

DIVISION C / Functional WG

DIVISION C

KEY INITIATIVES IN ASTRONOMY

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**Rosa M. Ros, Rosa Doran
George Miley, Gustavo Rojas**

DIVISION C - FUNCTIONAL WORKING GROUPS

Functional WG- KI / Program 1 Network for Astronomy School Education - NASE

Functional WG- KI / Program 2 Universe Awareness - UNAWA

Functional WG- KI / Program 3 Galileo Teacher Training Program - GTTP

Functional WG- KI / Program 4 Eratosthenes

*** Greece**

*** America**

Functional WG- KI / Program 5 Globe at Night

Functional WG- KI / Reports by the members

TRIENNIAL REPORT 2021-2023 (the working group was created at the end of 2021)

1. Background

The Key Initiatives is a Functional WG depending on the IAU Division C, and its main purpose is to act as an anchor to link the Programs with the IAU structure to involve the successful programs which were maintained for a long time, that have several successful stories, and which can serve as inspiration for the new proposals. In this sense and during the first two years of existence (the working group was created at the end of 2021), the KI-WG main objectives were:

- Assure continuity to link the programs with the IAU.
- Be a Forum to establish and discuss about key programs and to identify new ones.
- Propose tools for evaluation.
- Coordinate the work for exchange between the programs avoiding overlap.
- Advice about inclusion and equity.

Into this framework, the special projects which are part of the WG, are working in an independent way, enlarging their own goals and producing new and amazing tools, projects, programs and supporting specific lines of work, locally or globally, which, in some cases, were born as part of the IAU initiatives for the IYA2009, as it is the case of the GTTP and NASE.

1.1. *Structure*

The KI-WG has 4 fundational programs:

- (a) Galileo Teacher Training Program (GTTP)
- (b) Network for Astronomy School Education (NASE)
- (c) Universe Awareness (UNAWA)
- (d) Pale Blue Dot (Astronomy for Global Citizenship and Environmental Awareness)

During 2022 two very successful programs were incorporated:

- href<https://eratosthenes.ea.gr/Eratosthenes> Experiment (Greece)
- href<https://df.uba.ar/es/difusion/102-difusion-eventos/8453-eratostenes-2023> Proyecto Eratostenes (Argentina-America); La Tierra es redonda

Eratostenes (Argentina-America); La Tierra es redonda

In 2023, the Globe at Night was selected as a KEY Initiative Program.

At the moment, the KI-WG is organized through an EC, integrated by Rosa M. Ros (Co-Chair) Rosa Doran, George K. Miley and Gustavo de Araujo Rojas; 4 advisors: Itziar Aretxaga (ISYA Director), Lina Isabel Pires Canas (former OAO Director), Kevindran Govender (OAD Director) and Markus Pössel (OAE Director), and 23 members.

2. Developments within the past triennium

2.1. *Network for Astronomy School Education*

NASE's activities during 2023 have been many and very fruitful. We are very happy because we observe that interest in Astronomy grows year after year among members and followers of NASE activities. At present NASE involve 73 countries (see Figure 1) where we teach 386 courses regulated and 70 courses in cooperation (Figure 2).

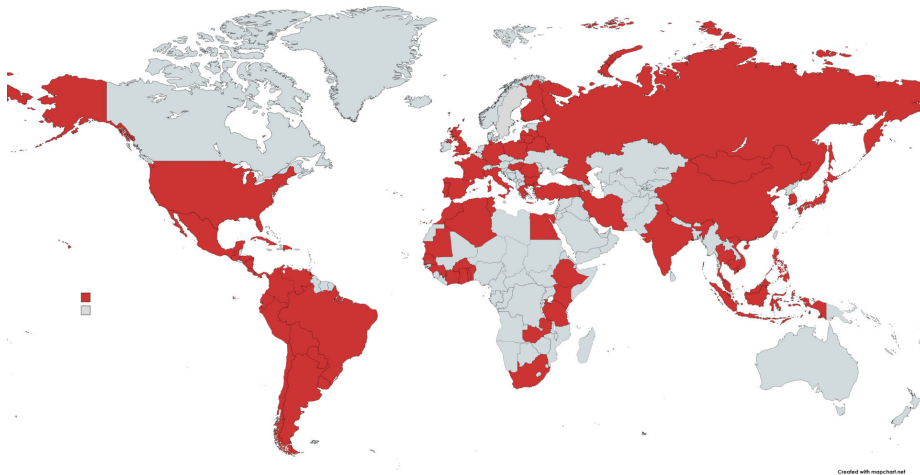


Figure 1. NASE Courses: Countries associated with the Network.

We want to begin this summary of the year 2023 presenting the courses organized around the world.

2.1.1. NASE COURSES

There have been 59 of these courses and in total xx secondary school teachers have participated.

Courses along 2023:

- 386 - Ulaanbaatar (Mongolia) – December 28-29, 2023
- 385 - Riga (Latvia) – December 4-6, 2023
- 384 - Tsevie (Togo) – November 22-23, 2023
- 383 - Santo Domingo (Dominican Republic) – November 6-21, 2023
- 382 - Hanoi (Vietnam) – November 4-5, 2023
- 381 - Hanoi (Vietnam) – November 2-4, 2023
- 380 - Campo Mourão (Brazil) – October 20-21, 2023
- 379 - Quito (Ecuador) – October 10-11, 2023
- 377 - Guadalajara (Mexico) – October 5-6, 2023
- 376 - Nouakchott (Mauritania) – September 30 – October 1, 2023
- 375 - Guatemala (Guatemala) – September 21-October 25, 2023
- 374 - Porto-Novo (Benin) – September 9th – October 22nd, 2023
- 373 - Porto-Novo (Benin) – August 31 – September 1, 2023
- 372 - Dodoma City (Tanzania) – August 25, 2023
- 371 - Mischelevka (Russia) – August 21-26, 2023
- 370 - Zapala (Argentina) – August 18-September 15, 2023
- 369 - Kerman (Iran) – August 3, 2023
- 368 - Busan (South Korea) – July 26, 2023
- 367 - Táchira (Venezuela) – July 22 – August 13, 2023
- 366 - Cairo (Egypt) – July 12-13, 2023
- 365 - Cairo (Egypt) – July 5-6, 2023
- 364 - Conakry (Guinea) – July 4-11, 2023
- 363 - Irkutsk (Russia) – July 4-5, 2023
- 362 - Abidjan (Ivory Coast) – July 3-13, 2023
- 361 - Nouakchott (Mauritania) – July 1-8, 2023
- 360 - Totoras (Argentina) – June 30 – July 8, 2023
- 359 - Malargüe (Argentina) – June 30-July 1, 2023
- 358 - Yerevan (Armenia) – June 29-30, 2023
- 357 - Yerevan (Armenia) – June 26-27, 2023
- 356 - Malargüe (Argentina) – June 23-24, 2023
- 355 - Yerevan (Armenia) – 12-13 June, 2023
- 354 - Yerevan (Armenia) – June 5-6, 2023
- 353 - Malargüe (Argentina) – June 2-3, 2023
- 352 - Ulaanbaatar (Mongolia) – May 26-27, 2023
- 351 - Dakar (Senegal) – May, 19-20, 2023
- 350 - Malargüe (Argentina) – 5-6 May, 2023
- 349 - Tianjin (China) – May 9, 2023
- 348 - Praia (Cape Verde) – May 6 – June 6, 2023
- 347 - Lahijan (Iran) – May 1-2, 2023
- 346 - Deylam (Iran) – April 29-30, 2023
- 345 - Delvar (Iran) – April 24-25, 2023
- 344 - Sac, Salta (Argentina) – April 20-25, 2023
- 343 - Delvar (Iran) – April 15th-16th, 2023

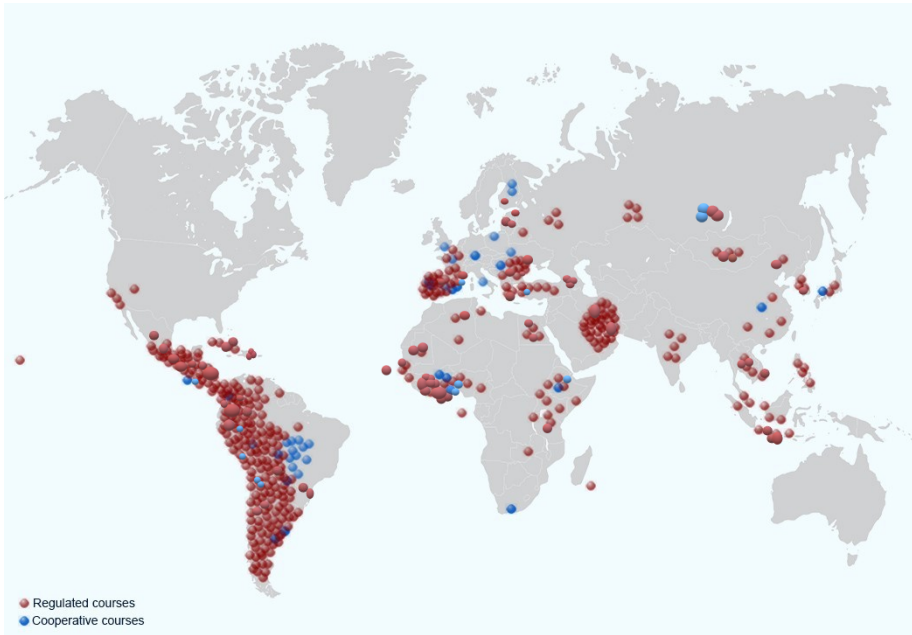


Figure 2. NASE Courses: Distribution on the Planet.

- 342 - Lleida (Spain) – November 2nd-April 23rd, 2023
- 341 - Turku (Finland) – April 5th, 2023
- 340 - Vilnius (Lithuania) – March 14th-15th, 2023
- 339 - Managua (Nicaragua) – March 11-12-25, 2023
- 338 - Mendoza (Argentina) – March 8 – June 3, 2023
- 337 - El Salvador (El Salvador) – 3rd-4th March, 2023
- 336 - Budapest (Hungary) – 28th February -7th June, 2023
- 335 - Barcelona (Spain) – February 14th-16th, 2023
- 334 - Las Tablas (Panamá) – February 13-17, 2023
- 333 - Tunja (Colombia) – February 9, 2023
- 332 - Dolna Mitropoliya (Bulgaria) – February 7-9, 2023
- 331 - Orihuela (Spain) – February 7th-14th, 2023
- 330 - Ciudad de Panamá (Panamá) – February 6-9, 2023
- 329 - Tunja (Colombia) – February 2-3, 2023
- 328 - Chiriquí (Panamá) – January 30-February 3, 2022
- 327 - Bucharest (Romania) – January 18-19, 2023

2.1.2. NASE-UNESCO Project

The Network for Astronomy School Education - NASE, has organized in the past years 3 event under the umbrella of UNESCO, to celebrate the International Day of Light (see [https://www.naseprogram.org/iau-unesco-projects/NASE UNESCO-IDL](https://www.naseprogram.org/iau-unesco-projects/NASE%20UNESCO-IDL)). NASE present this activity each year around March equinox, with an online synchronous event called Bridges Between Cultures.

The past three years, the topics of the project were:

- 2021 - Infrared and Music.
- 2022 - Latitud for traeling and navigate.

- 2023 - Looking for Micrometeorites.

In particular, the 3er Bridge between Cultures (2023), celebrated the International Day of Light with the project “Light, cameras and Life” from different approaches related to Astrobiology. The proposal consisted in introducing Astrobiology in schools by means of an activity based in Looking for micrometeorites any day between March 20 and September 23, 2023, and sending the results to newsletter.nase@gmail.com

The event consisted in:

- (a) Online meeting on March 19th 2023

This activity started on March 19th 2023 with a presentation by a zoom video conference from 12:00 to 15:00 CET (or 11:00 to 14:00 UTC).

Programme of this meeting:

After the presentation of the activity on March 19, the call for the “Looking for Micrometeorites” contest was opened for all students in the world who wanted to participate from their school. The call was open from March 20 to September 23, 2023. We have received 178 experiments from America, Europe, Africa and Asia and distributed as follow:

- 29 from America,
- 49 from Europa,
- 7 from Africa and
- 93 from Asia.

- (b) Face to face meeting on October 26th and 27th 2023

To conclude this activity, an in-person meeting was organized on October 26 and 27 within the call for Science in Action - Spain 2023, which took place in Viladecans (Barcelona), with the following programme:

October 26th, Thursday

19:30 - 20:30 NASE-UNESCO “Micrometeorites” Project Introduction

Distribution in 5 groups of teachers. A group for each tend on next morning. In each tend will be a group of teachers invited from a couple of countries. Revision of activities and materials.

October 27th, Friday

8:30 - 13:30 NASE-UNESCO Project “Micrometeoritos” in action

There were 5 different tends in different Localizations: 5 Institutes of Secondary school:

IES Miramar, Escola Montserratina, IES Torre Roja, IES Olimpia and IES Sales. In each tend there were the visit of several groups of students from 9:15 to 13:00. The activity organized for each group of students consisted in:

- A short introduction

- Visit the surrounding looking for dust with a plastic glass with a magnet inside and
- Detect the candidates to micrometeorites with the cellular or another device appropriate.

(c) Hybrid meeting on October 28th 2023

October 28th, Saturday

13:30 – 15:30 NASE-UNESCO “Micrometeoritos” Project Hybrid meeting – Zoom room

The program of online event was (Timeline: CET):

13:30 – 13:40 Opening session Beatriz García, Rosa M. Ros, NASE.

13:40 - 13:45 “Will we see the constellation of Orion without the star. Betelgeuse on December 12th?” Antoni Selva, Associació Astronómica de Sabadell, Sabadell, Spain.

13:45 – 14:00 “Searching for micrometeorites with students in Zhongguancun No.2 primary school students”, Geya Zhu, Zhongguancun No. 2 Primary School, Beijing, China.

14:00-14:15 “NASE project on Micrometeorites in Iran”, Fateme Hashemi Nasab, ITAU, Bushehr, Iran.

14:15-14:30 “City stardust: Comparison between two micrometeorites” Ambrozie Chis and Paula Chis, George Baritiu School, Cluj, Romania.

14:30-14:45 “Micrometeorites from the middle of the world in Latin America” Nicolas Vasquez, Escuela Politecnica Nacional, Quito, Ecuador.

14:45-15:00 “Observations of ablating micro-meteoroids using high-power and large-aperture radars” Qihou Zhou, Miami University, USA.

15:00-15:15 Summary of “Micrometeorites in Viladecans”, Visitors Teachers in Spain.

15:15 – 15:20 “The role of the municipality in the development of science”, Jordi Mazon, Viladecans Municipality.

15:20 – 15:30 Closing session Beatriz García, Rosa M. Ros, NASE.

This kind of meetings and the NASE courses promoted an important level of exchanges between the 73 NASE-countries (see Figure 3)

2.1.3. *NASE Publications*

During 2022 and 2023 NASE published the following texts:

- 3rd Bridgest Between Cultures: Looking for Micrometeorites, 2023.
- 2nd Bridges between Cultures: Latitude for Traveling and Navigate, 2022.

2.2. *UNAWE and the Pale Blue Dot*

Universe Awareness was one of the IAU2009 flagship proposals. Along the years, the activities evolved and the number of teachers and students using the UNAWE materials increased exponentially.

George Miley and the UNAWE group organized a pilot Carolina-Link PBD-UNAWE

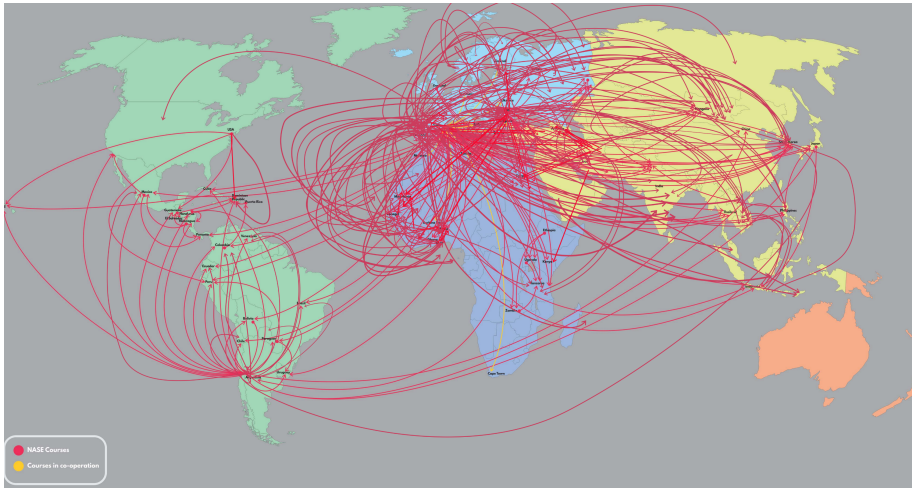


Figure 3. NASE Connections: relationship between trainers and countries.

event on 13 February in commemoration of Carolina Odman. The hope is that this program will eventually evolve into a "dating" site that will enable primary school teachers to link up with classes of similar-aged children over the world using the inspiration and perspective of the Universe to stimulate a sense of globalism at the age when value systems of children are developing and to encourage them to think about protecting our planet from the many threats that it faces. See the attached summary.

Of course, at the time of this report to the IAU as Key Initiatives WG, the activity will be done, but several essays were made in 2023. Some images of the online encounters can be appreciated in Figure 4 and Figure 5

The pilot C-Link Zoom between 5 classes in Armenia, Ethiopia, Ireland, Netherlands and Nigeria on February 13, with Kevin as master of ceremonies went off very well. The organizers are presently editing the video. It would have been difficult to have had more than 5 schools. The groups decided, if they can get some funding, that it would be really useful to to develop a sort of dating site in which primary school teachers can contact teachers in other countries and themselves arrange a Zoom link between their classes based on UNAWE themes. This would be accompanied by some possible material an "Ask the Astronomer" service in which astronomers (also PhD and postdocs) can volunteer to help. All in several languages.

The group is evaluating the idea about the need for a large-scale of action, world-wide, for PBD-UNAWE program (maybe via UNESCO) and that such a project could be offered to sponsors if the right approach was used. Probably a new chair to appoint a European Regional Office of Astronomy for Development, can continue with the proposal.

2.3. Galileo Teaching Training Program

The Galileo Teacher Training Program is a worldwide teacher training network born in the International Year of Astronomy 2009 (IYA2009) and remains a legacy of this initiative.

The GTTP has created a worldwide network of certified teachers, the Galileo Teachers



Figure 4. George Miley, Areg Mickaelian, Theofilus Pramono and Kevin Govender during a meeting with students.

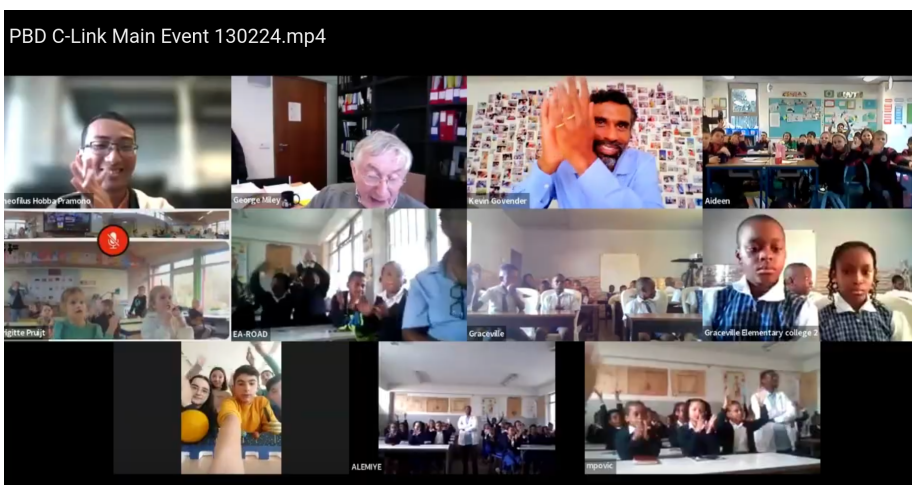


Figure 5. UNAWE meeting with students on the Planet.

(GT) and Galileo Ambassadors (GA), who are able to use astronomy education tools and resources in classroom science curricula and disseminate this knowledge among their peers (Figure 6).

In this network new tools and suggestions for deeper learning and innovation in education, are provided.

During this report's period (2022-2023), GTTP members organised several international teacher training events, reaching hundreds of teachers from over 50 different countries. The main events organized are listed below:

(a) Astronomy Education Adventure in the Canary Islands In 2022 and 2023, the 8th

and 9th editions of the Astronomy Education Adventure in the Canary Islands (AEACI) were organised in Tenerife (Spain). The 5-day course was hosted by the PeTER project at the Instituto de Astrofísica de Canarias (IAC) in partnership with NUCLIO (Por-

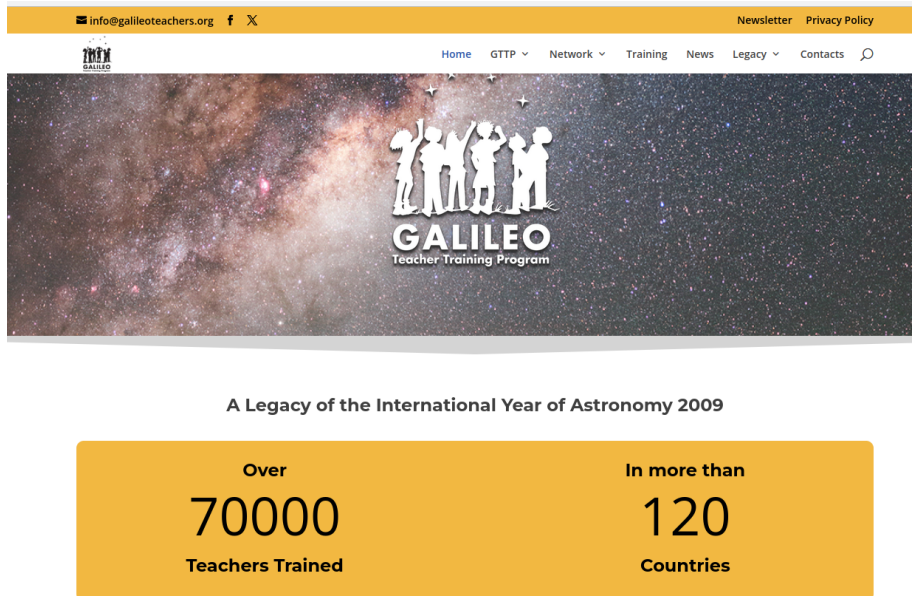


Figure 6. GTTP home website

tugal), Faulkes Telescope Project (United Kingdom), The Schools Observatory (United Kingdom), and the CESAR team from the European Space Agency Astronomy Centre (ESAC) (Spain).

The courses were offered in hybrid format, allowing participants from all continents to participate in most of the activities. The face-to-face activities were hosted at the IACTEC building (Figure 7) The program included 5 days of lectures, workshops, and visits to Teide and Roque de Los Muchachos observatories in the Canary Islands (Figure 8).

The 2022 edition counted with 20 on-site participants and 35 online attendees, while the 2023 edition was attended by 25 on-site and 40 online participants. In total, 120 teachers from 19 different countries were trained in these two events. Many lectures were recorded and are available online in the IAC YouTube channel.

Other links of interest include a picture gallery of the 2022 edition, and press releases reporting the results of AEACI 2022 and AEACI 2023.

(b) ESA/GTTP The 13th and 14th editions of the ESA/GTTP teacher training took

place in October 2022 and October 2023. The trainings were organized by CESAR (Cooperation through Education in Science and Astronomy Research), the resident educational team at ESAC, and NUCLIO (the coordinator of the Galileo Teacher Training Program), with the support of the team from the IAC (Instituto de Astrofísica de Canarias), the Faulkes Telescope Project and the National Schools' Observatory, and in partnership with the ESIA (European School Innovation Academy).

The 2022 training was held in online format only, while the 2023 edition was offered in hybrid format. In 2022, 96 teachers participated online, while in 2023 15 teachers participated on-site and 25 followed on-line (Figure 9).

In 2023, teachers on site had the chance to meet space experts and perform special visits to ESA space centres (ESAC and ESA's Cebreros tracking station) (Figure 10)



Figure 7. Participants of the 2023 edition of the AEACI in Tenerife, Spain.



Figure 8. Teachers visit the Teide Observatory in Tenerife during the AEACI 2023.



Figure 9. Teachers visit the ESA Astronomy Centre in Spain during ESA/GTTP 2023.

and to the Astrobiology Center (CSIC-INTA-Torrejn) together with an observing night in collaboration with the ESAC Astronomy Club. More information about the training sessions can be found at the CESAR website: [ESA/GTTP 2022](#) and [ESA/GTTP2023](#).



Figure 10. Group photo of ESA/GTTP 2023 participants.

(c) COSPAR Panel on Education A five day teacher training was organised during

the 2022 COSPAR Scientific Assembly in Athens, Greece, under the activities of the COSPAR Panel on Education. The training “Space Explorers in Schools - Empowering the Next Generation of Researchers” consisted in lectures and workshops by scientists and educators, and included a visit to the Athens Observatory (Figure 11). The training was attended by 25 teachers from 9 different countries (Figure 13). Teachers received financial support kindly provided by the COSPAR executive board. Training topics included Astronomy for Development, Solar System exploration, Robotic Telescopes, and Astrobiology.

More information about the training is available at this link.

(d) Global Hands-on Universe Conference The annual Global Hands-on Universe Con-

ference was held in virtual format in 2022 and in hybrid format in 2023 in Kagoshima, Japan. In 2022, the conference received over 500 registrations. The program covered 4 days of activities with workshops on astronomical resources developed by the Vera Rubin Observatory, use of robotic telescopes, astronomy mobile apps, Python programming, and exoplanets (Figure ??). The 2023 edition was attended by 200 participants from 50 different countries. The program covered 4 days of activities of lectures and workshops. Topics included asteroid search campaigns, exoplanets, use of robotic telescopes, and solar system exploration. More details about the conferences are available at the GHOU 2022 and GHOU 2023 websites.



Figure 11. Participants at COSPAR Panel on Education workshop 2022 visit the Athens Observatory.



Figure 12. Participants at COSPAR Panel on Education workshop 2022.



Figure 13. Participants of the Global Hands-on Universe Conference 2022.

2.4. *Eratosthenes Experiment*2.4.1. *Eratosthenes America*

The Eratosthenes Project in America is being performed since 2005 in different institutions with different sponsors, and from 2015 in agreement between the Physics Department, Exact and Natural Sciences Faculty, Buenos Aires University, the Argentinian Physical Association, the Pierre Auger Observatory, in Malargue, Argentina, and the National Technological University, Faculty Mendoza, Argentina.

The results in the last years were:

- Version 2023. Precession of the equinoxes, what does it mean?

Measurements were taken between 9/11/23 and 9/29/23 at solar noon (see Figures 17, 15, 16 and ??).

112 schools from Argentina, Brazil, Colombia, Spain, Italy, Romania y Uruguay.

$R = (6260 \pm 40)$ km.

More information in Eratosthenes 2023.



Figure 14. Eratosthenes: preparation of the experiment 1.

- Version 2022. International Year of Basic Sciences for Sustainable Development.

Measurements were taken between 9/12/22 and 9/30/22 at solar noon.

92 schools from Argentina, Brazil, Colombia, Spain, Honduras, Italy, Nicaragua, Paraguay, Peru, Romania y Uruguay.

$R = (6310 \pm 60)$ km.

For more information, visit the website for Eratosthenes 2022.



Figure 15. Eratosthenes: preparation of the experiment 2. Image by Armando Zandanel, Prociencia, Chivilcoy, Buenos Aires, Argentina

2.4.2. *Eratosthenes Greece*

Eratosthenes experiment: a 2252 year old inquiry based activity Students Measure the Size of the Earth”

On the 21st of March, 2023 from 12.00 AM to 01.30 PM Europe/Athens time (11.00 AM - 12.30 PM CET) students from Greece and South Africa joined forces to revive the Eratosthenes experiment, a 2252 year old inquiry based activity that bridges the wisdom of the past with the school of tomorrow. In this live event, students were guided step by step to Eratosthenes’s measurement using both simple materials and tools and collaborated to determine the circumference of the Earth using simple geometrical arguments. The event was flanked with observation of the Sun by means of solar telescopes from both hemispheres.

The event is organized by Ellinogermaniki Agogi and The University of the Free State in the framework of the international educational activity: “Eratosthenes Experiment”, under the auspices of the Greek Ministry of Education and Religious Affairs.

The event was broadcast live in the YouTube channel of Ellinogermaniki Agogi (Figures 18, 19).

2.5. *Globe at Night*

This Program Globe at Night, an international citizen-science campaign to raise public awareness of the impact of light pollution by inviting citizen-scientists to measure and submit their night sky brightness observations, is a consolidated project with a big number of volunteers on the planet; it was incorporated as part of the KI-WG at the end



Figure 16. Eratosthenes: performing the experiment in the school.

of 2023. 16 years of data can be inspected in their interactive data map. For the next campaign, the details are in Figure 20.

2.6. Report by Key Initiative WG members

- Reported by Idilio André Costa

I have been working, on the framework of the “Key Initiatives in Education, Outreach and Development”, within the NASE and the Pale Blue Dot. Nevertheless, for some time ago, I do not receive any feedback from Cecilia Scorza. In NASE I organized several

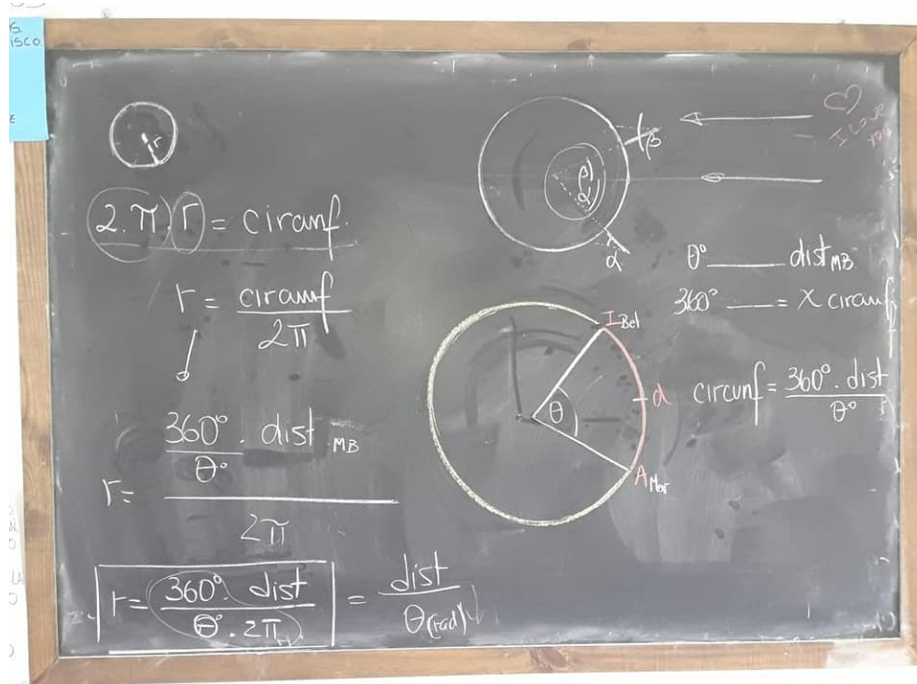


Figure 17. Eratosthenes: the theory. Image by the Professor Silvina Rojas from the EES N°6 Juana Azurduy, Moreno, Argentina

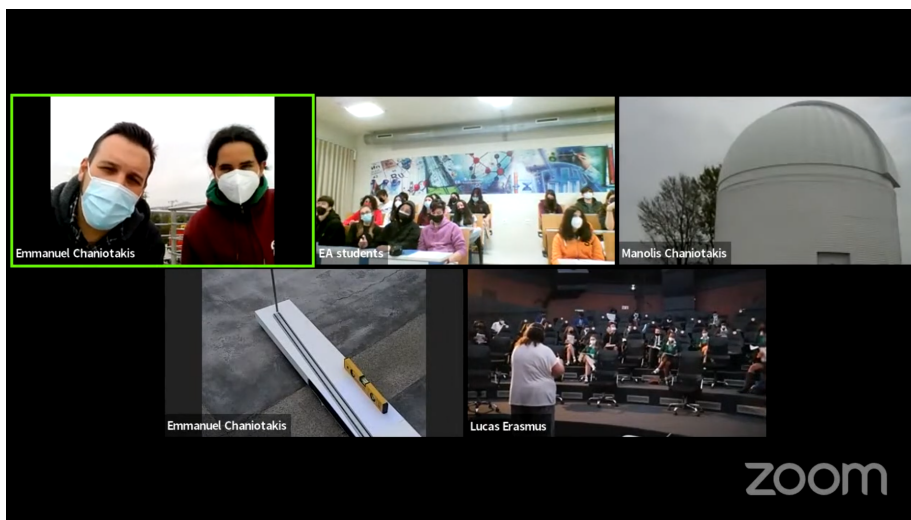


Figure 18. Eratosthenes Greece: Emmanuel Chaniotakis and colleagues in the 2023 live transmission, with students.

training courses. During 2023 I also dynamized, here in Portugal, the NASE activity (Project with UNESCO) “Latitude for travelling and navigate”.

As our WG is a functional WG: of course, we should continue.

I think that I will move from Junior Member to Individual Member. I already apply for it. My national representing organization (SPA) endorsed my application. So, I’m



Figure 19. Eratosthenes Greece: students with the Egypt map, during the live session in 2023.



Figure 20. Globe at Night 2024.

waiting for the IAU final decision. They said that may application will be reviewed by February 15th.

3. Conclusion and future plans

During its first two years, the KI-WG worked together the chairs of the different emblematic IAU programs, trying to distribute the information about each groups and

the news produced by them. A good relationship between WG members was reached and new challenges were concreted. In the coming period, the main objectives of the WG are devoted to maintain the visibility of the sub-programs, to identify new main projects on the planet and help the WG members with advise and resources, when it is needed.

The special structure of this WG will permit establish good relationships between the members, and also between the members and the IAU offices and other institutions.

Beatriz García
Chair of the KI-WG

Rosa M. Ros
Co-Chair of the KI-WG