Closing remarks
ELSA and the frontiers of astrometry

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- What was gained from the ELSA network?
- Some thoughts on the data processing and data publication
- A future ELSA?

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  - including preparations for the science exploitation

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- Trained next generation space astrometry experts

Astrometry


Did I tell you about my adventure with the covariances?


Conjugate gradients, my good man, of course!


Hmm, better verify what these guys are producing...


My attitude is a nuisance?!

Radiation damage mitigation

Universe model

Stars


I want my parallaxes spotless!


CCD-resolved photometry or bust!


Don’t forget theory!


10 000 templates? 20% discount, that’s the best I can do!

RVS, Solar system, IT infrastructure

Future proofing the Gaia data

- Gaia will provide an unprecedented stereoscopic map of our Milky Way and the nearby universe
  - 1 billion stars, 300 000 solar system objects, millions of galaxies, 500 000 quasars, 10 000 exo-planets, ...
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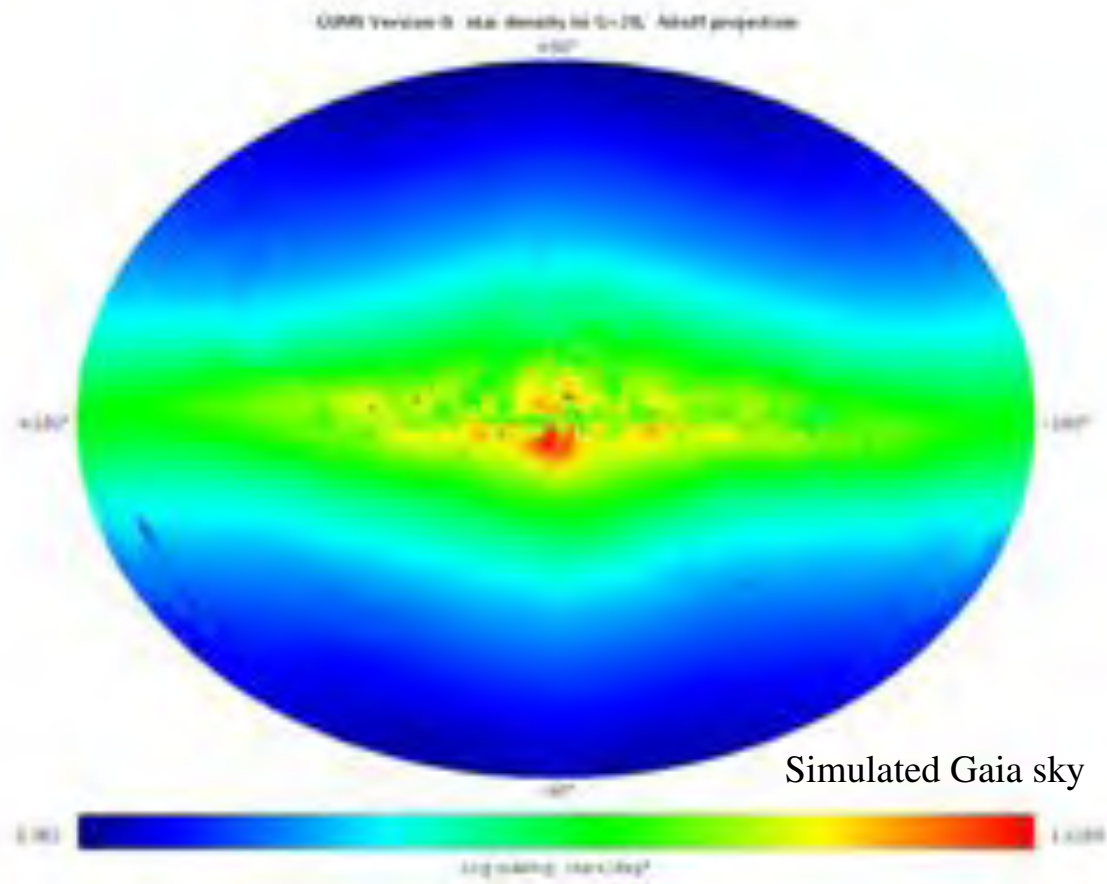
- It will be *the* astronomical data archive for decades to come
  - tremendous discovery potential when combined with other archives
- Let's therefore seriously explore the following:
  - publish early and often
  - keep raw data, calibration data, and processing software available
  - facilitate reprocessing
  - make the archive 'live'
  - consider the catalogue as the best explanation of the data at a given moment

Publish early and often

- Early Gaia data will still be fantastic resource
  - e.g., volume around the sun
- Provides early experience with catalogue publishing and use
- Feedback from users will be invaluable
- Keep in mind SDSS experience

First publications?

- positions
- G-band and $G_{\rm BP} - G_{\rm RP}$ colour
- rejuvenation Hipparcos proper motions

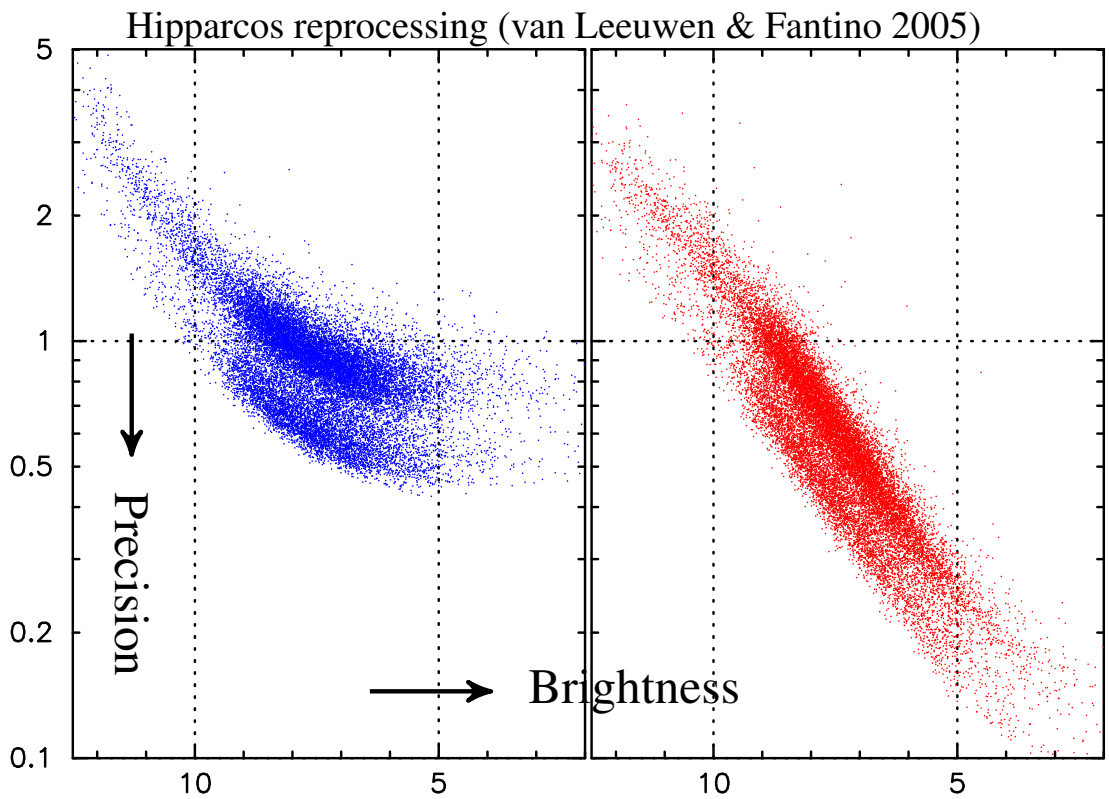


Simulated Gaia sky

Facilitating reprocessing

Data curation

- All raw data
  - ∼ 60 TB uncompressed
- Calibration data and models
- Intermediate data products
- All processing software
- Implement data lineage concept
  - 'no hard decisions'



Science goals

- Raw data reprocessing based on better algorithms, better calibration models etc
- Alternative processing of specific stars, groups of stars, or even entire catalogue
- Reprocessing data based on new and independent information

Living archive concept

Gaia catalogue and archive released in $\sim$ 2020 should not be 'final'

Photo Courtesy of the Isaac Newton Group of Telescopes, La Palma

- Updates should be allowed so as to incorporate:
  - updated classification or parametrization of stars
  - better distance estimates for faint stars
  - ground-based follow-up observations
  - independent information on, e.g., double stars
- Implications for maintenance, quality, security, keeping mirrors in sync

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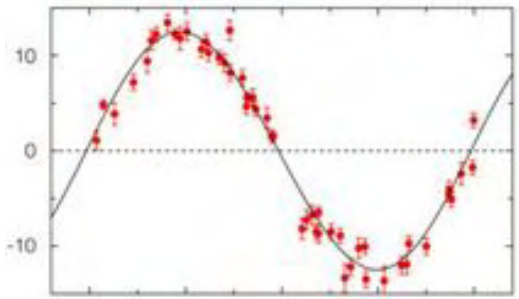

Bring the processing to the data

- Szalay (Sloan Digital Sky Survey) has advocated this for large archives
  - allows arbitrarily complex processing of archive data
  - example: dynamical model of the Milky Way that best explains the catalogue

- Virtualisation (O'Mullane, ESAC) could allow users a virtual machine *in the Data Centre with the Archive*
  - code what you want and specify how you want run it

Going even further...

Hogg (NYU): the catalogue is a probabilistic model of the data

- Single frozen catalogue contains all our knowledge about the data but it may not necessarily be the best description of the data
- Provide ‘catalogue’ as a model incorporating all our knowledge of the data
  - explains the observed data
  - predicts unobserved, new, or different kinds of data
  - adjustable through likelihood re-evaluation
- Include ambiguities in the catalogue as likelihood of certain parameters to explain observed data
  - makes priors in catalogue construction more visible
  - allows injection of new information

A future ELSA-II?

Innovative exploitation existing data in 2020

- How do we implement the advanced ideas on catalogue publication?
- Is an 'explanation of every pixel' feasible? Necessary? How?
- Combination with other data archives

Future astrometric surveys

- Where can we gain the most in terms of science?
- Develop breakthrough technology or measurement principles to circumvent current accuracy barriers

See brainstorming session at Heidelberg ELSA school in 2009 (DPAC-SVN)

The next generation