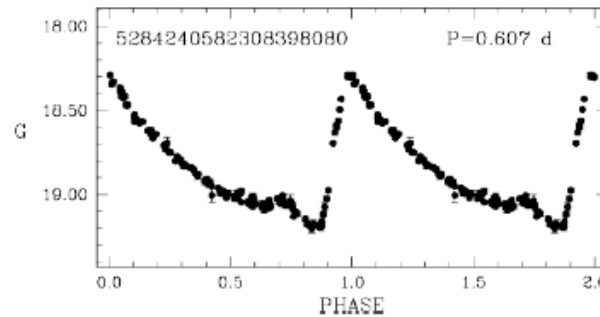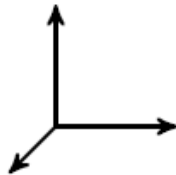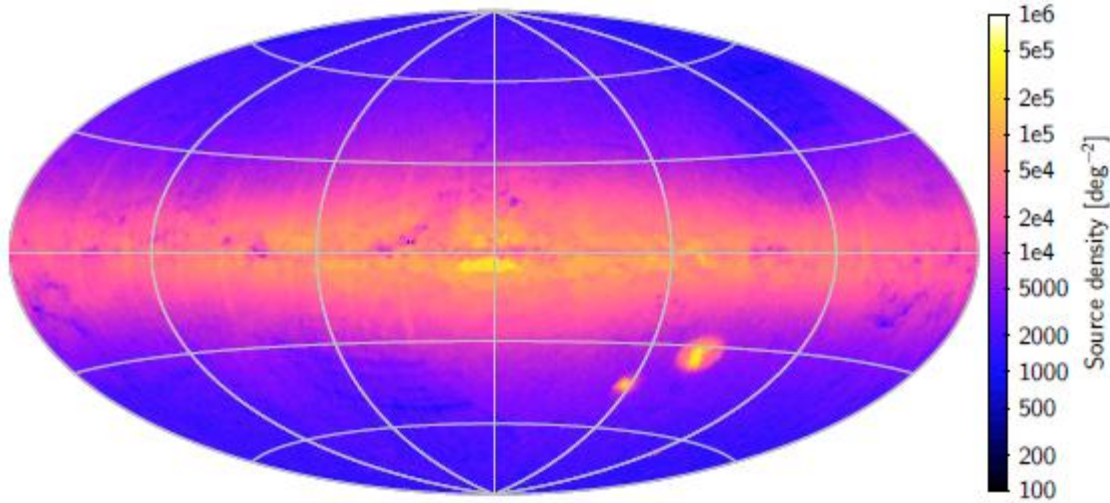
Variable stars near
south ecliptic pole
($\sim$ 600 Cepheids,
$\sim$ 2600 RR Lyrae)

DR1 magnitude distribution
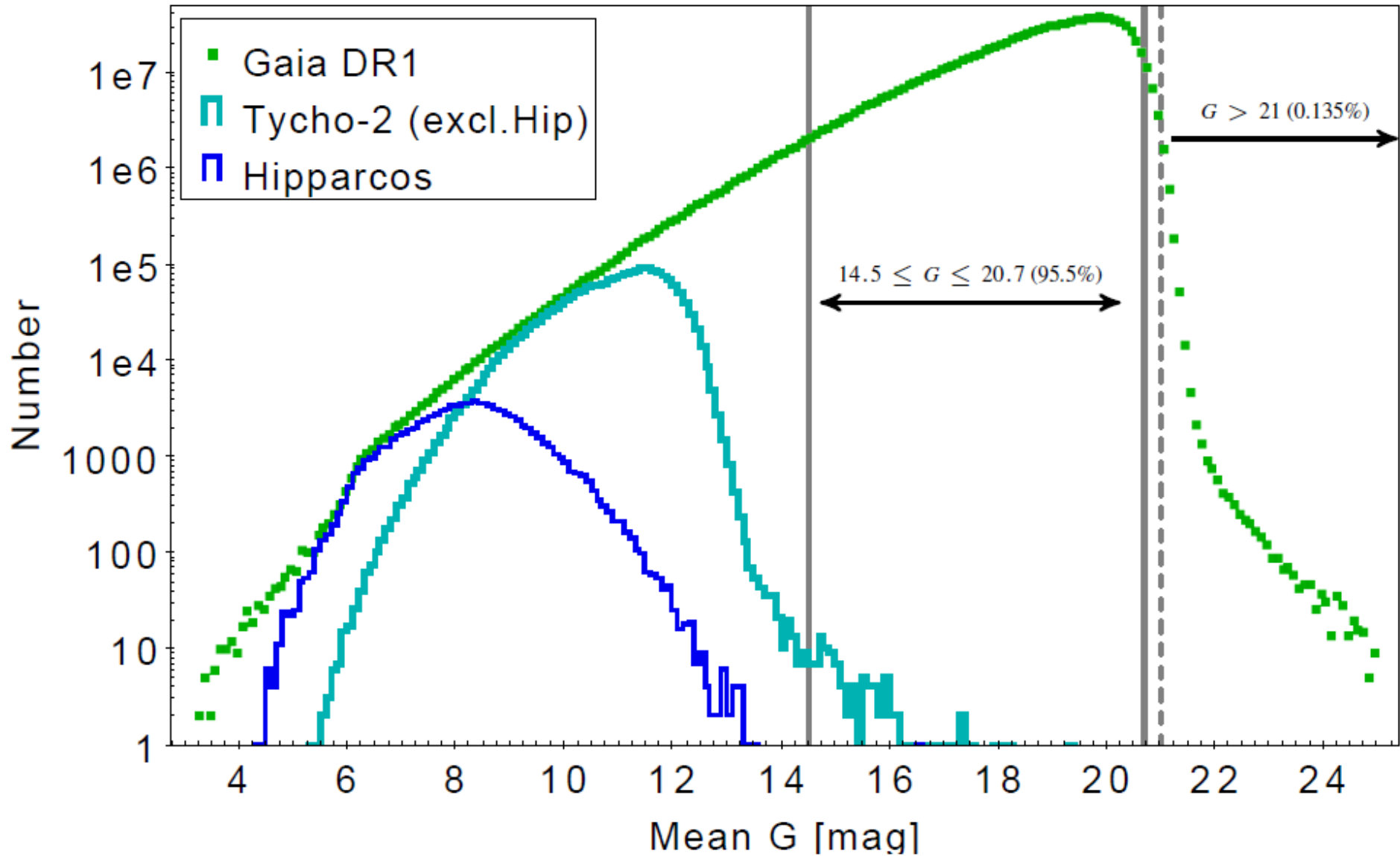
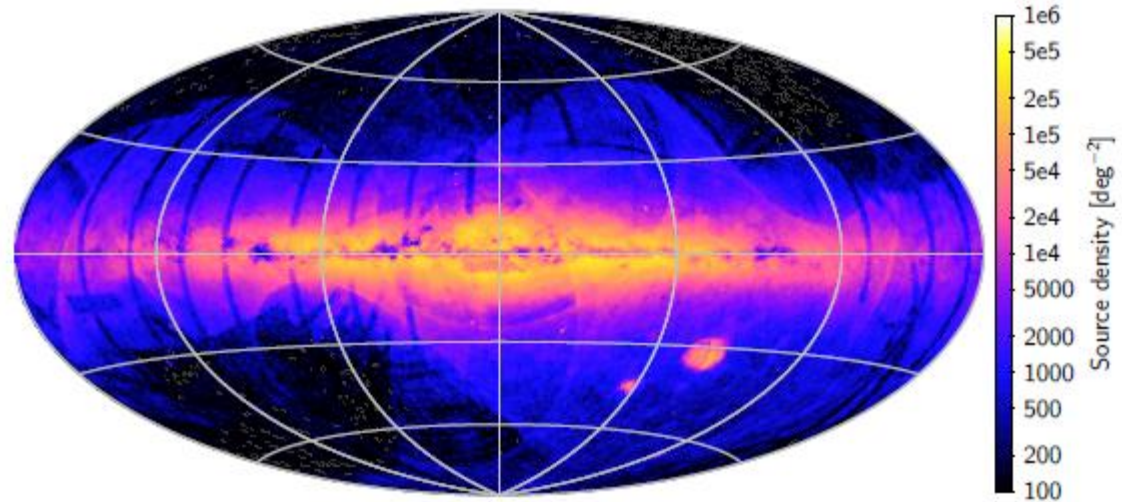# New sources

685 million sources matched to IGSL

456 million new sources in Gaia DR1

DPAC/CU3/Lindegren et al., 2016, A&A

# Highly precise positions

- (α, δ) for 1.1 billion sources to G = 20.7
- Epoch J2015.0, alignment to ICRF < 0.1 mas, rotation < 0.03 mas yr^{-1}
- Typical position uncertainty 10 mas
- Positions of 2191 ICRF sources from special astrometric solution (Mignard et al., 2016, A&A)
- 90% with pos < 3.35 mas
- no systematic differences with radio positions of more than few tenths of mas

HR diagrams with TGAS

Hipparcos *and* Gaia DR1 parallaxes precise to $\leq 20\%$
43 546 stars, 90% stars inside 280 pc

Gaia DR1 parallaxes precise to $\leq 20\%$
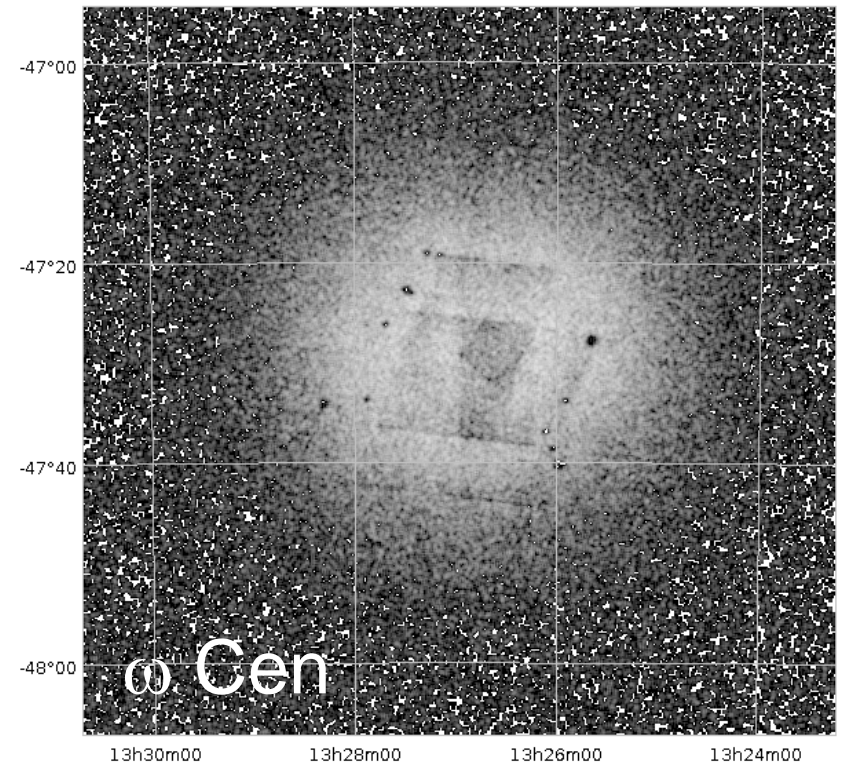77 771 stars, 90% inside 450 pc

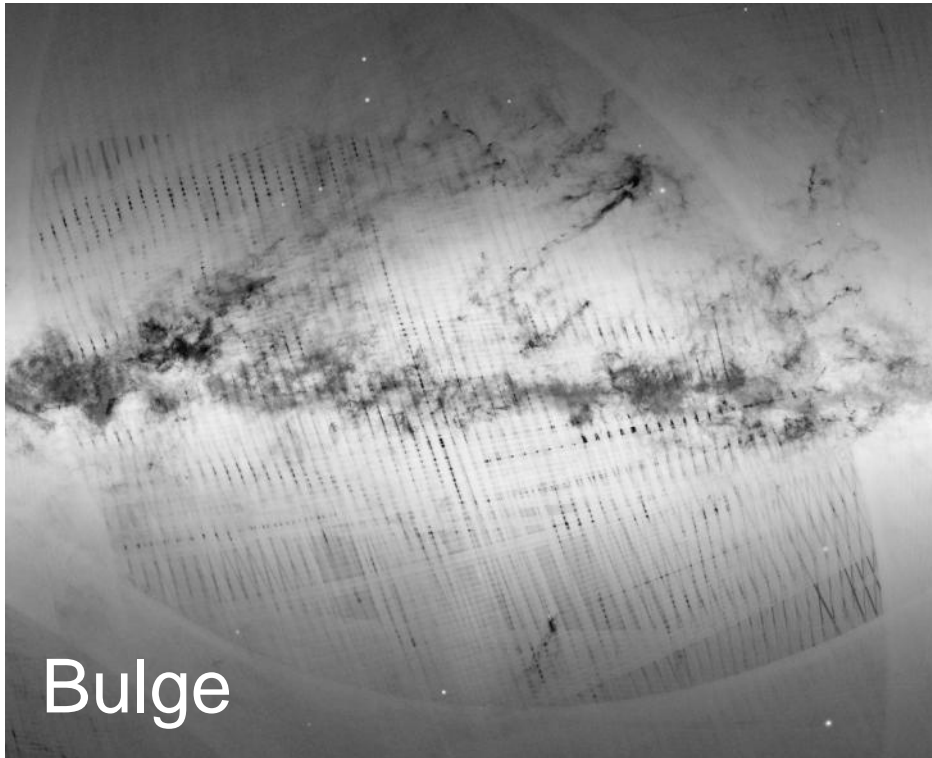Hipparcos (van Leeuwen 2007)
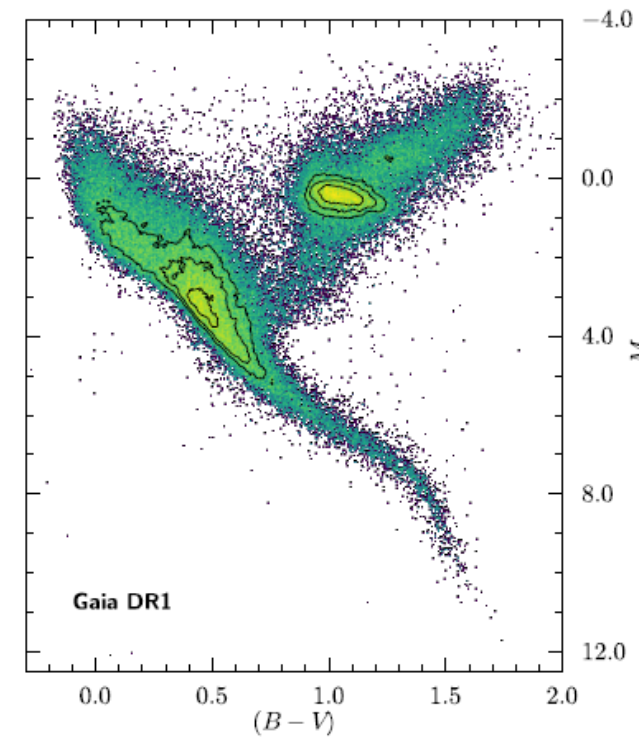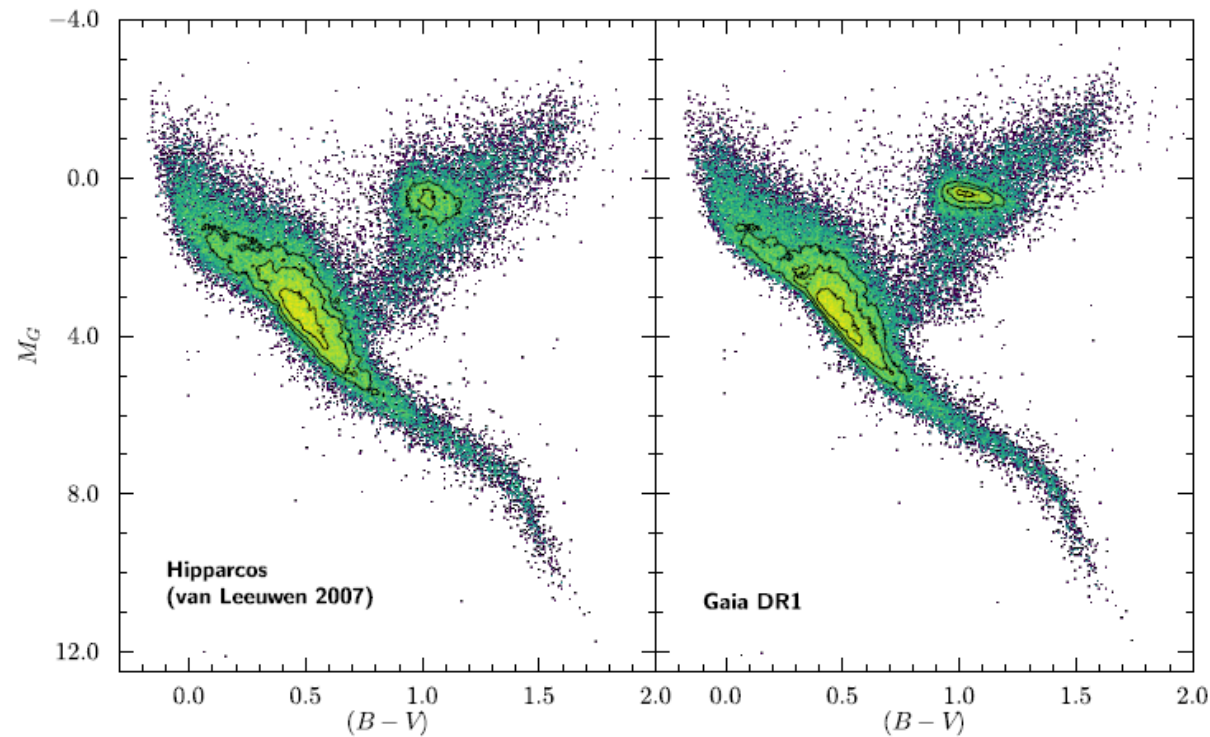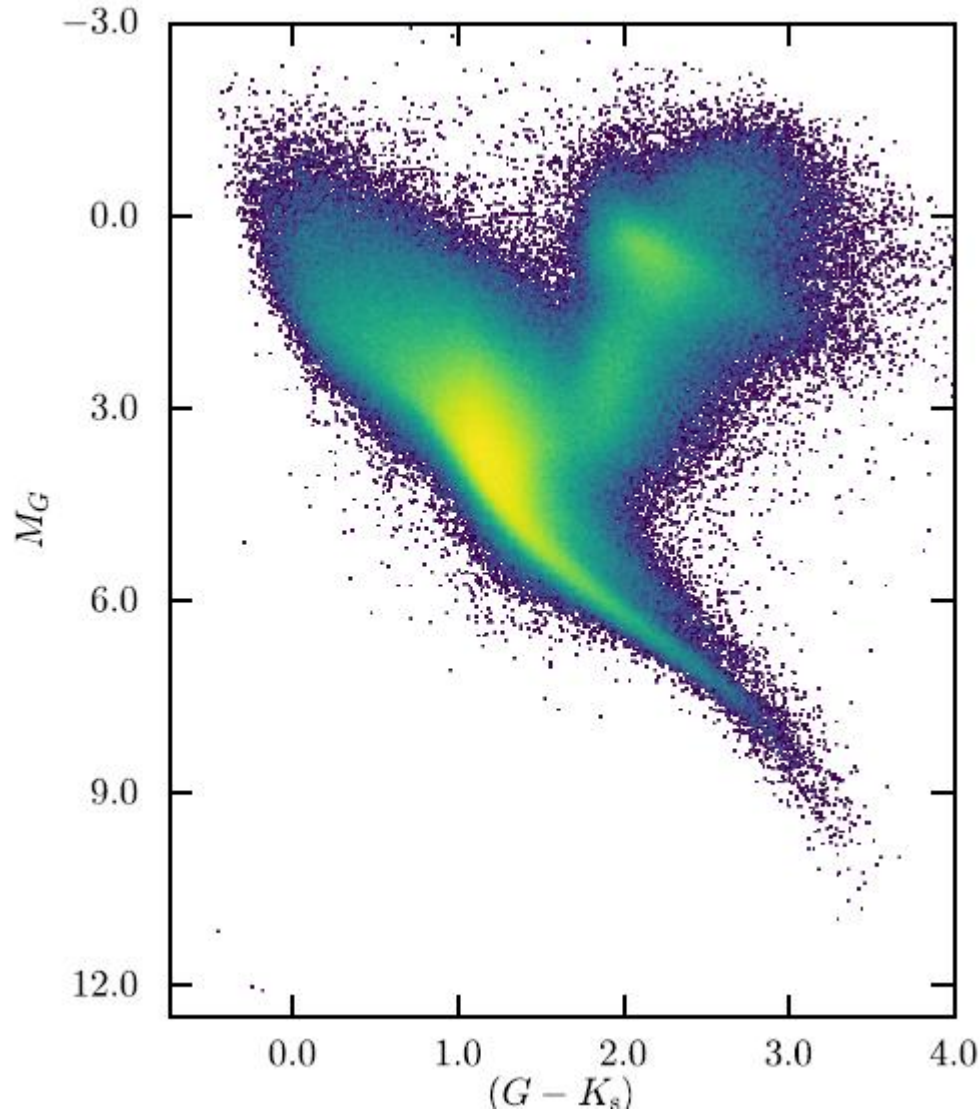
Gaia DR1

Gaia DR1

Full Gaia DR1 data set

● 1 million stars with parallaxes precise to $\leq 20\%$

● 90% inside 590 pc

● Future
  ▶ ~ 10 million parallaxes precise to 1%
  ▶ ~ 150 million precise to 10%
  ▶ ~ 280 million precise to 20%

DR1 completeness

Bulge

ω Cen

- Ill-defined and celestial position dependent faint limit
- Scanning law + filtering on data quality → source density artifacts
- High density regions (few 100 000 stars/deg2) affected by several factors
- Below 4 arcsec separation many secondary components of binaries missing
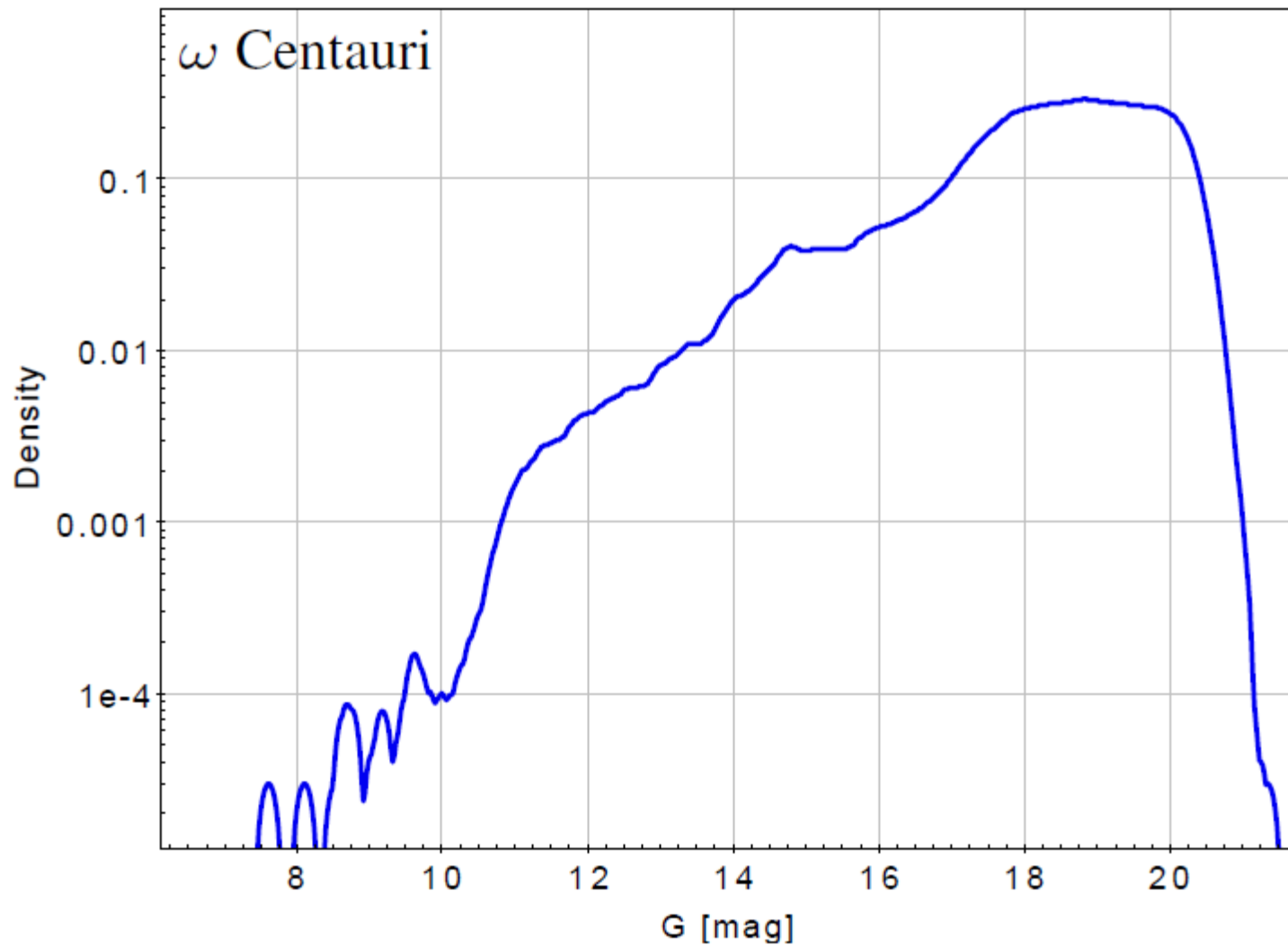
GENIUS

Many bright stars missing at G≤7
High proper motion stars (μ > 3.5) arcsec yr⁻¹ missing
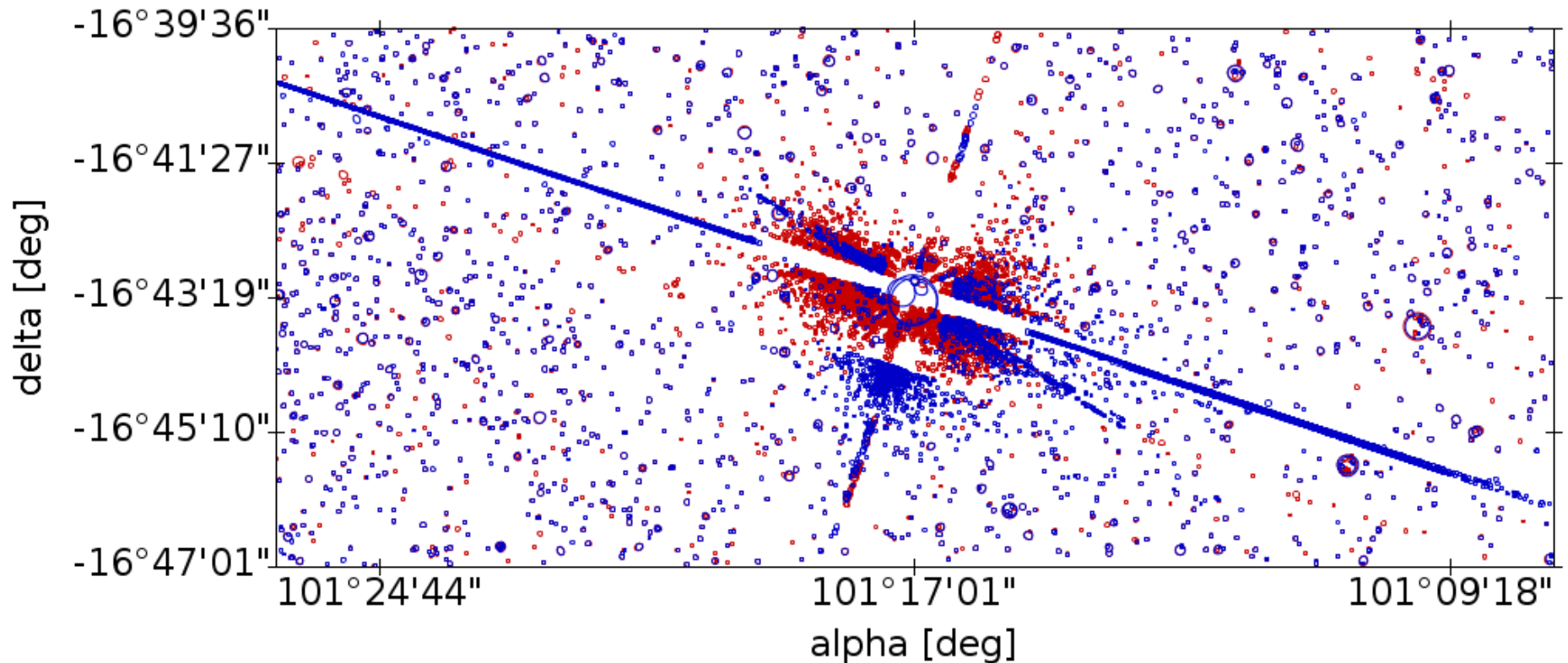
Spurious objects

- Bright objects cause spurious on-board detections
- Vast majority removed during data processing
- Small fraction of Gaia DR1 sources may have photometry affected by inclusion of a spurious transit

Future: Gaia DR2

- Targeted for Q1 2018
- Astrometry and photometry based on roughly 22 months of data
- Gaia <u>stand-alone</u> astrometric solution (unlike TGAS, no priors needed); 5-parameter astrometry for all sources
- Broad band photometry, G, GBP, GRP (broad band colours); improved photometric calibrations, proper pass-band calibrations
- Median radial velocities for bright (GRVS < 12), constant RV, stars
- More variable stars results
- SSO data
- T_{eff}, A_0 from GBP, GRP