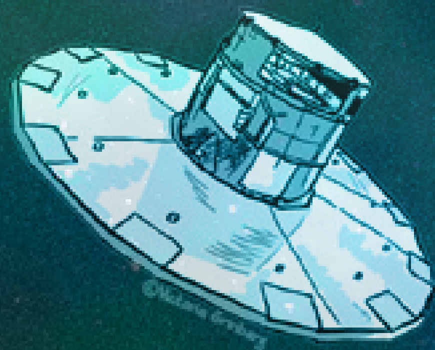

Spain, May 23 - 25, 2022

Santiago de Compostela

MW-GAIA WG5 WORKSHOP

Breaking Barriers: Inspiring the Next Generation

XUNTA DE GALICIA | CONSELLERÍA DE CULTURA, EDUCACIÓN E UNIVERSIDADE

galicia

Xacobeo 21·22

USC UNIVERSIDADE DE SANTIAGO DE COMPOSTELA — OBSERVATORIO ASTRONÓMICO "RAMÓN Mª ALLER"

USC UNIVERSIDADE DE SANTIAGO DE COMPOSTELA — FACULTADE DE ÓPTICA E OPTOMETRÍA

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

MW Gaia

AUTHORS

Josefina F. Ling
Carlos Viscasillas
Šarūnas Mikolaitis
Elsa Moreira

MW-GAIA WG5 WORKSHOP

Breaking Barriers: Inspiring the Next Generation

The workshop was hybrid, and held May 23 - 25, 2022

http://mao.tfai.vu.lt/breakingbarriers/

The workshop "*Breaking Barriers: Inspiring the Next Generation*" is about bringing the astronomical community together and get inspired by the way data from the Gaia mission is used in the different areas of astronomy.

The main purpose of the meeting is the development and implementation of the following plans:

- Framework of Research Coordination Action
- Training Plan
- Impact and Inclusion Plan
- Dissemination Plan

This includes tasks such as: impact of future advances on our understanding of the Milky Way, effective implementation of inclusion policies (such as geography, gender, age), outreach and advertising activities, and training tasks for future generations of astrometry experts.

The Gaia astrometric mission has recorded more than a billion stars in our Milky Way and neighbouring galaxies. It measures stellar positions, parallaxes and movements as well as physical properties with an unprecedented level of accuracy. Gaia has already published three catalogues, the most complete ever produced in our Galaxy, and the scientific exploitation by the international community is published at a rate of 3-4 articles per day. It is currently one of the most important astronomical research projects in the world.
A true revolution in astronomy.

INVITED SPEAKERS

Luis Aguilar, Universidad Nacional Autonoma de Mexico, Mexico
Sonia Anton, University of Coimbra, Portugal
Gisella Clementini, INAF Osservatorio Astronomico di Bologna, Italy
Jacky Faherty, American Museum of Natural Histor, USA
Despina Hatzidimitriou, National and Kapodistrian University of Athens, Greece
Paula Jofre, Universidad Diego Portales, Chile
Stefan Jordan, Zentrum für Astronomie Heidelberg, Germany
Sandor Kruk, Max Planck Institute for Extraterrestrial Physics, Germany
Alessandro Sozzetti, Osservatorio Astrofisico di Torino, Italy
Sara Vitali, Universidad Diego Portales, Chile

SCIENTIFIC ORGANIZING COMMITTEE

Corinne Charbonnel, University of Geneva, Switzerland
Francesca Figueras, University of Barcelona, Spain
Carme Jordi. University of Barcelona, Spain
Josefina F. Ling, University of de Santiago de Compostela, Spain
Šarūnas Mikolaitis (chair), Vilnius University, Lithuania
Elsa Moreira, Institute of Astrophysics and Space Sciences, Portugal
Tineke Roegiers, HE Space Operations B.V. for ESA, Netherlands
Carolina von Essen, Stellar Astrophysics Centre, Aarhus University, Denmark
Ivanka Stateva, Institute of Astronomy and NAO, BAS, Bulgaria

LOCAL ORGANIZING COMMITTEE

Pedro Campo Díaz, University of de Santiago de Compostela, Spain
Carlos Dafonte, University of Coruña, Spain
Josefina F. Ling (chair), University of de Santiago de Compostela, Spain
Minia Manteiga, University of Coruña, Spain
Ana Ulla, University of Vigo, Spain
Carlos Viscasillas Vázquez, Vilnius University, Lithuania


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gaia
MW-Gaia WG5 workshop
Breaking Barriers: Inspiring the Next Generation
Santiago de Compostela, Spain, May 23 - 25, 2022
http://mao.tfai.vu.lt/breakingbarriers
SOC:
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Josefina F. Ling
Šarūnas Mikolaitis (chair)
Elsa Moreira
Caroline van Essen
Ivanka Stateva
LOC:
Pedro P. Campo
Carlos Dafonte
Josefina F. Ling (chair)
Minia Manteiga
Ana Ulla
Carlos Viscasillas
USC
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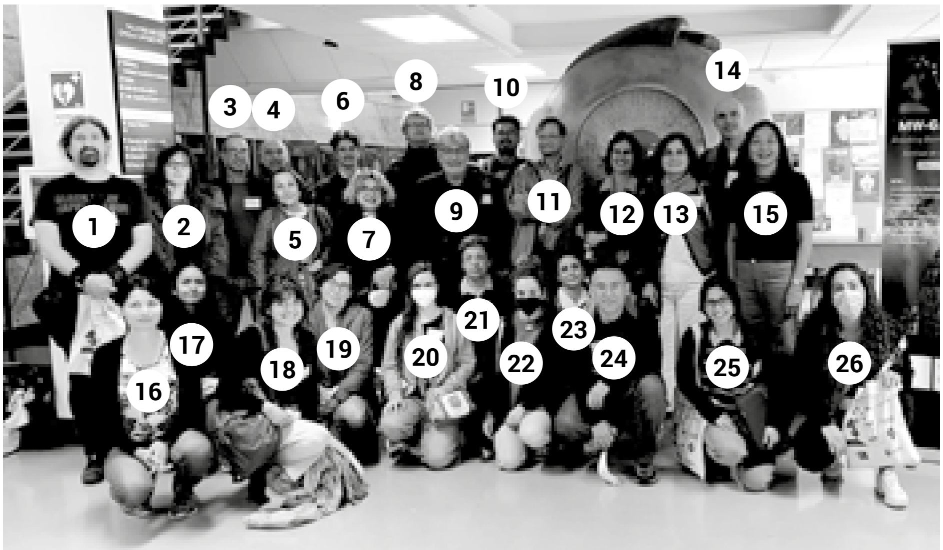
ON-SITE PARTICIPANTS GROUP PHOTO



1. *Pedro P. Campo*
2. *Maria Teresa Crosta*
3. *Eduard Masana*
4. *Carlos Dafonte*
5. *Ederlinda Viñuales*
6. *William Beordo*
7. *Rosa M. Ros*
8. *Šarūnas Mikolaitis*
9. *Emilio Alfaro*
10. *Javier Olivares*
11. *Luis Aguilar*
12. *Sonia Anton*
13. *Minia Manteiga*
14. *Carlos Viscasillas*
15. *Josefina F. Ling*
16. *Marusa Zerjal*
17. *Saniya Khan*
18. *Sara Vitali*
19. *Marta González*
20. *Judith Ardèvol*
21. *Carme Jordi*
22. *Marta Torreiro*
23. *Ana Ulla*
24. *Ramón Iglesias*
25. *Bárbara Soares*
26. *Elsa Moreira*

PARTICIPANTS

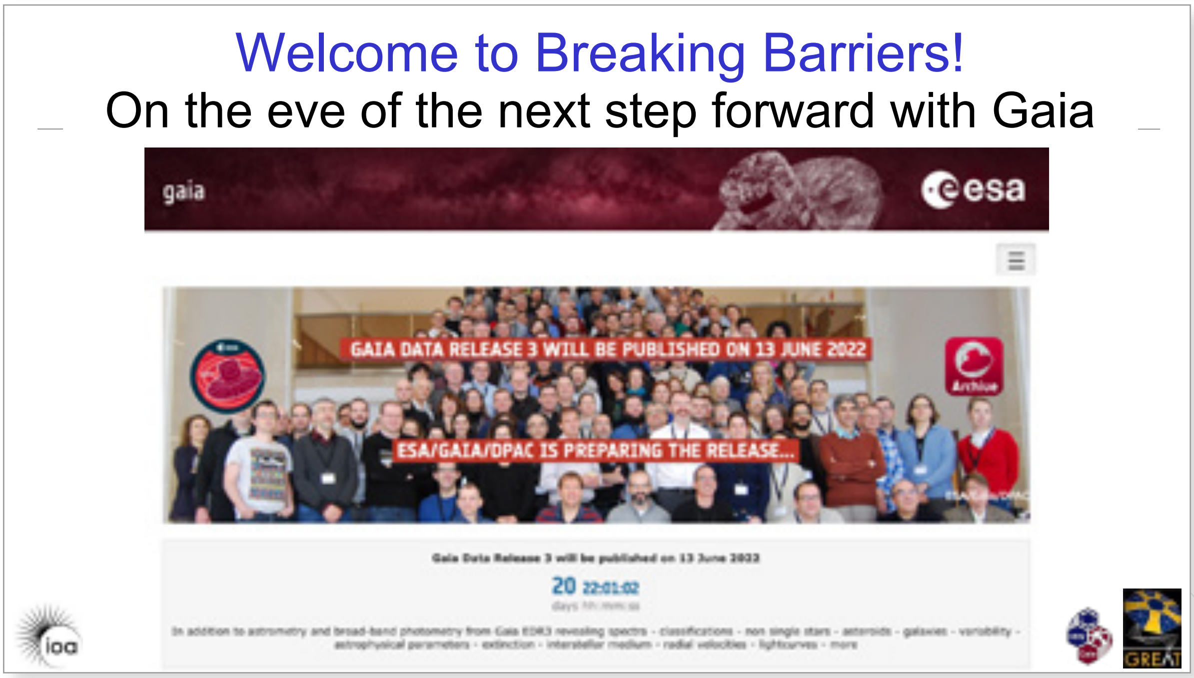
Vardan	Adibekyan	Portugal	Online
Luis	Aguilar	Mexico	On-site
Emilio J.	Alfaro	Spain	On-site
Sonia	Anton	Portugal	On-site
Antoaneta	Antonova	Bulgaria	Online
Judith	Ardèvol Guillamón	Spain	On-site
David	Arnot	United Kingdom	Online
Antoaneta	Avramova-Boncheva	Bulgaria	Online
Salva	Bará	Galicia	On-site
William	Beordo	Italy	On-site
Pedro Pablo	Campo	Spain	On-site
Oscar	Cavichia	Brazil	Online
Roberto Alexander	Cerviño Cortinez	Spain	Online
Macarena	Cespedes	Costa Rica	Online
Chetan	Chawla	India	Online
Gisella	Clementini	Italy	Online
Ilídio André	Costa	Portugal	Online
Mariateresa	Crosta	Italy	On-site
Borbála	Cseh	Hungary	Online
Barthélemy	d´Ans	Peru	Online
Carlos	Dafonte	Spain	On-site
Aditi	Das	India	Online
Danielle	de Brito Silva	Brazil	Online
Julia	de Leon	Spain	Online
Cecilia	Doporto Regueira	Spain	On-site
Jacky	Faherty	USA	Online
Francesca	Figueras	Spain	Online
Karl	Fiteni	Malta	Online
Xiaoting	FU	China	Online
Néstor	García	Argentina	Online
Oscar	Garcia Montilla	Spain	Online
Aayush	Gautam	Nepal	Online
Jose Manuel	Giron Diaz	Spain	Online
Vira	Godunova	Ukraine	Online
Marta	González	Spain	On-site
Consuelo	González Ávila	Chile	Online
Despina	Hatzidimitriou	Greece	Online
Joan	Hidalgo Ortega	Spain	Online
Ramón	Iglesias Marzoa	Spain	On-site
Rukmini	Jagirdar	India	Online
Paula	Jofre	Chile	Online

Stefan	Jordan	Germany	Online
Carme	Jordi	Spain	On-site
Taehyun	Jung	South Korea	Online
Saniya	Khan	Switzerland	On-site
Sandor	Kruk	Germany	Online
Josefina F.	Ling	Spain	On-site
Mario	Lopez Rodríguez	Spain	Online
Franco	Mallia	Italy	Online
Minia	Manteiga	Spain	On-site
Felix	Martinez	Mexico	Online
Roberto	Martínez Martínez	Spain	Online
Carlos	Martínez-Sebastián	Spain	Online
Eduard	Masana	Spain	Online
Šarūnas	Mikolaitis	Lithuania	On-site
John	Mora	Colombia	Online
Elsa	Moreira	Portugal	On-site
Javier	Olivares	Spain	On-site
Paula	Pancorbo Pabó	Spain	Online
Francisco	Reyes Andrés	Spain	Online
rozenn	robidel	France	Online
Tineke	Roegiers	The Netherlands	On-site
Rosa Maria	Ros	Spain	On-site
Isabelle	Santos	France	Online
Judith	Santos Torres	Spain	Online
Stuti	Sharma	India	Online
Shraddha	Shreshthi	India	Online
Bárbara	Soares	Portugal	On-site
Alessandro	Sozzetti	Italy	Online
Ivanka	Stateva	Bulgria	Online
Hristo	Stoev	Spain	Online
Edita	Stonkute	Lithuania	Online
Víctor	Tilve	Spain	On-site
Fernando	Tinaut-Ruano	Spain	Online
Tòfol	Tobal	Spain	Online
Marta	Torreiro Martínez	Spain	On-site
Maria	Tsantaki	Italy	Online
Ana	Ulla-Miguel	Spain	On-site
Himanshu	Verma	India	On-site
Ederlinda	Viñuales Gavín	Spain	On-site
Carlos	Viscasillas Vázquez	Lithuania	On-site
Sara	Vitali	Italy	On-site
Nicholas	Walton	United Kingdom	Online
Alessandra	Zanazzi	Italy	Online
Marusa	Zerjal	Spain	On-site

SUMMARY

WELCOME TALK

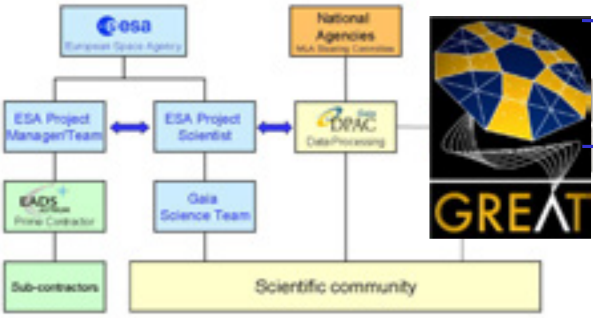
Nicholas A Walton



GREAT 2019-2027

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

Some history:



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Workshops & Exchanges

PhD training

New: Network starts Feb 2023

GREAT Plenaries

Next: http://great.ast.cam.ac.uk/Greatwiki/GreatMeet-PM15

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

Next GREAT plenary will be held at the EAS Annual Meeting 2022

Programme:

Gaia DR3: Highlight Science including presentations from the Gaia DR3 performance verification paper teams
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.

https://eas.unige.ch/EAS_meeting/session.jsp?id=S12

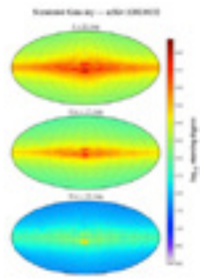
GREAT Community Input:

Looking ahead: Requirements for Gaia Data DR3+ Access

- Gaia Data Archive system has recently been upgraded to support Gaia EDR3
- GREAT provides a forum to gather science user input to the requirements for Gaia DR3+
- Requirements captured via the GREAT wiki

http://great.ast.cam.ac.uk/Greatwiki/GaiaDataAccess

- Use cases collected for Gaia-DR1/2: Brown et al (see http://www.rssd.esa.int/doc_fetch.php?id=3125400)



Your chance to suggest additional functionality for implementation with Gaia-DR3+

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

- The MW-Gaia COST Action has participants from 29 COST countries and participation from groups in Armenia, Canada, China, Lebanon, South Africa, Ukraine, USA
- Scientists in these COST countries can be supported to attend MW-Gaia events
- Check the website for details

MW:Gaia: Working Groups

MW-Gaia is 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:

Each WG has an organizer, with participants able to signup to the WG mailing list

Each WG is responsible for organizing workshops and training events in its topic area → **get involved, sign up to the mailing lists**

MW:Gaia: Working Group Leads

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)
Exchange Visit (STSM) Coordinator: Karri Muinonen (Helsinki: FI)
Country Inclusion Coordinator (TA): Ivanka Stateva (Sofia: BG)
Science Coomunications (SCM): Anthony Brown (Leiden: NL)
Inclusion and Training (ITM): Corinne Charbonnel (Geneva: CH)

MW-Gaia: WG5
Public Engagement

Objective: Develop and implement the Action Research Coordination Framework plans, Training Plan, Impact and Inclusion Plan, Outreach and Dissemination Plan. Organise interaction with industry, with schools. Deliver the final Action deliverables and closing conference.

Tasks: **WGT5a**: Deliver Action Impact, primarily through the generation of a science roadmap/case for sub-μas astrometry in delivering the next advances in our understanding of the Milky Way. This key Action task is directly under the leadership of the Action Core Group. **WGT5b**: Ensure the effective implementation of inclusiveness policies (e.g. location, gender, age) and the Action Inclusion and Impact plan. **WG5Tc**: Coordination of the Action outreach and dissemination activities. This will include developing and implementing the Dissemination plan. **WGT5d**: Training for the next generation of astrometry experts, with a priority focus on including ECIs from ITCs in training activities.

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

- The MW-Gaia COST Action continues to March 2023
  - Extension through to Sep 2023
  - Possible additional year to Sep 24
- Check the website for details of network activities
- Workshops at https://www.mw-gaia.org/participate/workshops/
- UK participation now assured as UK is now a full COST member

MW-Gaia: Exchange Visits
Short Term Science Missions (STSM) in "COST speak"

- STSMs provide 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/
  - All exchange visits for MW-Gaia Year 3 to complete by 30 Sep 2022
  - Applications now accepted at any time and reviewed at end of each month:
- Exchange visit idea originating at MW-Gaia workshops (such as this one!) will be viewed positively at the application evaluation stage.

ITC Conference grants provide support to those from ITC countries to attend conferences – see https://www.mw-gaia.org/participate/itc-grants/ for details

MW-Gaia: Exchange Visits

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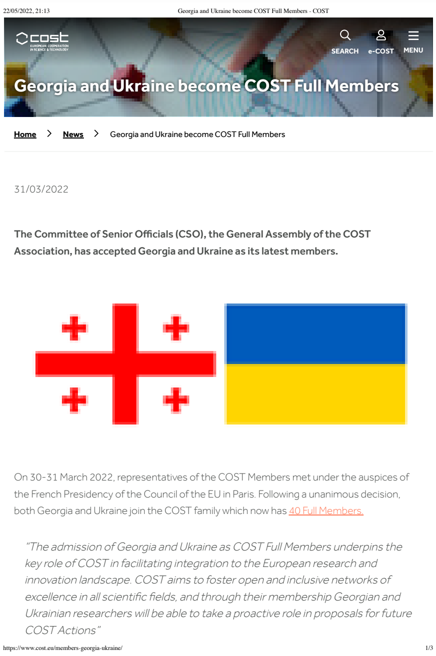

22/05/2022, 21:13 Georgia and Ukraine become COST Full Members - COST

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY SEARCH e-COST MENU

Georgia and Ukraine become COST Full Members

Home > News > Georgia and Ukraine become COST Full Members

31/03/2022

The Committee of Senior Officials (CSO), the General Assembly of the COST Association, has accepted Georgia and Ukraine as its latest members.

On 30-31 March 2022, representatives of the COST Members met under the auspices of the French Presidency of the Council of the EU in Paris. Following a unanimous decision, both Georgia and Ukraine join the COST family which now has 40 Full Members.

“The admission of Georgia and Ukraine as COST Full Members underpins the key role of COST in facilitating integration to the European research and innovation landscape. COST aims to foster open and inclusive networks of excellence in all scientific fields, and through their membership Georgian and Ukrainian researchers will be able to take a proactive role in proposals for future COST Actions”

https://www.cost.eu/members-georgia-ukraine/ 1/3

MW-Gaia and Ukraine

- COST has now admitted Ukraine as a COST Full Member
- Researchers based in Ukraine are fully eligible for support via COST
- Within MW-Gaia we welcome participation from our colleagues in Ukraine
- Specifically, I’d like to welcome our colleagues attending this meeting from Kyiv

ABSTRACTS

THE ACCRETED GALAXY: AN OVERVIEW OF TESS METAL-POOR ACCRETED STARS CANDIDATES

Danielle de Brito Silva

There is enough evidence that the Milky Way experienced mergers and accretion events in the past. Since the first evidence of stellar populations in the Galaxy with multiple origins, a large effort has been done to characterize accreted stars and to map the impact that accretion events had in the evolution of the Milky Way. In this work I will show detailed chemical abundances, dynamics and ages of accreted stars candidates for which TESS data are available. Combining TESS catalog with Gaia EDR3 data, we selected metal-poor counter-rotating stars in TESS that are not published in spectroscopic surveys and we observed them with MIKE spectrograph at Las Campanas Observatory obtaining very high resolution and signal to noise optical spectra of 30 stars. In this talk I will present our results about detailed chemical abundances, ages and kinematics of these TESS-accreted candidates. From our analysis, we concluded that the stars are old, metal-poor, Eu-rich and have orbits with high eccentricity, making them likely members of Gaia-Enceladus. Our work illustrates the potential of using bright stars with seismology from TESS for galactic archeology studies. I will discuss the properties of these accreted stars candidates, what we can learn from the progenitor galaxies and explore our findings in the light of spectroscopic surveys.

GAIA, STELLAR MODELS, AND ASTEROSEISMOLOGY

Saniya Khan

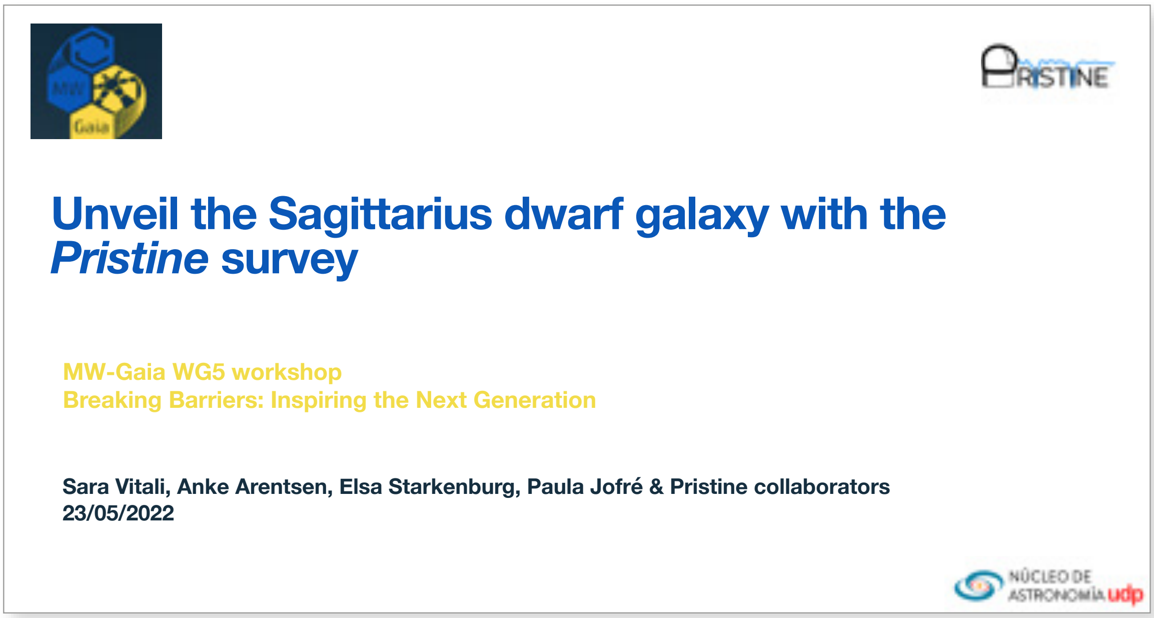
Using photometric, high-precision long (months) photometric time series, one can detect solar-like oscillations in dwarfs (few, nearby) and giants (tens of thousands). The detected modes can be combined with spectroscopic data to infer radii as precise as a few percent (also masses and, hence, ages). Coupling radius and effective temperature together, we get a luminosity that does not rely on any assumption on the mass-luminosity relation. With the addition of information on unreddened apparent brightness, the asteroseismic distance is straightforwardly obtained. Since tests of stellar evolution theory rely on the accuracy of asteroseismic constraints, it is important to check for any possible bias in the asteroseismically-inferred stellar properties. One possible way to address this issue is to compare with independent measurements, such as those provided by the Gaia mission. The successive Gaia data releases have provided unprecedented data that generate a lot of interest in the astrophysical community, including stellar modellers and asteroseismologists as can be seen from the publications following each data release. In this talk, I will discuss the important synergies resulting from the combination of Gaia and asteroseismology, and how one can benefit from the other. Gaia can help better constrain nearby stars with large parallaxes; while asteroseismology provides parallaxes to distant red-giant stars where the Gaia parallax zero-point becomes significant. I will review the progress that has been made since the first intermediate data release, and describe the current status with Gaia EDR3. Finally, I will mention a few examples of how one can further test stellar models, thanks to the promising advances reached with Gaia and beyond what one can do with asteroseismology alone.

UNVEIL THE SAGITTARIUS DWARF GALAXY WITH THE PRISTINE SURVEY

Sara Vitali

The Sagittarius system is a compelling example of an ongoing tidal disruption of a dwarf galaxy caused by the gravitational interaction with the Milky Way. Although many stars have been stripped away from the dwarf galaxy in long tidal streams, the core is still visible. It has however been challenging to study, since on the sky it is close to the Galactic bulge. Particularly, its more metal-poor stars remain objects that require more investigation. They are extremely important as they trace the early history of the dwarf galaxy.

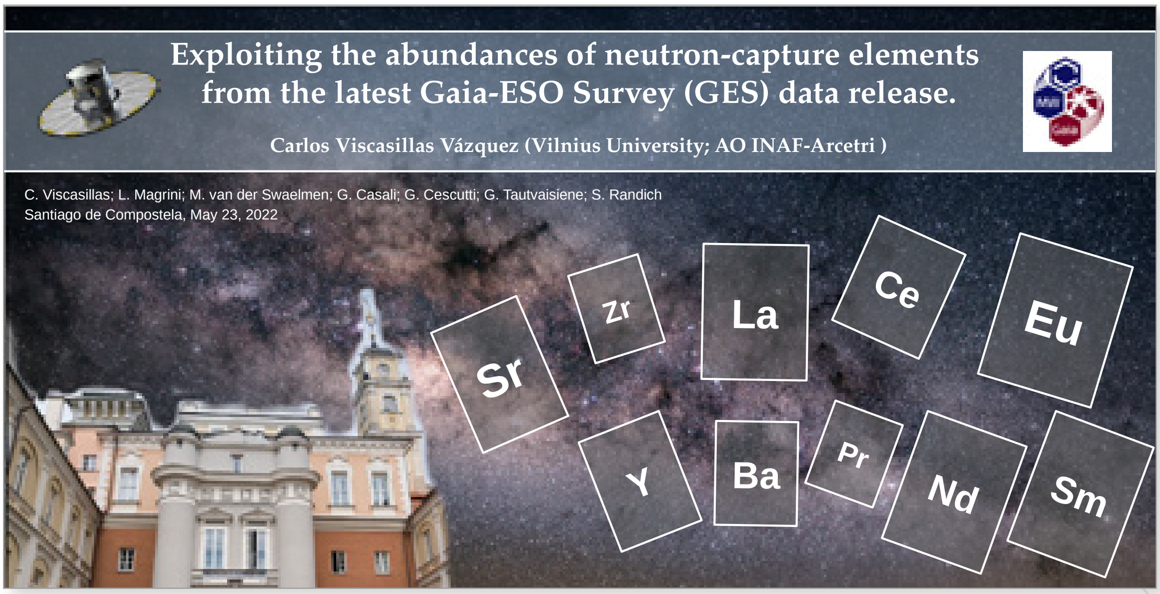
I will present results of the photometric metallicity analysis of the Sagittarius galaxy, carried out thanks to the Pristine metallicity-sensitive Ca H&K photometry. We select ~45000 Sagittarius members using Gaia EDR3 astrometry and derive photometric metallicities for the full sample, which have been calibrated using spectroscopic Sagittarius samples from the Pristine Inner Galaxy Survey (PIGS) and APOGEE and a training sample in the main halo Pristine survey. Using photometric metallicities instead of spectroscopic metallicities allows us to investigate the global metallicity structure of the Sagittarius dwarf galaxy, with little selection effects. This allows us to investigate the distributions and structural properties of the metal-poor and metal-rich stellar populations hosted in the galaxy. We reveal a metallicity gradient in Sagittarius extending to ~20℃ from the centre, much further out than reported in previous investigations. We also built an unprecedented selection of ~1100 new very metal-poor candidates, which can provide crucial insights into the early star formation processes in Sagittarius. I will discuss what the results from the largest photometric study of the core of the Sagittarius galaxy can teach us about its (early) evolution.



EXPLOITING THE ABUNDANCES OF NEUTRON CAPTURE ELEMENTS FROM THE LATEST GAIA-ESO SURVEY (GES) DATA RELEASE

Carlos Viscasillas

Neutron capture elements are among the most versatile in astrophysics, due to their origin in different astrophysical sites and their special nucleosynthesis, which involves two well-differentiated processes (called s- and r-). Thus, neutron capture elements are often used as a link between observational astrophysics, chemical evolution models, and nuclear astrophysics. The s-process is of interest in the physics of low-mass AGB stars, while the r-process is valuable for the study of neutron stars and gravitational waves. Among the most appreciated applications of neutron capture elements is their direct use as cosmic clocks. Its value increases considerably if we take its abundances from the open clusters, the most reliable tracers of the chemical evolution of the Galaxy. From the above, we can look at this combination as an astroarchaeological "treasure". Taking advantage of the latest Gaia-ESO Survey (GES) data release, and relying on one of the largest samples of open clusters used for this purpose, we present the most recent results on neutron capture elements. This work is the result of an STSM and collaboration at the Arcetri Astrophysical Observatory in Italy in the framework of the MW-Gaia Cost project.



THE CHEMICAL LINK BETWEEN STARS AND THEIR ROCKY PLANETS

Barbara Soares

Because of their common origin, it is expected (or assumed) that the composition of planet building blocks should (to a first order) correlate with stellar atmospheric composition, especially for refractory elements. In fact, information on the relative abundance of refractory and major rock-forming elements such as Fe, Mg, Si are commonly used to improve interior estimates for terrestrial planets (e.g. Dorn et al. 2015; Unterborn et al. 2016) and has even been used to estimate planet composition in different galactic populations (Santos et al. 2017). However, there is no direct observational evidence for the aforementioned expectation/assumption and was even recently questioned by Plotnykov & Valencia (2020). By using the largest possible sample of precisely characterized low-mass planets and their host stars, we show that the composition of the planet building blocks indeed correlates with the properties of the rocky planets. We also find that on average the iron-mass fraction of planets is higher than that of the primordial values, owing to the disk-chemistry and planet formation processes. This result can bring important implications for the future modelling of exoplanet composition.

EXPLORING NEAR-UV REGION FOR PRIMITIVE ASTEROIDS USING GROUND-BASED OBSERVATIONS AND GAIA

Fernando Tinaut-Ruano

Primitive asteroids (PAs) are characterized by dark surfaces (albedo<10%) dominated by carbon compounds. Their reflectance spectra are similar to those of carbonaceous chondrites (CCs), the most pristine meteorites in our records, that are abundant in hydrated minerals and organics. Studying these life-forming materials in PAs and CCs is important to answer how water and life appeared on Earth. PAs present rather featureless spectra in visible and near-infrared wavelengths (from 0.5 to 2.5 microns). The most diagnostic and reliable region to study hydrated mineralogies and organics is the 3 microns region. However, observing at those wavelengths is extremely complicated using ground-based telescopes due to Earth's atmosphere, and so, the 3-microns feature can only be properly studied using space telescopes (e.g. AKARI). As part of our current work, we have found a very promising correlation between the drop in reflectance observed for PAs below 0.5 microns (associated with the presence of an absorption band in the UV) and the shape and depth of the OH-band at 2.7 microns in the AKARI data. Therefore, this drop in reflectance in the so-called near-UV or NUV (0.35 - 0.5 microns) can be used as a proxy for the OH-band to measure the hydration degree of asteroids. In its DR3, Gaia will provide thousands of low-resolution slit-less spectra of asteroids in the range 0.35 - 0.90 microns. This will constitute the largest dataset of asteroid spectra down to the NUV and we must be ready for its full exploitation. In addition, we attempt to observe the NUV region with ground-based telescopes. So far we have obtained more than 50 reflectance spectra of PAs with a high signal-to-noise ratio in NUV. We describe our current work in the exploration of the NUV region as a potential diagnosis of hydration in PAs and how the Gaia data will expand our knowledge on these very particular and interesting types of minor bodies.

GRAVITATIONAL ASTROMETRY & FUNDAMENTAL PHYSICS TO TEST THE DYNAMICAL EVOLUTION OF OUR GALAXY AND ITS PLACE IN COSMOLOGY

William Beordo

Gaia directly measures the kinematics of the stellar component of the Galaxy with the goal to create the largest, most precise three-dimensional map of the Milky Way (MW). High accurate measurements in space force fundamental astronomy to move from the "classical" paradigm, responding to Newton's gravity, to that of Einstein's General Relativity (GR). Then, GR must be at the very core of the Gaia data reduction to guarantee the quality of the scientific products that span from the fraction-of-a-parsec scale of the Solar System to the two tens of kpc of that of the MW to comprise also GR tests. Indeed, any reconstruction of our Galaxy should be consistent with the relativistic-compliant astrometry delivered by Gaia to assure a coherent local cosmological laboratory for the predictions of the Lambda-CDM model at z=0. In this respect, a first attempt to investigate a relativistic Galactic rotation curve (RC) was done with DR2 products. Although based on a GR model for the equatorial plane, the test showed that the relativistic RC is statistically indistinguishable from its state-of-the-art DM-based analogue and supports the ansatz that a gravitational dragging effect could drive the stellar velocities in the plane of our Galaxy far away from its center without a dark halo. In the context of Local Cosmology, these findings push on the fully use of Einstein's theory. In this talk, we will present progress towards developing a more complex GR Galaxy to fit the upcoming DR3 data and establish to what extent the Milky Way can be described by GR.

GALACTIC HIERARCHY OF CLUSTERED STELLAR FORMATION

Marta González

The accuracy in the determination of the spatio-kinematical parameters of open clusters makes them ideal tracers of the Galactic structure.

In this work we study the hierarchical structure of clustered star formation within a 3.5 kpc radius around the Sun using a sample of Gaia Young Open Clusters (G-YOCs) from the literature. We apply the OPTICS density-based algorithm to obtain a hierachy of G-YOC complexes with different spatial scales and densities.

Our results show a rich hierarchical structure of the G-YOC distribution, displaying complexes embedded within each other. Their spatial scales range from a few hundreds to thousands pc, with the most intrincate layout appearing in the solar closest neighbourhood.

THE DYNAMICAL INTERACTION OF THE COMA BERENICES OPEN CLUSTER AND THE GROUPX MOVING GROUP

Javier Olivares

Thanks to Gaia data, several interacting open cluster pairs have been recently found. These pairs pose exciting questions, for example, Were they formed together? Are their populations mixing due to dynamical interactions?

Recent studies show that the Coma Berenices (~700 Myr, 86 pc) open cluster and the Group X (~400 Myr, 98pc) moving group are interacting, have unrelated origins, and will experience a flyby in 13 to 16 Myr. Given their proximity and the extension of the Coma Berenices tidal tails, this pair offers an excellent opportunity to analyse the effects of dynamical interactions in mixing stellar populations.

Using Gaia EDR3 we reassess the membership of these two groups extending the search to one half of the northern Galactic hemisphere. We identify members of the Coma Berenices as far as 60 pc from the cluster centre. We derive the mass functions of the systems and their 3D and velocity structures by combining Gaia data with public archives and our radial velocity measurements. With these precise velocities, we trace forward the present member's positions and further constrain the time of the flyby. Finally, we discuss the implications of this type of encounter in enriching the stellar populations of open clusters.

AN ASTRONOMY EXHIBITION, INCLUSIVE ALSO FOR BLIND AND VISUALLY IMPAIRED PEOPLE AND OTHER INAF INCLUSIVE ACTIVITIES

Alessandra Zanazzi

The INAF Arcetri Astrophysical Observatory hosts a permanent exhibition designed so to be inclusive also for blind and visually impaired people. The project builds on many previous activities at local, national and international levels and on newly designed exhibits, like the touchable planetarium dome. The exhibits, designed and tested with blind people, also proved to be attractive and useful for the general public visiting the observatory. We will also present other inclusive activities under development by the Working Group for inclusion at INAF, aiming at engaging a wide diversity of audiences.

MENTORSHIP PLATFORM FOR EARLY CAREER RESEARCHERS

Edita Stonkute

In August 2020, Europlanet launched Mentorship platform with the aim to support early career researchers. The Europlanet Society promotes the advancement of European planetary science and related fields for the benefit of the community and is open to individual and organisational members. The Europlanet Mentorship platform is built to help early career scientists to develop expertise, ask questions and discuss career plans with the support of more established members of the planetary community. On behalf of mentoring team, I will present the Europlanet mentorship platform and the current status of the programme.

“AstronomAs” A JOURNEY THROUGH THE UNIVERSE BY HAND OF HUNDREDS OF WOMEN

Josefina F. Ling

The Spanish online exhibition “AstrónomAs” focuses on nearly 300 women astronomers from different ethnic groups, geographic areas, professional categories, and functional diversity. There is complemented by downloadable educational brochures, interactive games, podcasts, videos, an original soundtrack, and a physical version of 16 explanatory panels. The aim is to encourage vocations, especially among teenage girls, and disseminate research carried out by women in astronomy and astrophysics.

OUTREACH AND COMMUNITY RESOURCES FOR GAIA

Tineke Roegiers

I coordinate the outreach for the Gaia community and the Gaia consortium from the Gaia team at ESA. I can run through the various ways of getting Gaia science exposed to the community, how to reach out using the Gaia Cosmos web portal (home of the Gaia scientific community) and give an overview of the available outreach material for Gaia, already currently available.

I can give an overview of where to go to get informed on Gaia mission news. Where to go for which information on the Gaia mission. Which websites exist, what is their targeting public, how to get in touch to make a chance to be featured there.

ASTRONOMICAL OUTREACH IN THE RAMÓN MARÍA ALLER ASTRONOMICAL OBSERVATORY

Pedro P. Campo

The Ramón María Aller Astronomical Observatory (OARMA) is an international reference center in the field of binary star research located at the University of Santiago de Compostela. In addition to the research and teaching activities of the center, the OARMA has developed many outreach programs promoted by its current director, José Ángel Docobo. These programs include different activities, such as conferences, workshops, and public astronomical observations, which are highly demanded by the public. The year 2021 was a Jacobean year, which was extended to 2022 due to the pandemic, and it has allowed us to focus our programs on the Milky Way (and highlight the role of Gaia in its study) due to the relationship between our Galaxy and the Way of Saint James.

A WEBSITE DEDICATED TO THE NEARBY YOUNG OPEN CLUSTERS AS SEEN BY GAIA

Marusa Zerjal

Open clusters are among the most captivating objects in the night sky. Many of them are visible to the naked-eye observers and had an important role in the folklore around the world for millennia. Their value in modern astronomy is unprecedented as they offer a direct insight into fundamental astrophysical processes, such as star formation and evolution.

In order to bring the latest scientific results to the public, we are building a website dedicated to the nearby (<=1 kpc) young (<=500 Myr) open clusters as seen by Gaia. We provide updated cluster membership analysis along with catalogues and interactive plots from the latest Gaia release cross-matched with other public catalogues. Interactive plots portraying all clusters will enable the professional and amateur communities to visualise quick and easily each member. We hope to inspire new student and citizen science projects locally in the Canary Islands but also world-wide.

LOS SECRETOS DE LA VÍA LÁCTEA

Carme Jordi

La misión Gaia de la Agencia Espacial Europea supone una revolución para la astrofísica actual y en particular para nuestra galaxia, la Vía Láctea. El satélite Gaia mide posiciones, movimientos y propiedades físicas de más de mil millones de estrellas a un ritmo medio de 70 millones de estrellas cada día. Esto nos ha permitido entender los procesos de formación y evolución de las estrellas, las colisiones entre galaxias e incluso pesar nuestra galaxia.

COASTRO: @AN ASTRONOMY CONDO-A NEW POSSIBLE PATH FOR GAIA'S DISSEMINATION STRATEGY

Elsa Moreira

The citizen science (CS) concept is now summarized in a simple common idea: the public engagement in different stages of scientific processes. If the view of CS as a scientific technique is very consensual, its use as an open science mechanism and as a science communication and education (SCE) method is not. However, accomplishing science communication and open science goals are two of the most common purposes of CS, highlighted by both scientists and CS project managers alike. Indeed, the advantages of associating science communication and science education have long been known, namely through CS projects, helping to bridge the gap between scientific research and science education. Thus, engaging teachers in CS processes is a natural path, enhanced by the "school effect" and the "teacher effect" in students, but also in the effect these have in students' families and the surrounding school community. This "multiplier effect" of influences, provided by schools, is unique and highly positive.

So, in this talk we will share the codesign model of the CS projeto "CoAstro: @n Astronomy Condo". It, starting from the framework already presented, reached more than one thousand participants, with lasting and wide-public-ranging science communication effects. Therefore, we will show how the CoAstro model can break barriers and be used as a dissemination strategy, using Gaia's mission data releases. Following this strategy we will see how, using Gaia's data, we can change attitudes and beliefs towards science, increase astronomy knowledge and really engage astronomers, science communicators and the lay public.

LIGHT POLLUTION DATA FROM GALICIA (SPAIN): MEASUREMENTS FROM THE EARTH

Victor Tilve

The scientific outreach group Calidade do Ceo Nocturno has been collecting night sky brightness measurements since 2016 in Galicia (Spain) with three SQM model LU-DL. In this presentation we want to make the measurements available to the scientific community to make visible the work carried out by non-professionals and for their use in research such as the comparison of these measurements with others obtained with other instrumentation, for example Gaia. In addition, these data will be useful for different discussions related to astronomical observation from Earth and the evolution of light pollution.

MODELLING THE NATURAL SKY BRIGHTNESS WITH GAIA DATA

Eduard Masana

E. Masana, S. Bará, J.M. Carrasco, S. J. Ribas, M. Mateiga, C. Dafonte, A. Ulla, A. Silvelo

Gaia data is providing a huge number of astonishing results, even in some areas of the astrophysics not a priori considered as targets of the mission. In this work we present one of these unexpected uses of the Gaia archive: the modelling of the natural night sky brightness. The Gaia photometry allows to compute the contribution of the integrated star light to the night sky brightness. By considering the other natural light sources (zodiacal light, the galactic and extragalactic background light, and the airglow), together with a model of the atmosphere extinction and scattering, we can obtain a realistic image of the night sky for a given place and time. The model can be used as a reference value of the natural sky brightness (in cloudless nights), an essential requirement to obtain reliable measurements of the light pollution levels; or to know the expected natural levels of sky brightness at pristine areas.

This work is part of the Gaia4Sustainability project. The aim of the project is to develop a robust, reliable, and straightforward framework for estimating the natural sky brightness. This framework consists in a set of implementations (web service, stand-alone program and open-source measurement device) devised for any stakeholder working on environmental activities, to accurately evaluate the impact of light pollution. The framework includes the design and construction of a cheap and easy-to-build photometer (FreeDSm), based on open hardware and software, with several connectivity options and the ability to collect positioning information, that will help to widely spread the acquisition of measures and achieve a greater engagement of the social agents involved in the light pollution problem. In the current version, FreeDSm is based on a Raspberry Pi Zero and on an Adafruit TSL2591 module, at a very low cost, although it will have other additional and optional modules. The integration of device data is done through the Fiware framework for IoT environments.

VISUALIZING THE GAIA ENABLED MILKY WAY FOR SCIENCE AND EDUCATION

Jackie Faherty

On April 25, 2018, the European space agency (ESA) released the second catalog of the Gaia mission. Contained in these data are nearly 1.4 billion parallaxes and proper motions, over 7 million radial velocities, photometric data in Gaia's three bands (G, R, and B), variability information, and effective temperatures for a subset of objects. On December 3, 2020 that catalog was refined and updated in the Gaia early data release 3 and further releases will take us deeper into a precise astrometric understanding of the Milky Way. The Gaia results provide a unique opportunity for astronomers and data visualizers. Stellar positions and velocities enable us to map the Milky Way and examine the dynamics of stellar streams, co-moving companions, hypervelocity stars, nearby moving groups, and solar system encounters. From a visualization perspective, real time rendering of the Gaia enabled Milky Way is an opportunity to provide scientists with a "field site" visit akin to how paleontologists, anthropologists, marine scientists, etc get to visit their scientific sites across the planet. In this talk, I will show the results of our visualization efforts with the Gaia catalog at the American Museum of Natural History. The visuals generated for this talk isolate scientifically rich data and stories, which lead to scientific discovery and illuminate the Gaia enabled Milky Way for the general public.

NASE, ASTRONOMY FOR EVERYBODY

Rosa M. Ros

Beatriz García, Rosa M. Ros, Ricardo Moreno and Ederlinda Viñuales
NASE members

NASE is an ambitious program of teaching astronomy for everybody. We have reached 4 continents, translated the materials into 10 of the most widely spoken languages in the world and partially translated in 15 languages more. We have more than 800 volunteers, we have trained more than 9000 teachers and through them we estimate that between 1 or 2 million of students have worked with the NASE materials. At present (March 15th 2022), we have been organized 285 courses. About 40 members of the IAU participate in the program, who collaborate mainly with the preparation of the texts and contents of workshops and conferences.

Not even the pandemic has stopped us, what's more, the online courses are very successful (46 courses in 2020, 63 courses in 2021 and 20 courses in 2022). Thanks to the courses online, we have taken the program to remote places that we would never have been able to reach, as Venezuela, the jungle in Guatemala and Ecuador and cities in India, China and several African countries. We have trained for events such as eclipses, cultural astronomy workshops and we promote local actions. The courses continue on their own once we light the fuse... they have been maintained in many countries for the 10 years of the program. NASE local Working Groups are integrated in different institutions: planetariums, science clubs beyond the Ministries of Education and Science, Universities, Teachers Associations and in some occasions, Amateurs Societies. We have unbeatable relationships with all of them (*www.naseprogram.org*).

NASE: USING DEMONSTRATORS FOR EASIER TRAINING OF FUTURE TEACHERS

Ederlinda Viñuales

Ederlinda Viñuales, Rosa M. Ros, Beatriz García y Ricardo Moreno
NASE members

The main objective of NASE is to train teachers in new ways of teaching sciences to facilitate their students its understanding through astronomy.

The idea is that teachers, by mean of workshop and demonstrators, to promote new science vocations to students. NASE introduces Astronomy in an innovative way and the program is based on practical activities with simple and cheap resources and tools, without sacrificing good work in the transmission of contents, promoting more inclusive scientific education and communication.

Since its inception, NASE has delivered more than 280 courses for teachers from all over the world, regardless of where the course was held, regardless of the conditions in which we had to work, or the race, age or gender of the participants in these courses.

With the arrival of the Covid-19 pandemic, in 2020, and given the impossibility of teaching face-to-face courses, the modality of teaching them online was offered. The reception of this modality has been surprising. The online approach offers the opportunity to increase the personal contact with the participants, as well as the number of women teachers who participate in our courses. This increase in women in online courses is undoubtedly due to the fact that it facilitates family reconciliation, being able to have children running around the house while they attend the workshop.

To improve our courses, NASE continually seeks to introduce new models, materials, methods, etc. In this presentation we want to show you a model that allows us to study the shape of the Moon in any part of the Earth on a given day. For this we have built a demonstrator where we consider latitudes from 90 °N to 90 °S, that is, both hemispheres: H North and H South. With this demonstrator it is very easy to show that for a fixed day, and the Moon being in a specific phase in the sky, its shape looks different depending on the latitude of the place where the observer is and the hemisphere.

EAAE'S CATCH A STAR COMPETITION: HELPING TEACHERS AND STUDENTS

Hristo Stoev

The European Catch a Star Competition is one of the most popular competitions among the European natural sciences teachers. It is organised by the European Association of Astronomy Education and ESO, the European Southern Observatory. In the presentation I am going to present an overview of the history of the Catch a Star competition since 2002 to 2021. in order to help teachers, the presentation gives information about the organisation and carrying out of the competition, about the requirements towards the presented works, the preparation and presentation of the projects. Special attention is paid to the curated library with awarded projects from the Catch a Star competition. This is an online educational space of great pedagogical value. It encompasses all best awarded projects which many European teachers use directly in their teaching practise. We also point to the work of the students which leads to strong motivation and provokes deep interest ini astronomy as a science. The methodical analysis and the presentation of EAAE's Catch a Star competition gives the possibility to natural science teacjers to expand their pedagogical possibilities in the process of teaching astronomy.

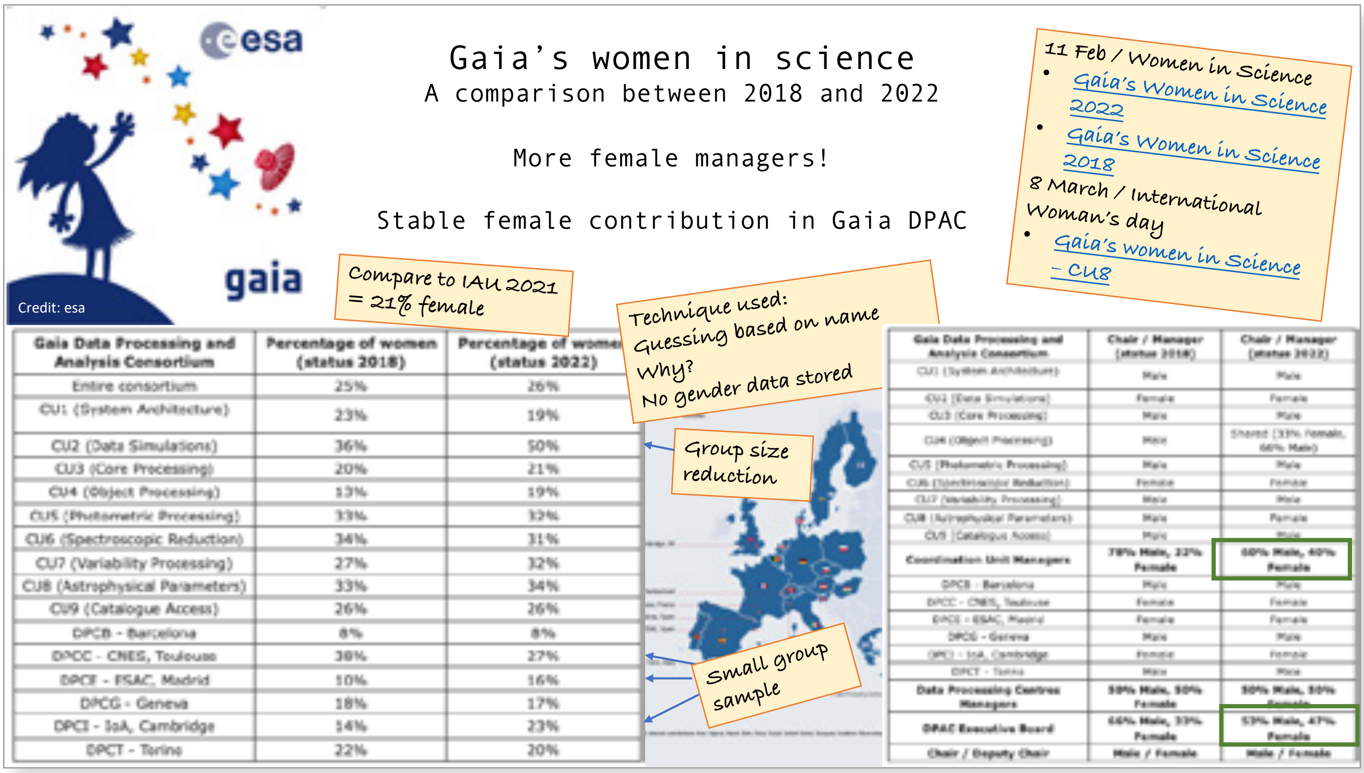
POSTERS

FEMALE CONTRIBUTION TO THE GAIA DPAC CONSORTIUM

Tineke Roegiers

For the women in science day, I have created a new overview of the gender distribution of the Gaia Consortium (focusing only on an estimation of female contribution). The story can be found here: https://www.cosmos.esa.int/web/gaia/iow_20220211.

I will explain the approach, and provide an overview of the numbers. The former contribution of women in DPAC story of 2018 was also created by me, in the same way, making it possible to do a comparison.



TWO STEMBACH PROJECTS BASED ON GAIA DATA: INTRODUCING BIG DATA ASTRONOMY IN SPANISH HIGH SCHOOLS

Minia Manteiga

Authors: Raúl Gómez Santoveña, Marco A. Álvarez-González, Guillermo Torralba Elipe, Iker González Santamaría, Carlos Dafonte and Minia Manteiga

Gaia ESA mission archives offer excellent opportunities for sparking early science vocations in school, and they are an engaging resource for getting students started on data science.

During the 2020-2021 and 2021-2022 academic years, our research group has directed two projects within the STEMbach program (Excellent Bachelor in Science and Technology). Our goal was to encourage high school students' creative thinking and interest in research, technology and innovation through different methods of investigation and analysis.

Our first project took place during course 2020-2021, and it made use of Gaia EDR3 precise astrometric and photometric parameters. Our students studied the stellar components of two bright and close by galactic open clusters: Praesepe (M44) and Pleyades (M45). They searched EDR3 archive selecting those objects contained in the neighbourhood of each cluster with similar parallax and proper motion values (in RA and Dec directions) to those reported in the literature for each cluster, taking into account measurement errors. Then, they located the selected stars in a colour-magnitude diagram (G-RP vs M(G)) with the aim of studying their evolutionary state using suited isochrone models. By interpolation, they calculated masses, luminosities, effective temperatures and radii of the sequences of stars. All the steps for the selection of the populations have been carried out using Python programming language and the interactive Jupyter Notebook tool. Using these tools, different 3D views of the clusters have also been implemented, representing different radii such as the tidal or the half-mass radius, as well as some astrophysical parameters of the stars such as their size, mass or temperature. Finally, using those stars which have information about their radial velocities in EDR3, an animation of how the cluster would move over hundreds of thousands of years was also implemented.

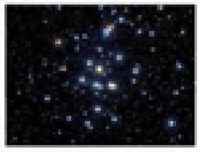
During the 2021-2022 academic year, a work based on machine learning (ML) was developed. ML techniques are becoming a useful and fast tool to make inferences where there is no known analytic relationship between observables and variables, that are hidden in the physical processes that produce these observables. In this work the students were guided to develop a Multi-layer perceptron neural network model able to estimate the stellar effective temperature, gravity and metallicity from RAVE survey stellar spectra in Gaia RVS instrument spectral region. The networks were trained with synthetic spectra that were obtained using a public spectral synthesis code. They tested several network architectures and configuration parameters, and chose the optimum one by analysing convergence and internal errors. Finally, the network that best inferences gave during the training phase was applied to a subset of real spectra measured by the RAVE experiment and the results analysed in comparison with literature values.

Two STEMBACH projects based on Gaia data: introducing Big Data Astronomy in Spanish High Schools

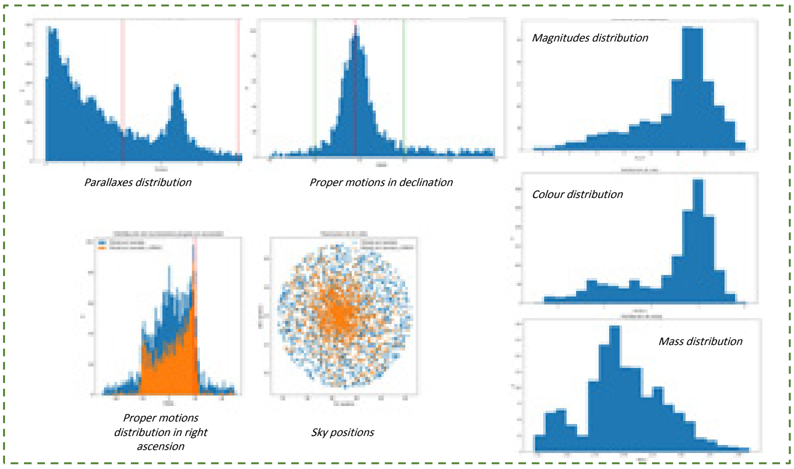
Raúl Gómez Santoveña, Marco A. Álvarez-González, Guillermo Torralba Elipe, Iker González Santamaría, Ángel Gómez, Carlos Dafonte and Minia Manteiga.
CITIC and University of A Coruña, Spain

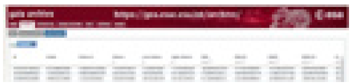
AIM: Gaia ESA mission archives offer excellent opportunities for sparking early science vocations in school, and they are an engaging resource for getting students started on data science. During the 20-21 and 21-22 academic years, our research group has supervised two projects within the STEMbach program (Excellent Bachelor in Science and Technology). Our goal was to encourage high school students' creative thinking and interest in research, technology and innovation through different methods of investigation and analysis.

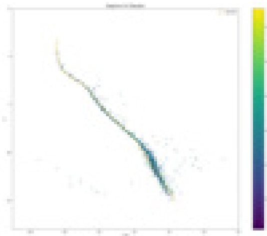
PROJECT 1: PROPERTIES OF STARS IN STELLAR CLUSTERS: THE PLEIADES AND PRAESEPE

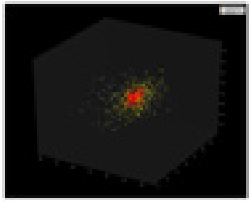


1- MEMBERS SELECTION BY ASTROMETRY. Our first project took place during course 2020-2021, and it made use of Gaia EDR3 precise astrometric and photometric parameters. Our students studied the stellar components of two bright and close by galactic open clusters: Praesepe (M44) and Pleyades (M45). They searched EDR3 archive selecting those objects contained in the neighbourhood of each cluster with similar parallax and proper motion values (in RA and Dec directions) to those reported in the literature for each cluster, taking into account measurement errors.









2- COLOR-MAGNITUDE DIAGRAMS. Then, they located the selected stars in a colour-magnitude diagram (G-RP vs M(G)) with the aim of studying their evolutionary state using suited isochrone models. By interpolation, they calculated masses, luminosities, effective temperatures and radii of the sequences of stars. All the steps for the selection of the populations have been carried out using Python programming language and the interactive Jupyter Notebook tool.

jupyter + python

Animation temperature | Animation tidal | Animation V3D

Two STEMBACH projects based on Gaia data: introducing Big Data Astronomy in Spanish High Schools

Raúl Gómez Santoveña, Marco A. Álvarez-González, Guillermo Torralba Elipe, Iker González Santamaría, Ángel Gómez, Carlos Dafonte and Minia Manteiga.
CITIC and University of A Coruña, Spain

PROJECT 2: DERIVATION OF STELLAR ATMOSPHERIC PARAMETERS USING A SYNTHETIC GRID OF STELLAR SPECTRA AND ARTIFICIAL NEURAL NETWORKS

1- INTRODUCTION. During the 2021-2022 academic year, a Stembach project based on machine learning (ML) was developed. ML techniques are becoming a useful and fast tool to make inferences where there is no known analytic relationship between observables and variables, that are hidden in the physical processes that produce these observables. In this work the students were guided to develop a Multi-layer perceptron neural network model able to estimate the stellar effective temperature, gravity and metallicity from RAVE survey stellar spectra in Gaia RVS instrument spectral region.

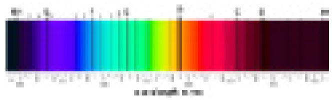
2- MAIN OBJECTIVES:

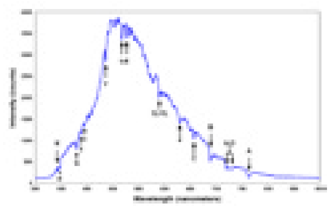
1- Understand the meaning of a stellar spectrum and the information it contains about the physical properties of a star's photosphere, its temperature and gravity, and chemical properties (presence of chemical elements in its atmosphere).

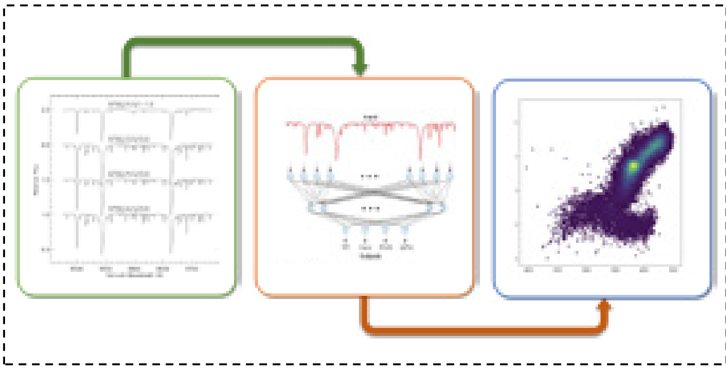
2- Basic knowledge about how the atmosphere of a star is modeled and how theoretical spectra can be obtained that can be used to interpret star observations.

3- Understand how artificial neural network (ANN) algorithms work, what their layered structure is, how they are trained and how their operation is validated.

4- Application of an ANN algorithm trained with star spectra models in the spectral region of the Gaia RVS instrument to obtain the temperatures, gravities and metallicities of a set of star observations. Interpretation of the results in terms of evolutionary state and spectral types.







EXTRACURRICULAR ACTIVITIES FOR SCHOOL STUDENTS WITH SPECIAL INTEREST IN ASTRONOMY

Antoaneta Avramova-Boncheva

Due to the significant reduction of the physics and astronomy classes in the school curriculum during the recent decades, important phenomena and laws of nature for most of the students remain a mystery, which has a negative impact on their general knowledge and understanding. Extracurricular activities which take place in the public astronomical observatories of our country are an additional, and sometimes main source of information, especially for motivated students who are interested in science, but not only for them. Our observatory has a history of nearly 60 years (it was founded in 1963) and a very rich experience in this field. We organize free astronomy classes which are attended by students of grades 5-12 on a regular base throughout the whole school year. During the vacations the students participate in observing camps and expeditions. In addition to studying theory, a wide variety of experiments and observations of space objects are made. We present some of our ideas for extracurricular activities during the astronomy classes at the observatory. We have selected four lessons with which the students can point out or understand the concepts related to the main properties of light, determine the scale of various astronomical images and find the parameters of the objects or the size of features within the image. They can investigate the diurnal path of the Sun changing with the seasons. Last but not least we present an idea for observational exercise to determine Jupiter's mass using Kepler's third law.

EXTRACURRICULAR ACTIVITIES FOR SCHOOL STUDENTS WITH SPECIAL INTEREST IN ASTRONOMY

Astronomical observatory "Nicolaus Copernicus"
Varna, Bulgaria

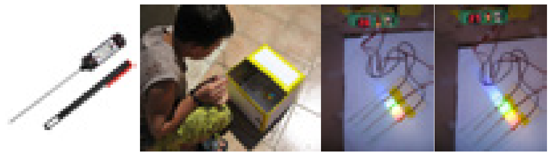
Antoaneta Avramova-Boncheva (1,2)
Eva Bojurova (1)

Abstract: *Due to the significant reduction of the physics and astronomy classes in the school curriculum during the recent decades, important phenomena and laws of nature for most of the students remain a mystery, which has a negative impact on their general knowledge and understanding. Extracurricular activities which take place in the public astronomical observatories of our country are an additional, and sometimes main source of information, especially for motivated students who are interested in science, but not only for them. Our observatory has a history of nearly 60 years (it was founded in 1963) and a very rich experience in this field. We organize free astronomy classes which are attended by students of grades 5-12 on a regular base throughout the whole school year. During the vacations the students participate in observing camps and expeditions. In addition to studying theory, a wide variety of experiments and observations of space objects are made. We present some of our ideas for extracurricular activities during the astronomy classes at the observatory. We have selected four lessons with which the students can point out or understand the concepts related to the main properties of light, determine the scale of various astronomical images and find the parameters of the objects or the size of features within the image. They can investigate the diurnal path of the Sun changing with the seasons. Last but not least we present an idea for observational exercise to determine Jupiter's mass using Kepler's third law.*

Herschel's experiment - discovering the infrared radiation:

This school year is special since the JWST space telescope was launched successfully on its long journey to L2. Our astronomical observatory's teaching staff has decided to spend a week dedicated to the telescope, during which students will learn about the structure of the device and the scientific aims of its mission. The first task was to explain to the students which part of the electromagnetic spectrum this telescope would be operating on and how infrared rays would be detected. The first portion of the experiment (Newton's experiment) related to the dispersion of sunlight from a glass prism. Once the students were convinced that sunlight is made up of the colors of the rainbow, we moved on to the actual experiment.

In 1800, William Herschel decided to investigate the thermal effect of the various colors in the spectrum of the sunlight. He used several thermometers placed in different color bands of the spectrum and found that the temperature rose from violet to red. But his control thermometer, that was in the "darkness" aside from the red band, showed the highest temperature. He concluded that there should be a kind of invisible "light" next to the red color So the infrared radiation was discovered. Our students repeated the experiment, using a glass prism, a box with a white paper sheet placed in the base, and a cooking thermometer with accuracy ±0.1°.



Measuring sidereal periods of Galilean moons and obtaining the Jupiter mass by using Kepler's third law:

An 8 cm refractive telescope with a guiding mechanism and a Canon 80D camera were employed for the task. On August 24, 25, and 27, 2021, photographic observations of Jupiter and its four Galilean satellites were made. The students turn the photos negative and accept the assumption that the satellites' orbits are circular. They use graph paper to draw the orbit of each satellite on a scale, using data from sources for the semi-major axis. By measuring the angle that the given satellite traveled between the two observations they can calculate the period of each satellite using Eq 1.
Using Kepler's third law (eq. 2) and the approximation:

$$M_1 \gg M_2 \rightarrow M_1 + M_2 \approx M_1$$

the pupils also determined **Jupiter's mass.** Table 1 shows all of the results.

$$T = (t_2 - t_1)\frac{360^\circ}{\varphi^\circ}$$

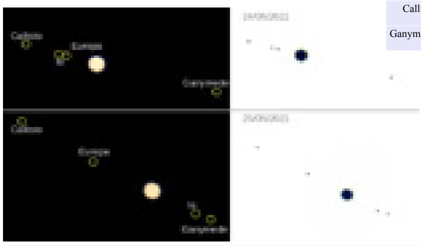
Eq.1

$$T^2 = \frac{4\pi^2}{G(M_1 + M_2)}a^3$$

Eq.2

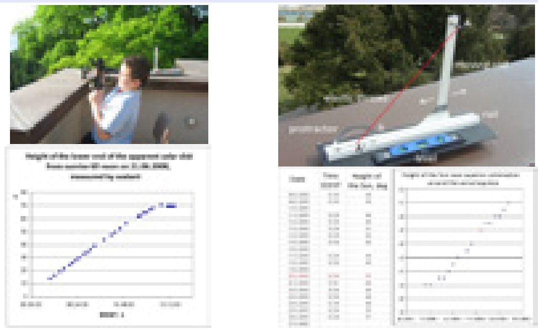
Object	a [km]	T [sec]	M_J [km]
Io	421800	168204	1.56993×10^{27}
Europa	671100	315632	1.79570×10^{27}
Callisto	1882700	1345633	2.18134×10^{27}
Ganymede	1070400	555488	2.35246×10^{27}

Tab.1



Measuring the height of the Sun above the horizon

It is interesting to observe how the height of the Sun above the horizon changes during the day and to follow the variations of the maximal height to which the Sun reaches at noon (in superior culmination) during the different seasons.
Due to the location of our observatory near the sea coast our students are able to use a sextant. But working with a sextant is somewhat complicated especially for younger students, also it can only be used if a clear sea horizon is seen, and of course not every educational institution has a sextant. That is why we designed a simple alternative device for measuring the height of the Sun, which can be seen on the following picture. First the device should be turned towards the Sun and it should be leveled. Then the vertical rod should be moved along the rail until the shadow of point A coincides with the center of the protractor A'. The height of the Sun h can be read on the protractor.

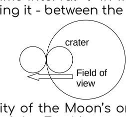


Measuring the sun spots and the Moon craters

The sizes of the lunar craters, the sun spots and other features on the surface of various space objects can be determined by means of measurements on photographic images or through a telescope and simple calculations.
Using a scale. On a photographic image of the whole Sun the size s of a large sun spot and the solar diameter d are measured in millimeters. Then the real diameter D of the Sun is used and the size S of the sun spot in kilometers is calculated:

$$S = s.\frac{D}{d}$$

Using a chronometer. The Moon is observed through a telescope without a guiding system. Measured is the time interval t in which a large crater crosses the boundary of the field of view when leaving it - between the positions 1 and 2.



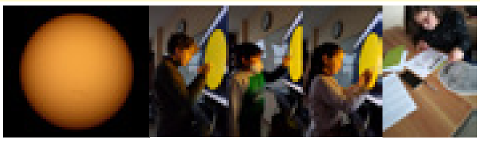
We use the angular velocity of the Moon's orbital motion (based on the sidereal month) and the angular velocity of the Earth's rotation (based on the sidereal day) to calculate the relative angular velocity of the Moon's apparent diurnal motion on the sky with respect to an observer on Earth:

$$\varpi = (\varpi_{Earth} - \varpi_{Moon}).\cos\delta$$

Here we take into account the lunar declination, since it determines the dimension of the celestial parallel on which the Moon is located at the time of our observation. Finally we use the distance to the Moon d in the same moment and the time interval t measured by us, to obtain the diameter D of the crater:

$$D = 2\pi d.\frac{\varpi t}{360^\circ}$$

On 21 August 2021 we used a small 6 cm telescope with a magnification of 80x and were able to determine the diameter of the Copernicus crater with an error of 9%. In this exercise the choice of the crater is important - it has to be large and located not far from the center of the apparent lunar disk, so that the distortions of the crater due to the spherical shape of the Moon to be minimal. To reduce the error it is recommended to carry out multiple measurements of the time t and to use the averaged value. The variability of the Moon's orbital velocity is not taken into account.



Conclusion: The experiments and observations we carry out are invaluable to all students. No video or book can replace the experiment in which students develop their skills and understand the laws of nature first-hand, i.e., prove them. On the other hand, the student's own observations with the telescope are an indispensable part of the astronomy classes, confirming the knowledge of celestial mechanics and their importance.

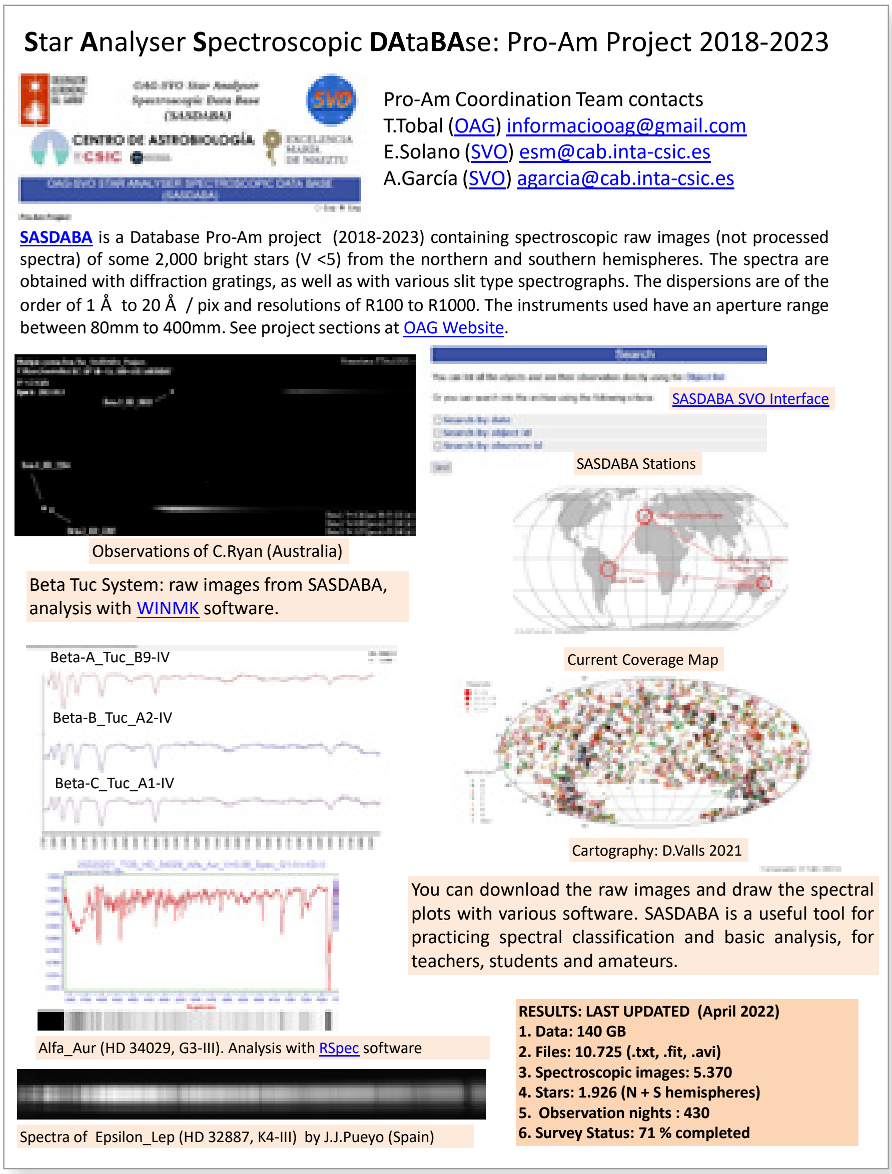
(1) The Astronomical Observatory "Nicolaus Copernicus", Varna, Bulgaria;
(2) Institute of Astronomy and National Astronomical Observatory, Bulgarian Academy of Sciences;

References: * Project number: 2017-1-SK01-KA201-035344, Erasmus+ Programme, KA2, Strategic Partnerships in School Education

STAR ANALYSER SPECTROSCOPIC DATA BASE. OAG-SVO PRO-AM PROJECT

Tòfol Tobal

SASDABA (OAG-SVO Pro-Am project 2018-2023) aims to create a database containing raw spectroscopic images (not processed spectra) of some 2,000 bright stars (V<5) from the northern and southern hemispheres. The spectroscopic images are obtained with Star Analyzer 100-200 L / mm diffraction gratings to which a 3.8°C prism can be added, as well as with various spectrographs (Alpy 600, LHIRES-III, DADOS or similar). The dispersions are of the order of 1Å to 20Å / pix and resolutions of R100 to R5000. The instruments used have an aperture range between 80mm to 400mm. Currently, a total of 20 observers spread over various stations in the Northern and Southern hemispheres. SADABA last updated (April,2022) contains more than 5,000 images about 1,900 stars, the sky coverage has reached 70%.



STELLAR :AN EU TWINNING PROJECT ON LOFAR DATA ANALYSIS AND KNOWLEDGE TRANSFER

Antoaneta Antonova

Co- authors: K. Kozarev(1), A. Avramova-Boncheva(1), R. Miteva(1), M. Dechev(1), P. Zucca(2), E. Carley(3), S. Maloney(3), P. Petkov(4)

Affiliations: (1) Institute of Astronomy and National Astronomical Observatory, Bulgarian Academy of Sciences, Bulgaria; (2) ASTRON, the Netherlands; (3) DIAS, Ireland; (4) Technical University of Sofia, Bulgaria

The Scientific and Technological Excellence by Leveraging LOFAR Advancements in Radio Astronomy (STELLAR) is a project of mutual collaboration and know-how transfer in the field of radio astronomy, solar physics and space weather using the LOFAR instrument and data. Two institutions from Bulgaria, benefit from technical and scientific know-how exchange from world-leading RA institutions - ASTRON (the Netherlands) and DIAS (Ireland) via a series of training hands-on sessions, workshops, seminars and project-focused schools for both students and senior staff. The poster presents the activities so far and future plans. All results, links to videos and outreach activities are hosted at a dedicated web-site. The STELLAR project is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No 952439. It is coordinated by the Institute of Astronomy, Bulgarian Academy of Sciences.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 952439.

STELLAR : a EU twinning project on LOFAR data analysis and knowledge transfer

A. Antonova(1) , K. Kozarev(1), A. Avramova-Boncheva(1), R. Miteva(1), M. Dechev(1), P. Zucca(2), E. Carley(3), S. Maloney(3), P. Petkov(4)
Affiliations: (1) Institute of Astronomy and National Astronomical Observatory, Bulgarian Academy of Sciences, Bulgaria; (2) ASTRON, the Netherlands; (3) DIAS, Ireland; (4) Technical University of Sofia, Bulgaria

Abstract: The Scientific and Technological Excellence by Leveraging LOFAR Advancements in Radio Astronomy (STELLAR) is a project of mutual collaboration and know-how transfer in the field of radio astronomy, solar physics and space weather using the LOFAR instrument and data. Two institutions from Bulgaria, benefit from technical and scientific know-how exchange from world-leading RA institutions - ASTRON (the Netherlands) and DIAS (Ireland) via series of training hands-on sessions, workshops, seminars and project-focused schools for both students and senior staff. The poster presents the activities so far and future plans. All results, links to videos and outreach activities are hosted at a dedicated web-site. The STELLAR project is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No 952439. It is coordinated by the Institute of Astronomy, Bulgarian Academy of Sciences.

General Information:

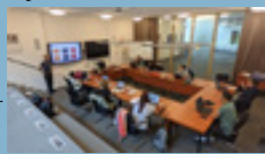
- **Call: H2020-WIDESPREAD-2018-2020, Twinning topic**
- **EU Grant: 899 877 EUR**
- **Duration: 36 months**
- **Start Date: 01 September, 2020**

STELLAR Consortium Members:

- **IANAO (https://astro.bas.bg/)**
- **TUS (http://www.tu-sofia.bg/)**
- **ASTRON (https://www.astron.nl/)**
- **DIAS (https://www.dias.ie/)**

STELLAR objectives:

- To **transfer** scientific and technical **knowledge and capacity in radio astronomy** from the highly experienced staff in ASTRON and DIAS to IANAO and TUS staff by means of versatile training activities;
- To expand the research potential of the local **solar and space weather scientists** through a combination of target training activities and research discussions and collaborations using LOFAR observations;
- To provide an opportunity for IANAO and TUS scientific and engineering personnel to build the necessary expertise and technical **capabilities required for the building and operation of a Bulgarian LOFAR station**



Highlights Period 1:
Online courses freely available at https://stellar-h2020.eu/ :
ASTRON Training I on RF Technology and RF Development I;
Space Weather Training I - Introduction to Space Weather at DIAS;
ASTRON Training I on RF Technology and RF Development;
ASTRON Training II on Phased Array Digital Signal Processing.
Online seminars also freely available at https://stellar-h2020.eu/
Other activities:
LOFAR Data School
Staff Visits to ASTRON (LOFAR Operations and Science, Data reduction)
Staff Visit I and II to DIAS (Space Weather Data Analysis)

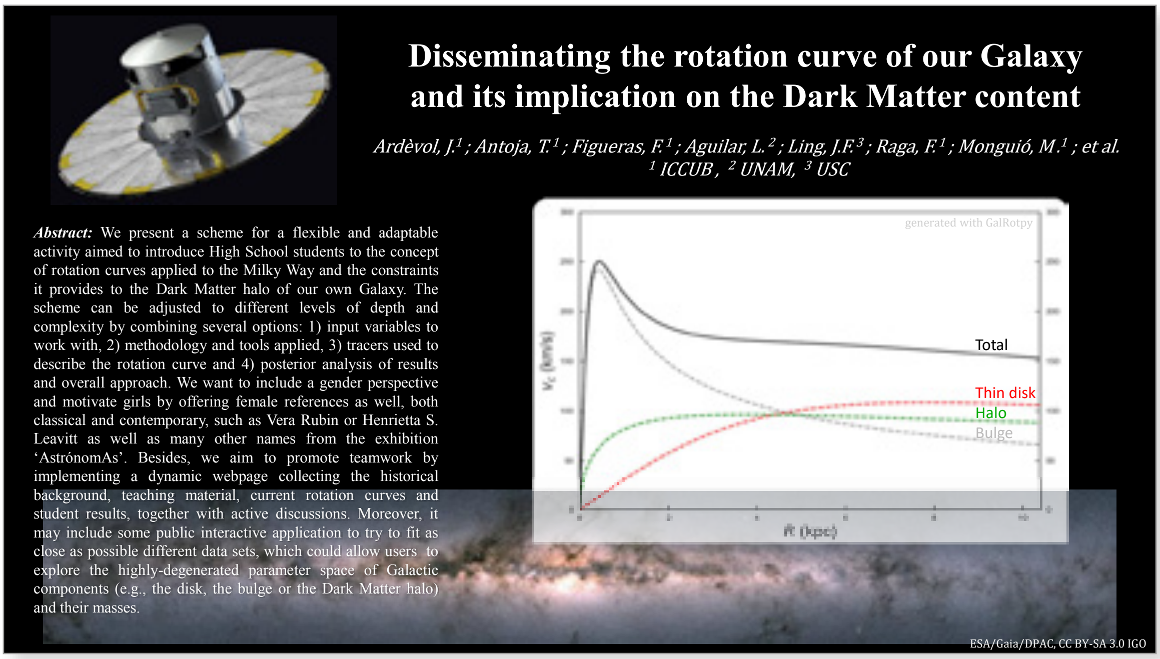
Synergistic Activity: the LOFAR-BG Project (https://lofar.bg/)

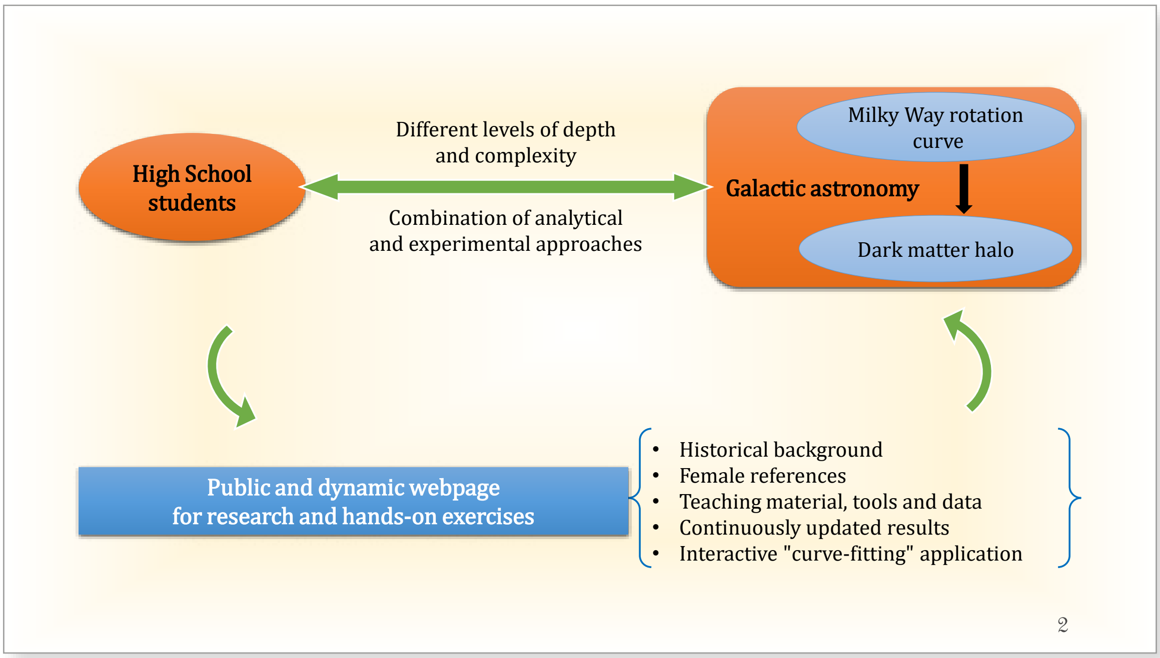
- The consortium at present: IANAO, TU, SU, SHU
- Included in the Bulgarian National Roadmap for Science Infrastructures (Ministry of Education and Science of Bulgaria)
- Received funding for building and maintaining LOFAR station
- Site selected (close to the Rozhen Observatory), RF checked and approved

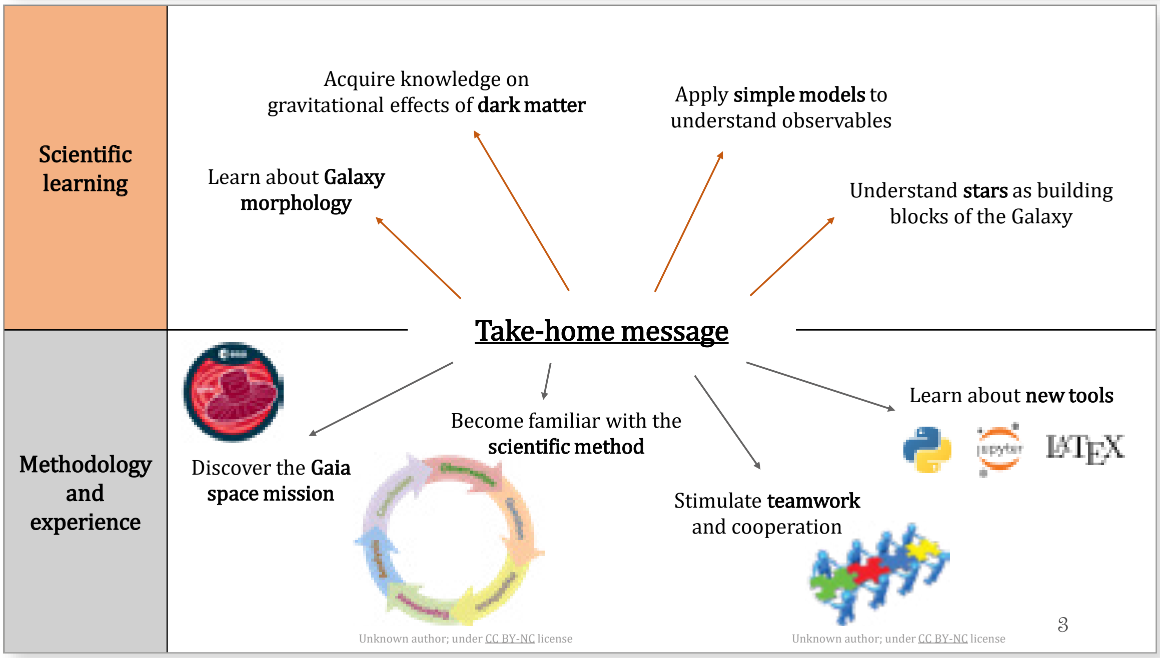
DISSEMINATING THE ROTATION CURVE OF OUR GALAXY AND ITS IMPLICATION ON THE DARK MATTER CONTENT

Judith Ardèvol Guillamón

We present a scheme for a flexible and adaptable activity aimed to introduce High School students to the concept of rotation curves applied to the Milky Way and the constraints it provides to the Dark Matter halo of our own Galaxy. The scheme can be adjusted to different levels of depth and complexity by combining several options: 1) input variables to work with, 2) methodology and tools applied, 3) tracers used to describe the rotation curve and 4) posterior analysis of results and overall perspective. We want to include a gender perspective and motivate girls by offering female references as well, both classical and contemporary, such as Vera Rubin or Henrietta S. Leavitt as well as many other names from the exhibition 'AstrónomAs'. Besides, we aim to promote teamwork by implementing a dynamic webpage collecting the historical background, teaching material, current rotation curves and student results, together with active discussions. Moreover, it may include some public interactive application to try to fit as close as possible different data sets, which could allow users to explore the highly-degenerated parameter space of Galactic components (e.g. the disk, the bulge or the Dark Matter halo) and their masses.



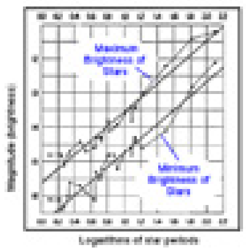




A tribute to our pioneering female astronomers

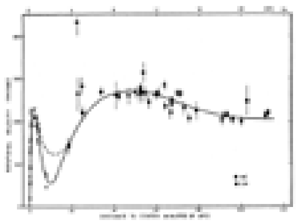
Henrietta Leavitt (USA, 1868-1921)
The distance scale of the Universe

She discovered the relation between the luminosity and the period of Cepheid variable stars.



Vera Rubin (USA, 1928-2020)
Rotation curves, dark matter

She measured the rotation curve of spiral galaxies leading to the realisation that most of their mass might be dark and resides in haloes.



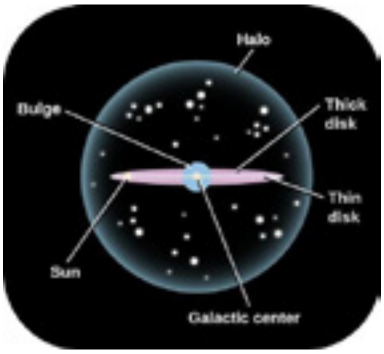
4

Analytical	Empirical

From gravitational force to the mass model of the Galaxy:

- Galactic components
- Density profiles

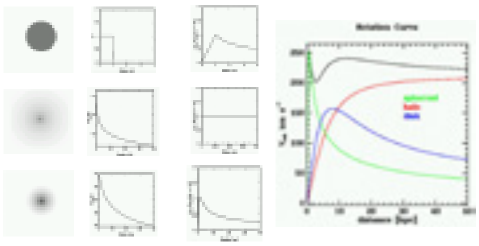
} Derivation of the modelled rotation curve



Select the density distribution

- Point source
- Uniform sphere
- Isotherm
- ...
- Disk-like
- Plummer model

Derive and combine circular velocities



PYNBODY (Python 3.5): **Radial density profiles** making profiles of all kinds.

PYNBODY (Python 3.5): **Plotting the rotation curve** combining different densities and masses

https://www.coursehero.com/study-guides/astronomy/the-architecture-of-the-galaxy/

https://www.astro.utu.fi/~cflynn/galdyn/lecture4.html

5

Analytical	Empirical

From gravitational force to the mass model of the Galaxy:

In galaxies, there are typically 10^9 to 10^{11} stars gravitationally interacting

⇩

Newton law: the gravitational interaction among them is

$$\mathbf{F(r)} = -\frac{GM\mathbf{e_r}}{r^2}$$

⇩

Strategies to approach the problem:

a) stars –as point masses– in a computer simulation
b) stars considered to have a smooth distribution in space

⇨

Two useful theorems (from Newton):

1. A body inside a spherical shell of matter experiences no net gravitational force from the shell.
2. A body outside a closed spherical shell experiences the same gravitational force as if all the matter in the shell were concentrated at a point at its center.

⇧

A test particle in a a circular orbit at radius r would have the **circular speed**:

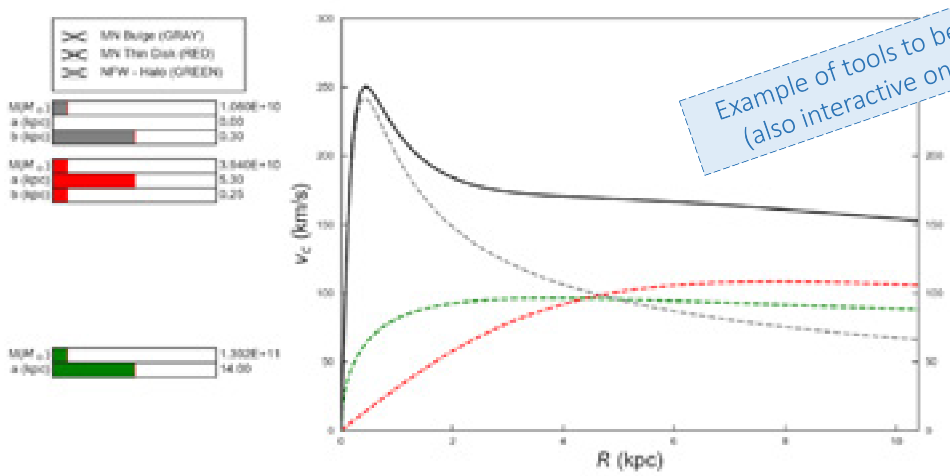
$$F(r) = v_{circ}^2(r)/r$$

Example of educational content on web

https://www.astro.utu.fi/~cflynn/galdyn/lecture3.html

6

Analytical	Empirical

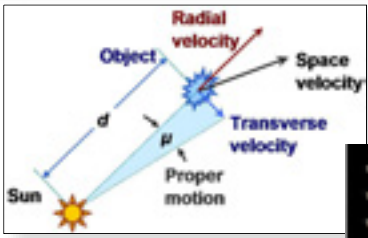


Example of tools to be used (also interactive on web)

Generic modelled rotation curve generated by GalRotpy
(https://arxiv.org/pdf/1705.01665.pdf)

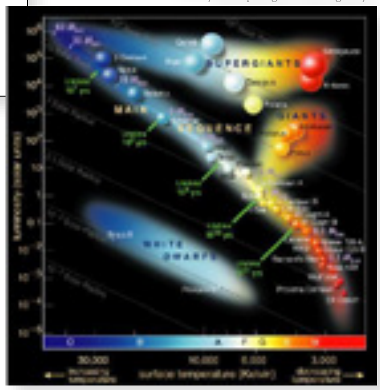
7

Analytical	**Empirical**



Brews Ohare; https://commons.wikimedia.org/wiki/File:Proper_motion.JPG

https://www.universetoday.com/39974/hertzsprung-russell-diagram/



Working with Gaia data

What can we see? What do we need?

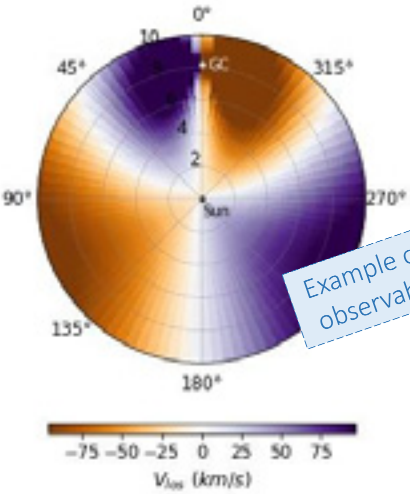
Astrometry:
- Concept of stellar distances in astronomy

Kinematics for tracing the dynamics of the system:
- Velocities from the Sun and from the Galactic Centre

Stellar physics:
- Different stellar tracers (Cepheids, Red Giants, OB stars...)

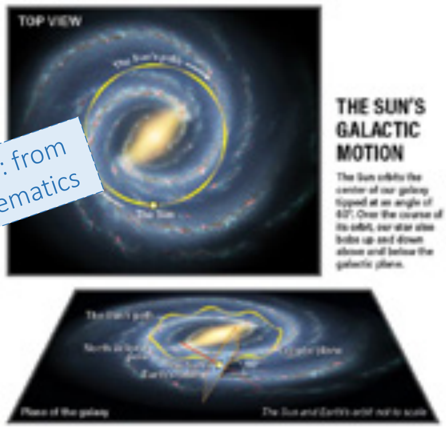
8

Analytical	**Empirical**



Line-of-sight velocities observed from the Sun for a toy model with circular orbits and a flat rotation curve.

Example of material: from observables to kinematics



Roen Kelly; https://astronomy.com/magazine/ask-astro/2020/07/in-which-direction-does-the-sun-move-through-the-milky-way

9

Analytical	**Empirical**

Input data available on web:

Prepared data files with Galactic positions and velocities ready to directly obtain the rotation curve

Query to the data archive (proper motions, radial velocity and parallax) + use of **public codes** to derive Galactic velocities and distances

What do we measure? How do we use it?

- Examples of optimal use of available data: "looking to the anticenter, no transformation is needed"
- Range of application and limitations
- Work in the space of the observables: Can we use directly what we observe?

10

Analytical	Empirical

Take home message: the clear **connection** between both approaches

Making use of GalRotpy, the rotation curve will be fitted to the observed velocities

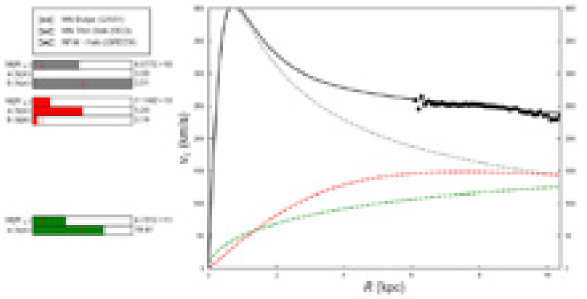


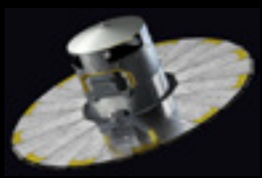
Figure 5.1: Fitting with halo. Figure generated by GalRotpy

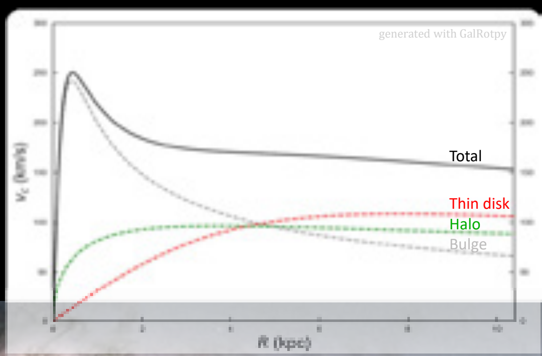
Results and conclusions for students:

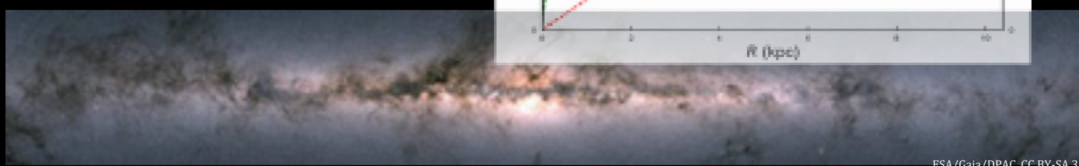
- Learn that scientific method needs fitting data with models to check them
- Analyse results in comparison with previous work (dynamical webpage)

11

Thank you







THE MUSEUM OF LALIN "RAMON MARIA ALLER ULLOA", THE FIRST ASTRONOMICAL OBSERVATORY IN GALICIA

Cecilia Doporto Regueira
Carlos Viscasillas Vázquez

In this poster we present what is considered the first astronomical observatory in Galicia. Located in Lalin, a beautiful town in the heart of Galicia, it is the house where lived the wise astronomer and priest Ramón María Aller Ulloa (1878-1966), a pioneer of astronomy in Galicia and Spain. This 19th century building was converted into a museum in 1989, and where his office and astronomical instruments are preserved, as well as his personal library. There, in the galleries of his house, would be his first place of astronomical observation. The second, two square towers that he began to build in 1912 and had them completed in 1917. One of them housed a telescope and the other a theodolite that his benefactor María Lajosa had given him in 1903. After the death of his uncle Saturno Aller in 1923 and with the use of his property, he built what would be his third observatory, Mr. Ramón being the one who carried out the project and directed the work, completed in August 1924. In April of the following year he acquired a 12 cm refractor of 180 cms focal length to the Steinel house in Munich. Mr. Ramón Aller Ulloa carried out several investigations from this particular observatory, which was the first in Galicia and collaborated with the main directors of the observatories in Spain. In 1943 a new observatory was built at the University of Santiago, in the capital of Galicia, where the instruments of the Lalin Observatory were moved.

SOCIAL ACTIVITIES

MONDAY:
VISIT TO THE ASTRONOMICAL OBSERVATORY OF THE UNIVERSITY OF SANTIAGO

The first of the extra activities of the workshop was on Monday afternoon, at the end of session 2. The on-site participants had a guided visit to the “Ramon Maria Aller” Observatory of the University of Santiago. This observatory was founded in 1943 by Dr. Ramón María Aller Ulloa, after whom it is named, as a continuation of the private observatory that he owned in the village of Lalín (Pontevedra), which was the first observatory in Galicia. Josefina Faen Ling and Pedro Pablo Campo were in charge of explaining all the details to the visitors and showing the astronomical instrumentation of the astronomical observatory, which will celebrate its 80th anniversary next year.

TUESDAY:
PUBLIC LECTURE AND WORKSHOP DINNER

At the end of session 5 and in the same Faculty of Optics, a public conference by Carme Jordi took place. The conference had the title of “The secrets of the Milky Way” and was in Spanish language, to bring the knowledge about our Galaxy to the general public in a simple way. The attendees, some of them arrived from different places in Galicia, were able to enjoy this excellent informative talk and better understand the Galaxy in which we live.

In the evening, the onsite participants had a workshop social dinner. This was in a very special place, in the old convent of San Francisco. According to tradition, this convent was founded by Saint Francis of Assisi himself on his pilgrimage to Compostela in 1214. Emperor Charles V held the Cortes of Santiago in this convent in 1520. The dinner was held in the old convent bodega (winery), located next to the Monumental Dining Hall and very close to the Glass Courtyard. It is one of the most charming spaces in the convent. Its vaulted ceilings and stone walls create a warm atmosphere for any celebration. The participants were able to socialize and enjoy a typical Galician menu.


Dinner
MW-Gaia WG5 workshop
esa
gaia


Menu
Creamy rice
with Scallops and Mussels
Cod with Romesco Sauce
and Vegetable Ratatouille
or
Pork Sirloin with Mustard and Honey Sauce
and Potato Cream
Galician Crêpes
stuffed with Cream and Orange Sauce

WEDNESDAY:
TOURIST GUIDED VISIT TO PAZO DO FARAMELLO

At the end of session 8, the onsite participants traveled by bus to the Pazo do Faramello. A pazo is a palatial civil construction typical of Galicia. This country house is located on the Tinto river canyon, a tributary of the Sar river. In its gardens is one of the oldest holly trees in Galicia, a symbol that is included in the coat of arms of the Rois town hall. This country house is integrated very well into the natural environment that surrounds it and is mentioned in the work of the most important writers in Galicia: the poet Rosalía de Castro, the Nobel Prize winner Camilo José Cela and Emilia Pardo Bazán, among others.
The participants in the workshop were able to see first-hand a typical rural construction of Galicia and enjoy the atmosphere of the Camino de Santiago, as well as taste their wines.

THURSDAY:
EXCURSION TO THE ATLANTIC OCEAN COAST AND CASTRO DE BAROÑA

On the last day in the morning, the participants who had not yet returned to their places of origin, were able to enjoy a beautiful excursion to see the Atlantic Ocean and an old typical fortification in Galicia. In a very special place, they were able to visit an ancient "castro" settlement built between the 1st century BC. C. to I d. C. on a peninsula. A "castro" is a fortified town, usually pre-Roman. This one had two walls around it and twenty houses with a circular or oval floor plan are preserved. Finally, some of the participants dared to take a bath in the "icy" Galician waters. Finally, the last participants were taken to the airport, receiving a warm farewell. Thus, a few days of scientific knowledge and fraternity ended successfully, and the participants took home a little piece of Galicia.

“AstronomAs” EXHIBITION

During the Workshop, both participants and the general public could visit the Galician version of the “AstrónomAs” exhibition. Located in the Hall of the Faculty of Optics, it served as a complement to the oral talk that its curator, Josefina F. Ling gave in session 3 entitled *“AstronomAs” A journey through the Universe by hand of hundreds of women* (see abstract on page 26)

MW-GAIA WG5 WORKSHOP

Breaking Barriers: Inspiring the Next Generation

POST-WORKSHOP REPORT

(Prepared by
Šarūnas Mikolaitis
and Elsa Moreira)

The ninth workshop of the CA18104 COST Action MW-Gaia and the second WG5 was held at the Faculty of Optics and Optometry of the University of Santiago de Compostela in Santiago de Compostela, Spain, May 23 - 25, 2022.

SCIENTIFIC MOTIVATION FOR THE WORKSHOP

The Gaia astrometric mission has recorded more than a billion stars in our Milky Way and neighbouring galaxies. It measures stellar positions, parallaxes and movements as well as physical properties with an unprecedented level of accuracy. It is currently one of the most important astronomical research projects in the world. A true revolution in astronomy. Although this revolution is important for science, but it effects the society as well through education, research opportunities and outreach. This effect must be understood.

MW-Gaia WG5 meeting "Breaking Barriers: Inspiring the Next Generation" is aimed to discuss the current state of advances in our understanding of the Milky Way from WG1, WG2, WG3, and WG4 in a context of equal opportunities, education and outreach.

The topics of the workshop include:

- Current state of advances in our understanding of the Milky Way
- Inclusiveness and equal opportunities
- Gender balance
- Reaching out to the public with Gaia
- Citizen science and amateur input
- Bringing Milky Way to schools and universities

WORKSHOP SUMMARY

The workshop started with the welcome talks by vice-chancellor of University of Santiago de Compostela (USC) Vicente Pérez Muñuzuri and dean of the Faculty of Optics and Optometry Maria Jesus Giraldez Fernandez and the chair of Local Organizing Committee Josefina F. Ling. They gave overview of the USC activities on the topics of the workshop and welcomed participants to the city of Santiago and University. Then leader of MW-Gaia Nicolas Walton gave an overview of the COST action activities so far, presented the MW-Gaia workplan and the plan for the future workshops and activities.

The first day was dedicated to the presentations by leads of WG1, WG2, WG3, and WG4 that were followed by presentations by PhD students or early career investigators on corresponding topics. The second and third days were dedicated to educational, outreach and inclusiveness topics.

SESSION 1

The first session was dedicated to advances in our understanding of the Milky Way from WG1 and WG2 perspective. This session was opened by the talk of Despina Hatzidimitriou. She is the lead of WG1 activities. Despina presented a number of scientific advances from Gaia DR1 and DR2 in understanding of global structure and history of the Milky-Way, possibilities of ground and space based follow-up surveys, and Gaia's data input into development of detailed Galactic chemodynamical models. The second talk by Danielle de Brito Silva "The accreted Galaxy: An overview of TESS metal-poor accreted stars candidates" was a great example of the synergy of two space based surveys TESS and Gaia and on-ground observations.

Gisella Clementini (lead of WG2) continued with presentation about recent advances in understanding of stars from the interiors to their atmospheres in the context of stellar spectroscopy, modeling, stellar clusters and astroseismic constrains. Saniya Khan Gaia continued the session with the talk "Gaia, stellar models, and asteroseismology". She showed how one can further test stellar models, thanks to the promising advances reached with Gaia and beyond what one can do with asteroseismology alone. Next speaker was Sara Vitali with the talk "Unveil the Sagittarius dwarf galaxy with the Pristine survey" where she discussed how the data from three surveys (Pristine, APOGEE and Gaia) of the core of the Sagittarius galaxy can teach us about its (early) evolution. The last speaker of the session was Carlos Viscasillas showed the synergy of astrometric Gaia data and spectroscopic ESO observations in his talk "Exploiting the abundances of neutron capture elements from the latest Gaia-ESO Survey (GES) data release".

SESSION 2

The second session followed the previous one with presentations from WG3 and WG4 perspective. The session was opened with a talk by WG3 representative Alessandro Sozzetti. He presented the MW-Gaia COST action input in understanding of Solar system, planets, asteroids and comets, and Exoplanets. The second talk by Barbara Soares "The Chemical link between stars and their rocky planets" was a nice example of Gaia and on-ground spectroscopy power studying possible exoplanet compositions. Later Fernando Tinaut-Ruano continued with a talk about studies of primitive asteroids using ground-based observations and Gaia data. Another speaker was Sonia Anton, the lead of WG4 who gave a presentation about latest WG4 achievements in context of Fundamental physics, Gravitation Waves distance scale and transient events with Gaia. Later three speakers showed detailed examples of WG4 activities: William Beordo with a talk "Gravitational Astrometry & Fundamental Physics to test the dynamical evolution of our Galaxy and its place in cosmology", Marta González - "Galactic hierarchy of clustered stellar formation" and Javier Olivares - "The dynamical interaction of the Coma Berenices open cluster and the GroupX moving group". The end of the session was followed by the group photo (see. Page 5).

SESSION 3

Third session, called "MW Gaia inclusiveness and equal opportunities. Gender Balance", was started with an invited talk "An astronomy exhibition, inclusive also for blind and visually impaired people and other INAF inclusive activities" by Alessandra Zanazzi. Alessandra. The INAF Arcetri Astrophysical Observatory hosts a permanent exhibition designed so to be inclusive also for blind and visually impaired people. Alessandra presented achievements and best examples of the project. The next speaker - Edita Stonkute introduced the Mentorship platform for early career researchers provided by Europlanet 2024 Research Infrastructure. Another invited speaker was Paula Jofre. Paula is deeply interested in the outreach activities and problematic of women representation in science. Her experience was shared in a talk "Inclusiveness and equal opportunities. Gender Balance". The topic "women in science" was further developed by Josefina F. Ling in the talk "AstronomAs: A journey through the Universe by hand of hundreds of women".

SESSION 4

The fourth session was dedicated to poster contributions. All posters are published online, however every presenter had up to 10 minutes to present their contribution to the audience. There are seven posters in total. All of them are published online: http://mao.tfai.vu.lt/breakingbarriers/.

SESSION 5

The invited talk by ESA representative Stefan Jordan have started the fiftieth session. Stefan presented wide resources that ESA team have developed to represent Gaia data for outreach and education. This talk was nicely followed by Tineke Roegiers, who coordinates the outreach for the Gaia community and the Gaia consortium from the Gaia team at ESA. Tineke gave an overview of where to go to get informed on Gaia mission news. Where to go for which information on the Gaia mission. The local representative Pedro P. Campo who presented the programs of Ramón María Aller Astronomical Observatory that include different activities, such as conferences, workshops, and public astronomical observations, which are highly demanded by the public. The last speaker of the session was Marusa Zerjal. Marusa presented a tool to bring the latest scientific results about young open clusters to the public. They are building a website dedicated to the nearby (<=1 kpc) young (<=500 Myr) open clusters as seen by Gaia.

PUBLIC TALK

The last scientific event of the day was a Public talk by Carme Jordi. It was an inspiring presentation about Gaia instrument and achievements. The talk (in Spanish) was dedicated to local people of Galicia who visited the venue of the workshop.

SESSION 6

"Citizen science and amateur input" was a title of the sixth session. The invited talk "From galaxies to asteroids: Citizen science as an efficient tool to explore large datasets" was presented by the big Citizen science enthusiast Sandor Kruk, who is involved in a number of similar activities like the famous "Galaxy Zoo" project. Elsa Moreira continued the Citizen science topic presenting the "CoAstro project as a new possible path for GAIA's dissemination strategy". CoAstro's approach is to engage teachers in Citizen science processes and to make it a natural path, enhanced by the "school effect" and the "teacher effect" in students. It was nicely shown that it can have the desirable effect in students' families and the surrounding school community. In the next talk Victor Tilve presented the scientific outreach group "Calidade do Ceo Nocturno". The group has been collecting night sky brightness measurements since 2016 in order to study the light pollution from Galicia (Spain). The last talk of the session was performed by Eduard

Masana. Eduard showed a very interesting and unexpected use of the Gaia archive: the modelling of the natural night sky brightness. This work is a part of the Gaia4Sustainability project.

SESSION 7

This was the last session of contributions called "Bringing Milky Way to schools and universities". In the invited talk Jackie Faherty demonstrated the results of our visualization efforts with the Gaia catalog at the American Museum of Natural History Visualizing for Science and Education. This was followed by two contributions by Rosa M. Ros and Ederlinda Viñuales about an ambitious program called NASE that aims to teach astronomy to everybody. They have reached 4 continents, translated the materials into 10 of the most widely spoken languages in the world and partially translated in 15 languages more. Later Hristo Stoev presented EAAE's Catch a Star competition that gives the possibility to natural science teachers to expand their pedagogical possibilities in the process of teaching astronomy. The last talk was by invited speaker Luis Aguilar who shared the vast experience in teaching the next generation of astrometry experts.

MEDIA

PRESS

LA VOZ DE GALICIA
https://www.lavozdegalicia.es/noticia/santiago/2022/05/22/ochenta-astronomos-analizaran-usc-secretos-via-lactea/0003_202205S22C4994.htm

https://www.lavozdegalicia.es/noticia/sociedad/2022/07/03/galaxia-chocara-andromeda-sera-colision-camiones/0003_202207G3P27992.htm

GALICIA DIGITAL
https://www.galiciadigital.com/nota.13277.php


Carme Jordi Nebot, catedrática de Astrofísica: «Nuestra galaxia chocará con Andrómeda, será como una colisión de camiones»

…da Gaia ha desvelado numerosos secretos de la Vía Láctea


SANTIAGO

Más de ochenta astrónomos analizarán en la USC los secretos de la Vía Láctea

LA VOZ
SANTIAGO / LA VOZ

El Observatorio Ramón María Aller organiza…

22 may 2022 . Actualizado a las 23:52 h.


Preto dun cento de participantes dunha vintena de países danse cita na USC para abordar os segredos da Vía Láctea

RADIO

RADIOVOZ GALICIA
https://serviastro.ub.edu/noticies/carme-jordi-sobre-gaia-a-con-voz-de-radiovoz-galicia

PLAYER FM
https://player.fm/series/a-noite-necesaria/gaia-conversa-con-carme-jordi

IVOOX
https://www.ivoox.com/en/gaia-conversa-carme-jordi-audios-mp3_rf_87923007_1.html

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SEA
https://www.sea-astronomia.es/mw-gaia-wg5-workshop-breaking-barriers-inspiring-next-generation

ESA
https://www.cosmos.esa.int/web/gaia/calendar-archive

USC
https://www.usc.gal/gl/xornal/eventos/rompendo-barreiras-inspirando-proxima-xeracion

RSEF
https://rsef.es/images/Fisica/Boletin_abril2022.pdf

THE WORKSHOP IN NUMBERS

- **85 participants from 24 different countries:**

  Argentina (1), Brazil (2), Bulgaria (3), Chile (2), China (1), Colombia (1), Costa Rica (1), France (2), Germany (2), Greece (1), Hungary (1), India (6), Italy (8), Lithuania (3), Malta (1), Mexico (2), Nepal (1), Peru (1), Portugal (5) South Korea (1), Spain (35), Switzerland (1), The Netherlands (1), United Kingdom (2), USA (1)

- **Invited talks (IT): 11 (7 F, 4 M)**
- **Contributed talks (CT): 19 (11 F, 8M)**
- **Financial support: 9**
- **PhD students (PhD): 12**
- **Undergraduate students (PhD): 20**
- **Early stage researchers (ESR): 6**
- **Amateurs: 11**
- **SOC: 6 F, 1 M**
- **LOC: 3 F, 3 M**
- **Total participants: 42 F, 43 M**

  30 Onsite, 55 Online

MW-GAIA COST ACTION CA18104

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-μas 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 Mar 2023 (although with the possibility of an extension). More information.

The workshop supported by COST Action CA18104: MW-Gaia

MW-GAIA WG5 WORKSHOP

Breaking Barriers: Inspiring the Next Generation

XUNTA DE GALICIA
CONSELLERÍA DE CULTURA, EDUCACIÓN E UNIVERSIDADE

galicia

Xacobeo 21·22

USC Universidade de Santiago de Compostela
OBSERVATORIO ASTRONÓMICO "RAMÓN Mª ALLER"

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MW Gaia