



MW-Gaia: Revealing the Milky Way with Gaia

“Final Conference”, Barcelona, Spain



Nicholas Walton
(MW-Gaia COST Action Chair)
(Institute of Astronomy, University of Cambridge)

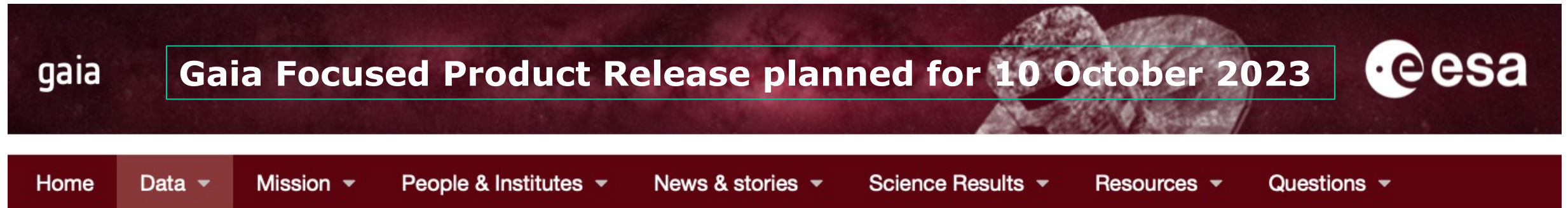


Nic Walton - Final Conference - MW-Gaia @ Bar



Welcome to Gaia – Beyond the Milky Way!

New science with the latest data from Gaia



This workshop site at <https://indico.icc.ub.edu/event/252/>

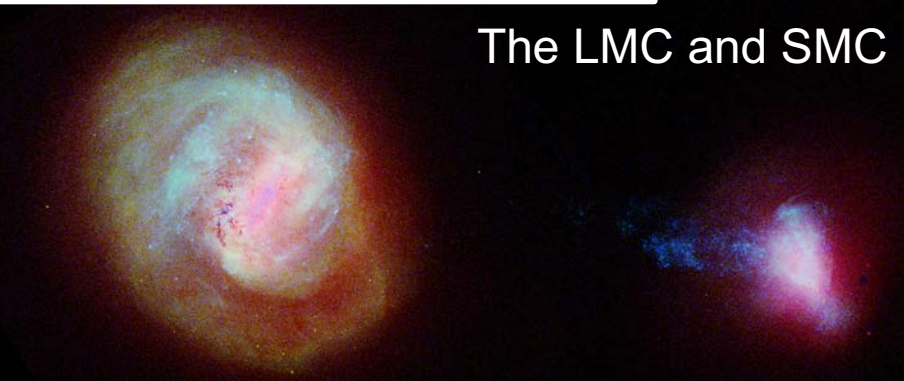
MWGaia Action Rationale

Gaia: a Big Science, Big Data Challenge

Gaia data leads to insight across astronomy

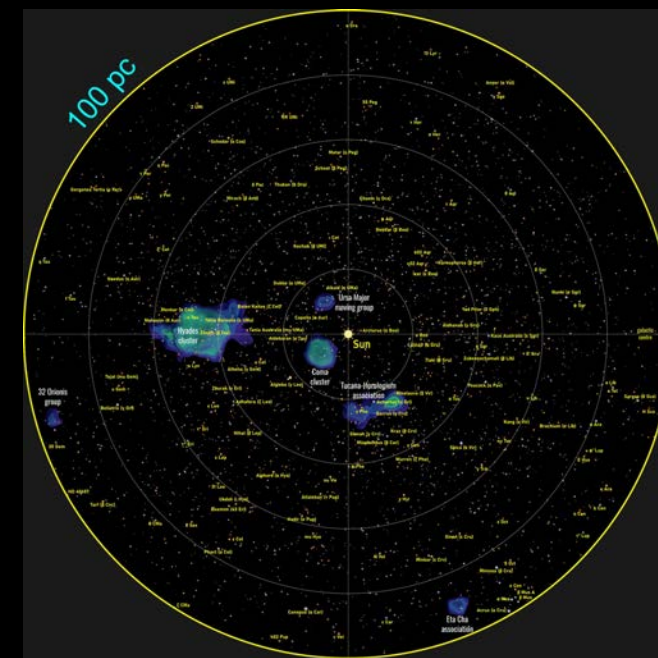
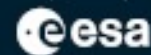


The LMC and SMC



Credit: ESA/
Gaia/ DPAC

Gaia (E)DR3: with larger to come



Mapping star density out to 100pc

Credit: ESA/
Gaia/ LMC and SMC DPAC

Over 2.2 Trillion observations, and counting ...

Gaia Research for European Astronomy Training

GREAT 2010-2015

Some history:

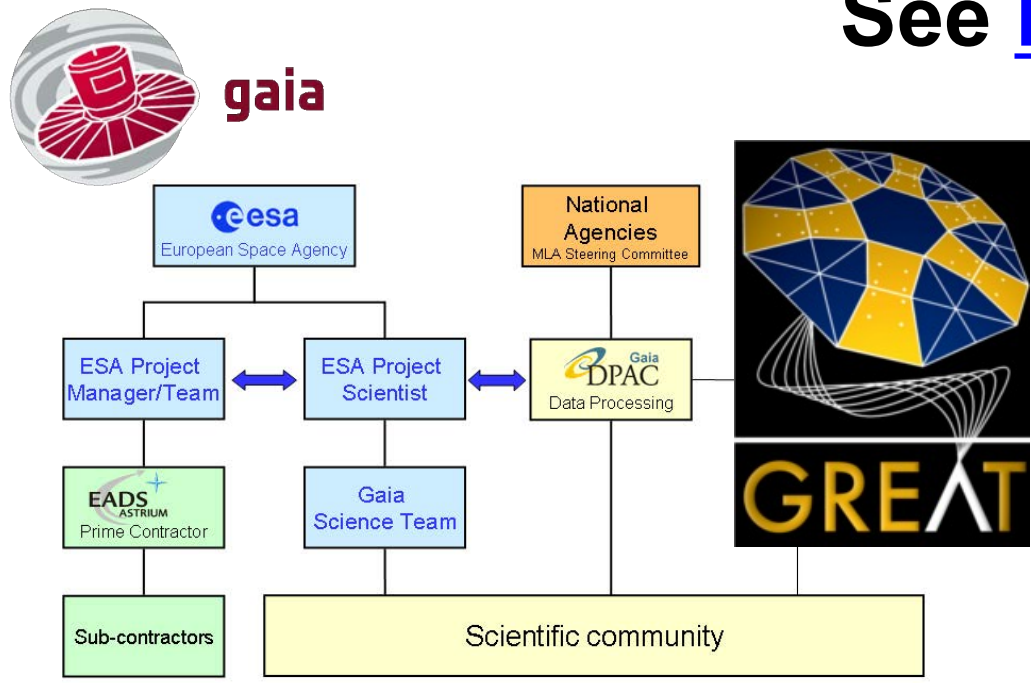
See <http://www.great-esf.eu>

over 2000 scientists attending ~60 events

Workshops & Exchanges

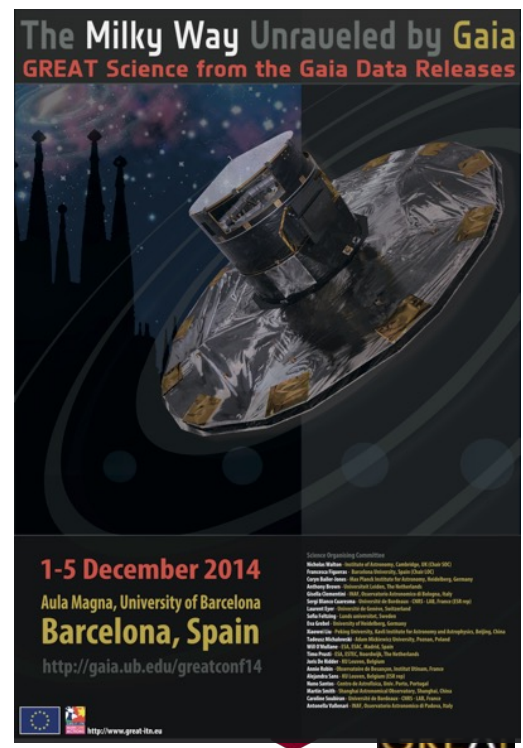
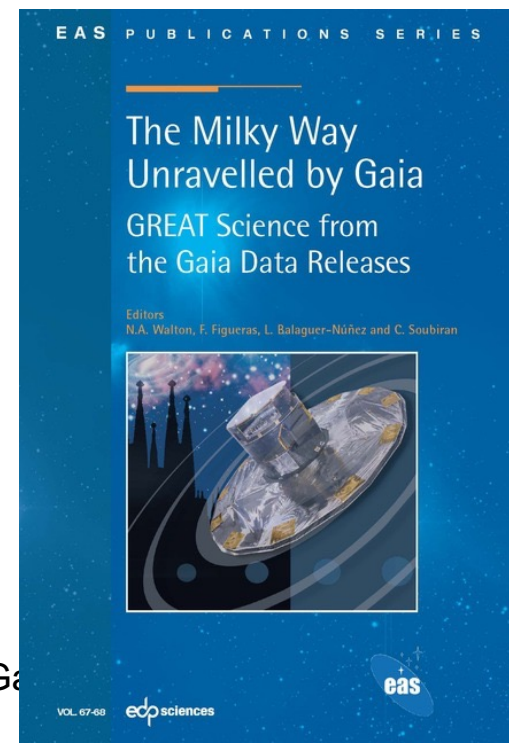
Student Training
17 ESR/PhDs

Outputs: science teams, science case for new instruments, case for new networks



Gaia launched Dec 2013. 1st data release Sep 2016

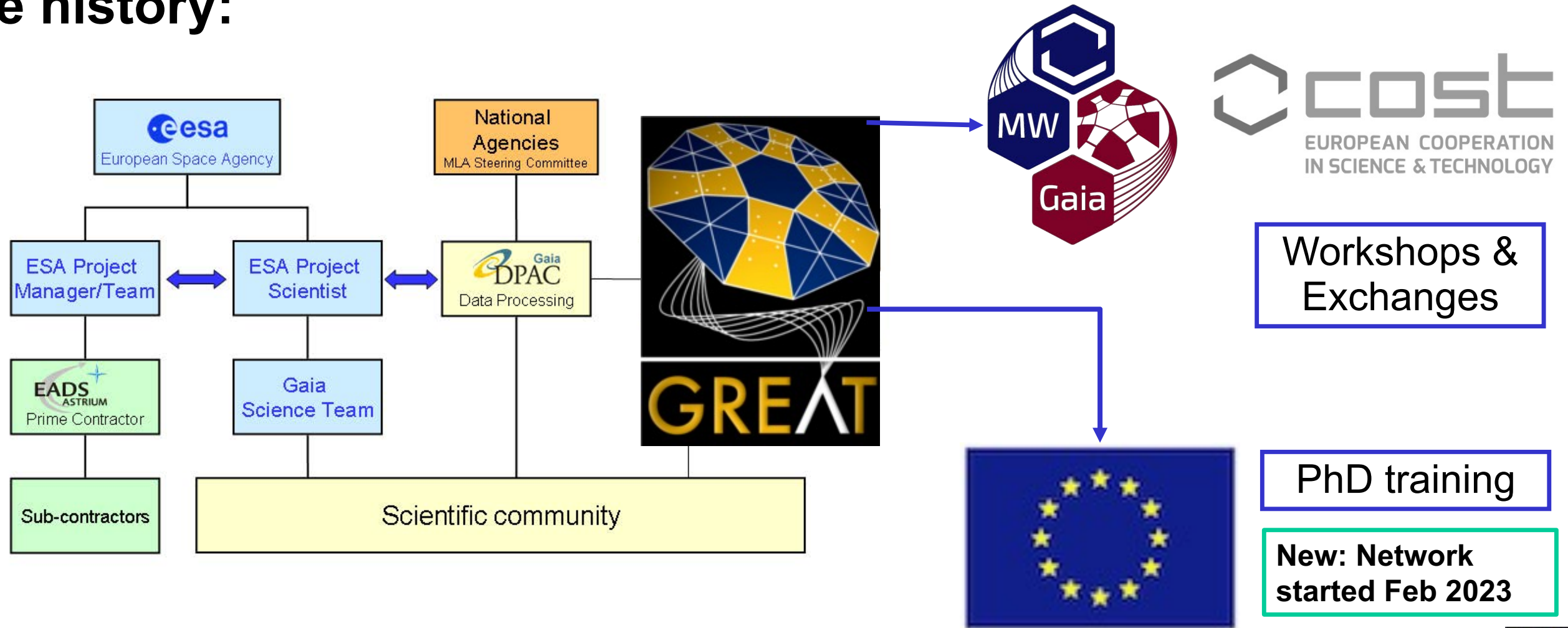
This phase of GREAT underpinned preparation for Gaia and early science



GREAT/ MWGaia 2019-2027

See <http://www.mw-gaia.org> and <http://www.great-esf.eu>

Some history:



GREAT Plenaries

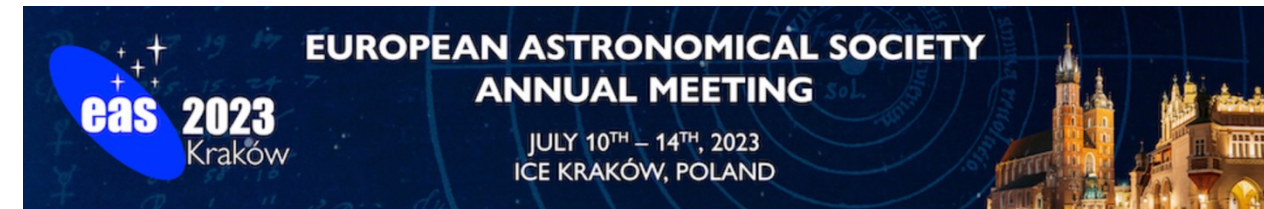
Last: <http://great.ast.cam.ac.uk/Greatwiki/GreatMeet-PM16>

- GREAT has held plenary meetings since 2009 (at EAS from 2012)

The last GREAT plenary was held at the EAS Annual Meeting 2023 in Kraków as Symp S3 (10-11 Jul 2023)

Programme

- Gaia DR3: Highlight Science including a review of recent major science highlights in the Gaia DR3 release and an early look at the new Gaia Focused Product Release.
- Gaia / GREAT/MW-Gaia / Gaia Unlimited Status
- Gaia EDR3/DR3: Highlight Science (The Milky Way as a Galaxy)
- Gaia EDR3/DR3: Highlight Science (The Birth, Life and Death of Stars)
- Gaia EDR3/DR3: Highlight Science (from Solar system to reference frames)
- Gaia networking and ground based synergies with Gaia
- Lunch session with an update on the Gaia Archive, and update on the ESA Voyage 2050 L mission concept (GaiaNIR), and also an opportunity for poster presenters to deliver a 'lightening' talk of their (e-)poster.



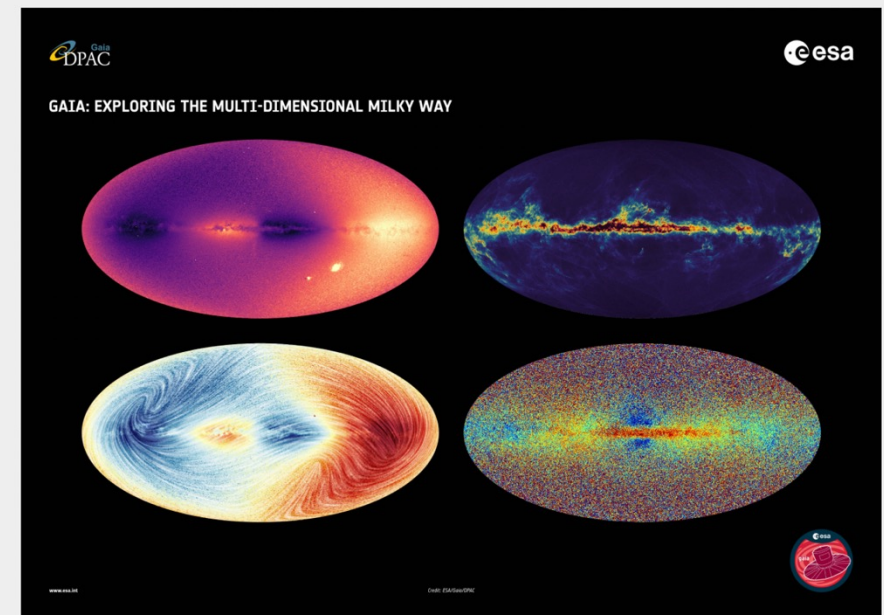
Expand All | Collapse All

- EAS 2023
- Welcome & News
- Organisers
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- Registration
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- Accommodation
- Child care
- Graphics
- Sponsorship & Exhibition
- Sponsors & Exhibitors
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- Contact

Symposium S3

10-11 July 2023

Gaia: The (TWO) Billion Star Galaxy Census: The Magic of Gaia DR3

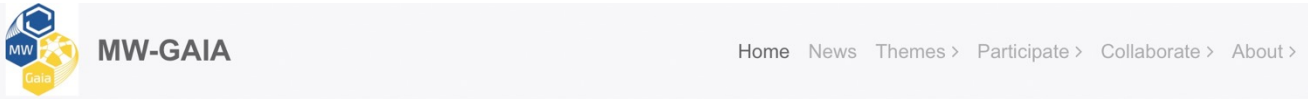


News:

- 20230127 Session Information updated.



MW-Gaia: <http://www.mw-gaia.org>



Welcome to MW-Gaia

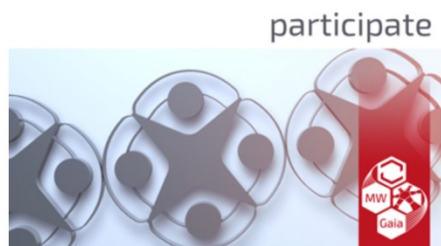
MW-GAIA will provide European leadership in understanding the Galaxy, its stars and planets, enhance the potential of the community in its scientific exploitation of the observations of more than a billion stars with the European Space Agency's Gaia satellite, and enhance the development of the next steps in astrometry and space astrometry missions.

The Action brings together key stakeholders from across Europe, to leverage expertise, and develop new techniques to fully maximise the scientific returns from Gaia's rich and complex data.

Five key challenges are addressed: The Milky Way as a Galaxy, The Life and Death of Stars; Planetary Systems Near and Far; Gaia Fundamentals: Space and Time; and Astrometry Innovation Challenge – towards sub- μ as astrometry. COST enables the vital Action activities, supporting exchanges, training and meetings.

The Action will have a significant legacy, creating a dynamic and vibrant network of researchers with expertise in the study of the Milky Way, its constituents and the art of Astrometry. Participation is inclusive, with researchers accessing the Network from across Europe, irrespective of their gender or location.

This COST Action commenced 14 Mar 2019 and will complete 13 Sep 2023.



Final Conference: The Milky Way Revealed by Gaia: The Next Frontier [↗](#)

01.05.2023 Filed in: [Participate](#)

The Action COST MWGaia invites you to participate in the Final Conference "The Milky Way Revealed by Gaia: The Next Frontier" that will take place in Barcelona, ES from 5 to 7 September 2023.

Social Media



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- [WG2](#)
- [WG3](#)
- [WG4](#)
- [WG5](#)

- The MW-Gaia COST Action has participants from 30 COST countries (including Ukraine) and participation from groups in Armenia, Canada, China, Lebanon, South Africa, USA
- Scientists in these COST countries have been supported in attending MW-Gaia events





MW:Gaia: Working Groups

MW-Gaia is/was organised into five working groups (WG):

- [WG1: The Milky Way as a Galaxy:](#)
- [WG2: The Life and Death of Stars:](#)
- [WG3: Planetary Systems Near and Far:](#)
- [WG4: Gaia Fundamentals: Space and Time:](#)
- [WG5: Impact, Inclusiveness and Outreach:](#)

Updates from
each WG at
this final
conference

Each WG has/had an organizer, with participants able to signup

Each WG was responsible for organizing workshops and training events in its topic area

The WGs will remain active in preparation for future Actions!



MW:Gaia COST Action: Working Group Leads

Thanks to all the leads for
making MW-Gaia work!

Action Chair: Nicholas Walton (Cambridge: UK)

Action vice-Chair: Carme Jordi (Barcelona: ES)

WG1 Lead: Despina Hatzidimitriou (Athens: GR)

WG2 Lead: Gisella Clementini (Bologna: IT)

WG3 Lead: Joris De Ridder (Leuven: BE)

WG4 Lead: Sonia Anton (Aveiro: PT)

WG5 Lead: Šarūnas Mikolaitis (Vilnius: LT)

MW-Gaia Action Administrator:
Anna Bertolín

STSM Committee: Karri Muinonen, Sonia Anton,
Andreas Just, Elena Pancino, Ivanka Stateva

Exchange Visit (STSM) Coordinator: Karri Muinonen (Helsinki: FI)

Country Inclusion Coordinator (TA): Ivanka Stateva (Sofia: BG)

Science Communications (SCM): Anthony Brown (Leiden: NL)

Inclusion and Training (ITM): Corinne Charbonnel (Geneva: CH)





MW-Gaia: <http://www.mw-gaia.org>

Grant Period 4: Workshops and School

Grant Period 4 Workshops (1 Nov 2022 to 13 Sep 2023)

■ WG2-Sofia-GP4

Stellar variability, stellar multiplicity: periodicity in time & motion: 6-8 June 2023

■ WG4-Lund-GP4

Science and technology roadmap for μ as studies of the Milky Way: 18-20 Jul 2023

■ WGALL-Barcelona-GP4

The Milky Way Revealed by Gaia: The Next frontier: MW-Gaia Final Conference: 5-7 Sep 2023

■ WG1-Cambridge-GP4

The Halo-Bulge connection (Title TBC): 11-13 Sep 2023

4 Schools over the
Action lifetime

MW-Gaia Outcomes
and Deliverables

17 Workshops (~1000
attendees) over the
Action lifetime

Schools

This page contains details about the schools organised by MW-Gaia

Last Updated: 9 April 2023

■ WG5-Vilnius-GP4

Better Inclusion, Better Science, Building Impact in MW-GAIA: 3-5 July 2023



MW-Gaia: Exchange Visits

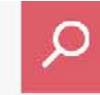
Short Term Science Missions (STSM)

MW-Gaia Outcomes
and Deliverables

- STSMs provided funding for (primarily) early career investigators to visit another institution to carry out collaborative research
 - Details of the procedure available at: <https://www.mw-gaia.org/participate/stsm-visits/>
 - **Final exchange visits for MW-Gaia Year 4 completing by 13 Sep 2023**
 - Applications accepted at any time and reviewed at end of each month
- Exchange visits often based on ideas originating at MW-Gaia workshops and schools**

ITC Conference grants provided support to those from ITC countries to attend conferences – see <https://www.mw-gaia.org/participate/itc-grants/>

~50 STSM and ITC grants awarded over the Action lifetime



A window to the Universe with Gaia

Choose your language!
EN • ES • CA

MW-Gaia Outcomes and Deliverables

MW-Gaia Outreach Site

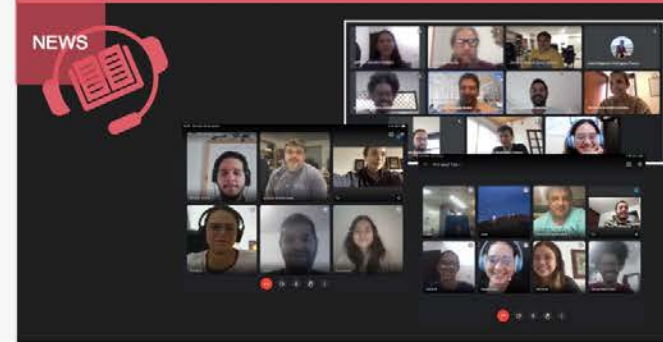
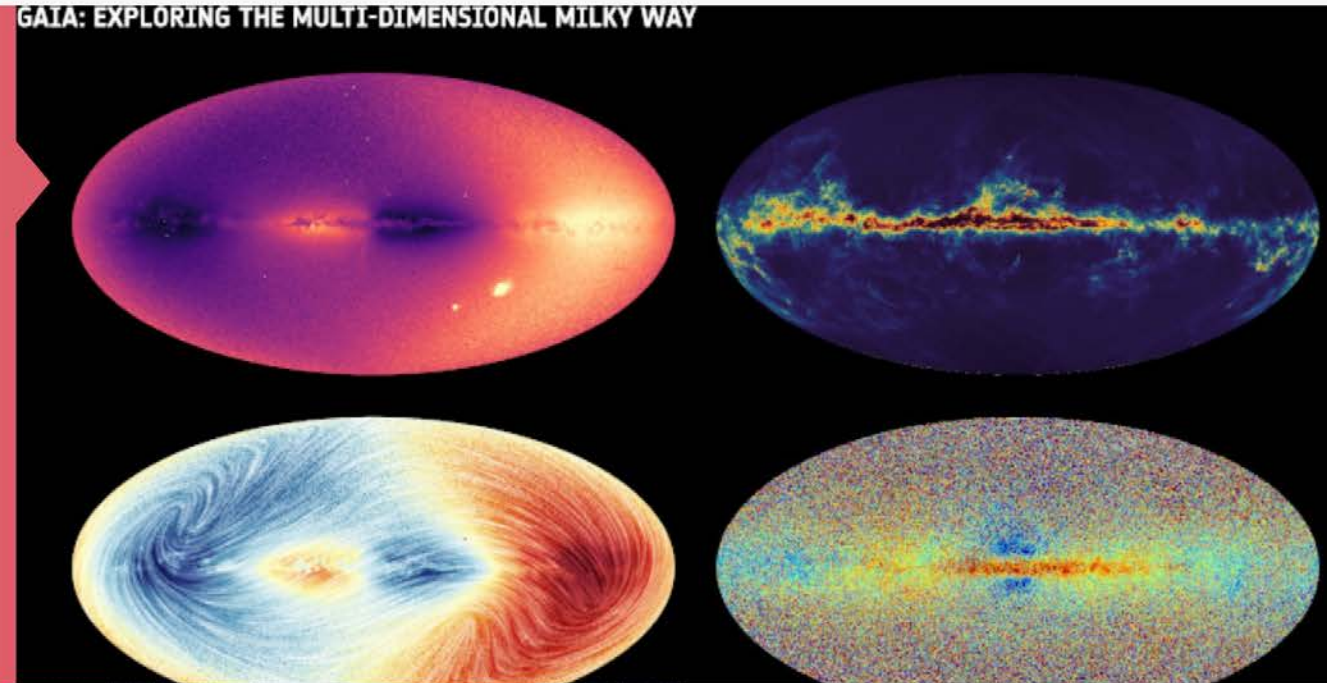
Gaiaverse.eu

Reports from MW-Gaia COST Action meetings and exchanges will shortly be added to the website (output of an ongoing VM grant activity!)

NEWS

GAIA DR3 IS OUT!

Data release 3 from Gaia mission has been published!



NEWS

Public resources for stellar spectroscopic analysis

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Tweets from @ESAGaia Follow

ESA Gaia @ESAGaia · Jan 25, 2022
Hello to @NASAWebb / @ESA_Webb / @csa_asc! Welcome to the neighbourhood here, beyond the Moon! Good to have you join us at L2. Let's watch the sky together.

Virtual Astronomy Mentoring to developing countries: Colombia

The technology allows interns to access astronomy resources on the other side of the planet.

Public resources for stellar spectroscopic analysis

A virtual platform that provides a large-scale panorama of available tools for researchers.



MWGaia Doctoral Network

MW-Gaia Outcomes
and Deliverables

- EU Horizon Europe funded MWGaiaDN commenced Feb 2023 and runs for 4 years to Jan 2027
 - 12 PhD projects based at 10 EU Institutes + 2 UK Institutes
 - 13 Associate partners including space industry
 - Organised around three key science themes
 - Gaia Frontiers: The MW as a Galaxy
 - Gaia Frontiers: Stars and Planets
 - Gaia Fundamentals: Space and Time
- Range of workshops planned (open to the MWGaia/ GREAT community)

Objective both to exploit current Gaia Data Releases, and define science cases for next generation astrometry

<https://www.mwgaiadn.eu>

What's next: Into the centre of the Milky Way

GaiaNIR and ESA Voyage 2050

Gaia like mission extending to the near infrared – probes x5 Gaia sources – implies 10 Billion sources

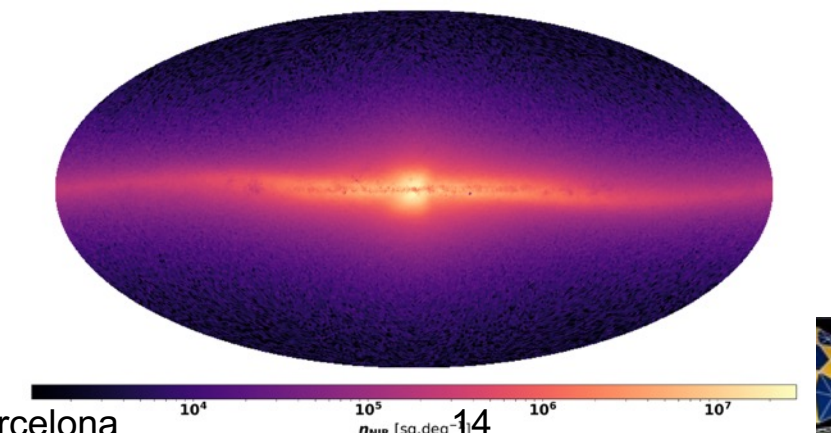
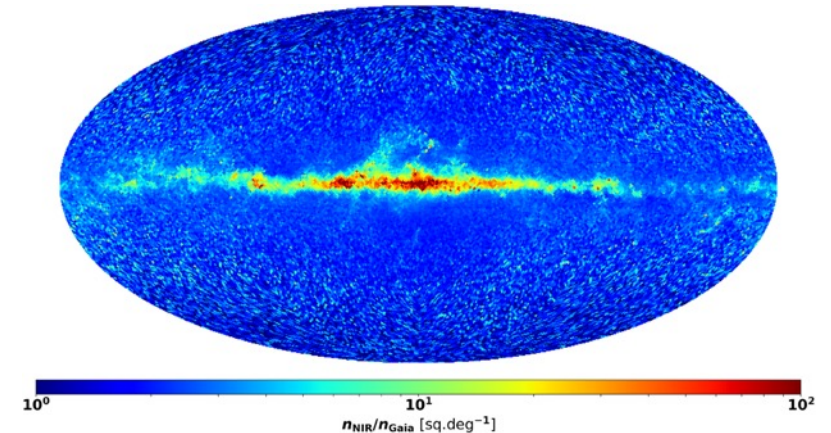
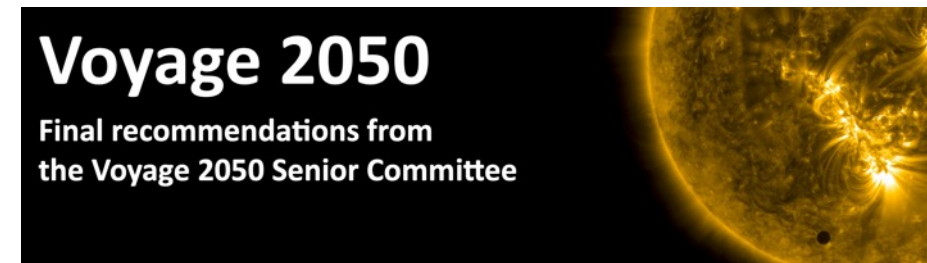
Three key science goals:

Penetrate dust obscured of the Milky Way to reveal the Bulge and Disk to disentangle the formation history of our Galaxy

Combine with Gaia data to increase the proper motion baseline to probe the outer regions of our galaxy

Maintain the Celestial Reference Frame and explore the fundamental physics of gravitational waves

Key technical challenges include the development of InfraRed detectors – opportunities for European expertise and industry

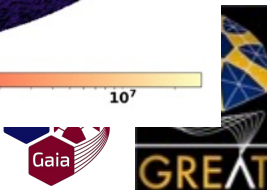


A transformational L-class ESA Space mission



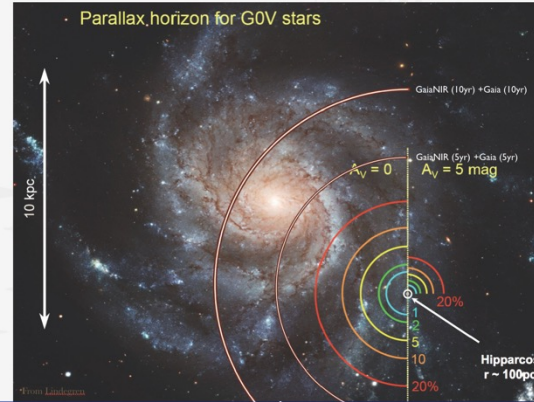
Nic Walton - Final Conference - MW-Gaia @ Barcelona
Credit: Hobbs et al 2020

5 Sep 2023



- Adding NIR astrometry and photometry to probe hidden regions of the Galaxy and allow us to observe intrinsically red objects.
- A new mission, combined with common stars from Gaia, with a ~20 yr time gap would give PMs 20 times better (compared to DR4) & parallaxes $\sqrt{2}$ times better, opening many new science cases.
- The slowly degrading accuracy of the Gaia optical reference frame and catalogue ageing needs to be reset. Expansion of the RF to NIR is important.

Volume increase at the same accuracy
 Parallax: $(\sqrt{2})^3 = 2.8$
 Proper Motion: $10^3 - 20^3 = 1000 - 8000$

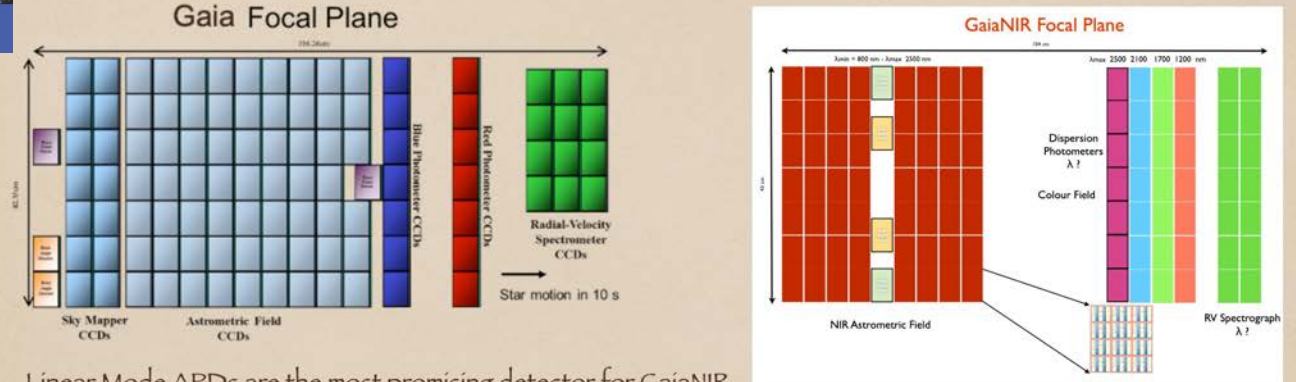


MWGaia Action workshops feeding into science case development and requirements, e.g. wavelength coverage required.

GaiaNIR Concept: Hobbs et al, 2021 (2021ExA....51..783H)

Credit: Hobbs, 2023

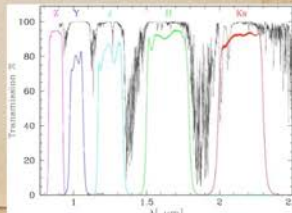
The Focal Plane & Filters



- Linear Mode APDs are the most promising detector for GaiaNIR
- Cooling strategy must be passive (~90K)
- Blue stars (<800nm) are more challenging – studies ongoing
- Max wavelength – 2500 nm
- Filter photometry with different λ cutoffs can be achieved in manufacture or by depositing filter material
- No SMs – track motion of stars instead to determine the FoV
- Dispersion photometers to give good astrophysics
- An RVS Spectrograph is a great opportunity? – space is available for more full wavelength detectors!

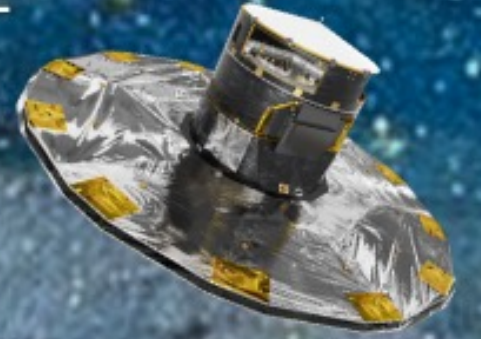
4x3= 12 APDs (TBD)

A modular concept uses small detectors to form larger ones



Example from VVV

MWGAIA COST ACTION FINAL CONFERENCE
THE MILKY WAY
REVEALED BY GAIA



MW-Gaia final conference:
<https://indico.icc.ub.edu/event/252/>

Presentations organised by Action WG

Enjoy!