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Executive Summary / Abstract:

This annual report provides a comprehensive overview of the activities performed within WP12 NA2 Coordination of Ground-based Observations over the fourth project year of Europlanet 2024 RI. These include, among others, the coordination of the Europlanet Telescope Network, collaboration with amateur astronomers, the organization of virtual and on-site events, and management and dissemination activities. It also gives an overview of the objectives and impact of NA2, as well as deviations from the original work plan due to the COVID-19 pandemic.

1 Explanation of work & Overview of progress

1.1 Deliverables

Deliverable number	Deliverable name	Lead participant	Dissemination level	Delivery date (month)	Status
D12.1	Observation Campaign Website and Observational Alert System	AMU	PU	12	Delivered on time
D12.2	NA2 Annual Report	IWF-OEAW	PU	24	Delivered on time
D12.3	NA2 Annual Report	IWF-OEAW	PU	36	Delivered on time

1.2 Milestones

Milestone number	Milestone name	Due date (month)	Means of verification	Status
MS9	Kick-Off Meeting of NA2	3	Meeting organized and held	Held as virtual meeting on March 30, 2020
MS10	Establishment of the Scientific Working Group	3	Scientific Working group Established	Established during kick-off meeting on March 30, 2020
MS13	NA2 Website and Observational Support Application Form	4	NA2 website and application form for observational support online.	Published online on June 01, 2020
MS14	Memorandum of Understanding	5	Set up to be signed by Europlanet 2024 RI and collaborating telescope facilities.	Finalized and sent to facilities in June 2020
MS20	Amateur Workshop Guidelines	8	Workshop Guidelines for the regional amateur trainings established	Finalized in September 2020
MS32	Year 1 Scientific Working Group (SWG) Telecons	12	4 SWG telecons held to decide on observational support applications.	Meeting to discuss review process on March 31, 2020; first review on November 27, 2020

MS33	Year 1 Amateur Training Workshops	12	At least one big amateur workshop held at Pic du Midi	Held as 3 virtual workshops at EPSC 2020 due to COVID-19
MS34	Year 1 Observational Workshops	12	Have been organized and held	Shifted to PM19 due to COVID-19
MS35	Year 1 Observational Support	12	Up to 50 observation nights agreed to be funded by the project	First observation nights taking place in January 2021
MS58	Year 2 Scientific Working Group (SWG) Telecons	24	SWG telecons held on average every two months depending on incoming proposals	Telecon on 30. Nov. 2021 on implementation of "fast-tracking" follow up observations.
MS59	Maintenance/further updates of the Observational Alert System, 1st iteration	24	Work in progress as scheduled	www.astro.amu.edu.pl/parsec
MS60	Year 2 Amateur Training Workshops	24	In progress – but only virtual (already held one virtual training workshop + 3 EPSCsplinter sessions)	http://mao.tfai.vu.lt/europlanet2022/ Online Workshop, Postponed to 9. – 11. 2. 2022
MS61	Year 2 Observational Workshops	24	Hybrid Workshop 16.- 27. 6. 2021	Europlanet Virtual Summer School on "Asteroid Photometry" at Moletai Observatory, Lithuania
MS62	Year 2 Observational Support	24	Up to 100 observation nights agreed to be funded by the project	60 observing nights granted under influence of pandemic.
MS92	Year 3 Scientific Working Group (SWG) Telecons	36	SWG telecons held depending on incoming proposals	Telecons: 23/03/2022 25/07/2022 11/11/2022
M93	Maintenance/further updates of the Observational Alert System, 2nd iteration	36	Work in progress as scheduled & 3 alerts issued via PVOL	New link to service: http://www.parsec-europlanet.eu/ We have developed the database for collecting observations from the Europlanet Telescope Network. A data service responsive to EPN-TAP/VESPA standard has been setup in Adam M Univ. It collects data from

				<p>the telescope network and can be queried through the VESPA portal and other interfaces. The PARSEC service was invited to the 3rd VESPA workshop (May 2023).</p> <p>Alerts regarding planetary observations issued via the PVOL system: https://pvol2.ehu.eus/ Six alerts were announced in 2023. Alerts on occultation will be available through VESPA services in 2024 (satellites being published, then LuckyStar data base).</p>
MS94	Year 3 Amateur Training Workshops	36	2 training workshops held as scheduled	<ul style="list-style-type: none"> - Europlanet Telescope Network Science Workshop, Feb 9-11, 2022 (online) - Europlanet Pro-Am Comet Community (Hybrid) Workshop, June 10-12, 2022 (hybrid - Prague & online) -> also hybrid between training workshop and science workshop
MS95	Year 3 Observational Workshops	36	3 science workshops held & 2 pro-am science workshops at EPSC 2022	<p>Workshops held:</p> <ul style="list-style-type: none"> - 2 fireball workshops (Feb 4-5, 2022 & Aug 14-15, 2022) - Europlanet Pro-Am Comet Community (Hybrid) Workshop, June 10-12, 2022 (hybrid - Prague & online) -> also hybrid between training workshop and science workshop <p>Pro-am science workshops at EPSC 2023:</p> <ul style="list-style-type: none"> - Exoclock and Amateur Astronomy contribution Exoplanet Science; - Amateur Observations of Outer planets: Juno and James Webb support
MS96	Year 3 Observational Support	36	Support of observational proposals at Europlanet Telescope Network	Out of 14 observation requests 10 were granted in the reporting period, i.e., 124 nights were requested and 66 were granted. An additional 7 nights were granted for free at Moletai observatory
MS114	Year 4 Scientific Working Group Telecons	48	SWG telecons held depending on incoming proposals	<p>Telecons:</p> <p>02/02/2023 22/03/2023 06/07/2023 16/11/2023</p>

MS115	Maintenance/further updates of the Observational Alert System	48	Regular alerts issued via PVOL and Gaia-GOSA	Planetary related alerts on PVOL on Year 4: 5. (1) Venus and asteroid 20221PH27; (2) Jupiter impact on 28 Aug. 2023; (3) The New Horizons Uranus/Neptune Observation Campaign; (4) Call for Jupiter hi-res observations from the Juno mission; (5) Jupiter impact on 15 Nov. 2023.
MS116	Year 4 Amateur Training Workshop	48	Goal in the proposal: At least 2 regional training workshops held.	Europlanet Pro-Am Training Workshop, 2-5 June 2023 at Calar Alto Observatory (Spain, about 16 on-site participants) and Europlanet Pro-Am Training Workshop "Asteroid Research Training Workshop" on 21-25 August 2023 at the Tartu Observatory (Estonia). 4 th Fireball workshop 12–13 May 2023
MS117	Year 4 Observational Support	48	The aim was 200 nights in total over the 4 years of the project to be granted.	209,5 observing nights granted from 289,5 requested. For 9 (1 Pro, 4 Amateurs, 4 Early career) proposals received just before the end of deadline 31. 12. 2023, evaluation pending

1.3 Objectives

1.3.1 Task 12.1: Management of the Work Package

Task 12.1, managed by a core team led by IWF-OEAW, supported by the deputy UoE and advised by the task leaders and its deputies, coordinates and manages NA2. The core team aims to also work closely with NA1 and to exploit the Europlanet Society's Regional Hubs to distribute information on observational campaigns and training events to the wider planetary science community and to bring in new participants.

In this project year, the overall objectives of this task are

- Overall coordination of the WP and support of all NA2 tasks
- Distributing and disseminating the campaigns, events, and results of NA2
- Maintaining or updating the NA2 website as required as part of the general Europlanet website together with Tasks 12.2 and 12.4
- Preparing the NA2 Annual Report (D12.3).

1.3.2 Task 12.2: Coordination of Observations

This task, led by UoE and supported by AMU, IWF-OEAW, UPV/EHU, VU and OBSPARIS, is organising the cooperation of a network of small telescopes (i.e. the so-called Europlanet Telescope Network) to facilitate and coordinate observation campaigns related to different planetary science topics. It has established a Scientific Working Group (SWG), thereafter called 'Science Advisory Panel' (SAP), including science experts of different research topics. The SAP plays a key role in developing the network of telescope facilities and in supporting and coordinating planetary observation campaigns. The SAP is also reviewing applications for observational support. In addition, Task 12.2, led by AMU, will develop a generalized alert system for observations, which will notify and allow participating observatories to select

appropriate targets across the diverse range of planetary science topics listed above. A dedicated website has been created, gathering easy-to-find information about the observation campaigns and links to the tools for observation planning (first prototype online as of project month 12).

In the fourth project year, the overall objectives of this task are:

- SAP reviewing incoming application forms for the telescope network (MS114)
- Maintenance/further updates of the Observational Alert System (MS115)
- Organising of Amateur Training Workshops (MS116)
- To provide the observational support (MS117).

1.3.3 Task 12.3: Amateur Education & Training

This task, led by IWF-OEAW and supported by UPV/EHU and OBSPARIS, exploits the amateur community's potential to support planetary science i) by streamlining workflows and cooperation with professional scientists, and ii) by reaching out to the diverse regional communities within Europe and beyond. The main objective of this task is the organisation of dedicated training and education workshops for amateurs. This will include workshops that will be held in the different Europlanet Society Regional Hubs to engage the different local communities. To assure quality, standardised workshop guidelines and tutorials will be developed in the project.

In this project year, the overall objectives of this task are:

- Organisation of two amateur training workshops (MS116)
We held a training workshop at Calar Alto Observatory on 2-5 June 2023 at Calar Alto Observatory (Spain) with 16 participants and 3 nights of practical observations. Participants also learnt about the Europlanet Telescope Network and how to access the telescopes through the project.
- Supporting amateur observations in planetary sciences.
Year 4 of the project counted with several granted proposals for observations using the Europlanet Telescope Network coming from amateur astronomers.

1.3.4 Task 12.4: Ground-based Observations Support

This task, led by VU and supported by IWF-OEAW, UPV/EHU, UoE and OBSPARIS, supports coordinated planetary observation campaigns by (i) supporting scientists and trained amateurs to observe using the telescope network set up in Task 12.2, (ii) the support of professional telescope facilities to observe in dedicated observation campaigns and (iii) the support of workshops for the organisation of coordinated observation campaigns. Task 12.4 (together with Task 12.2) has set up a simple application form to the telescope network and the SAP will recommend which applications to fund. Observational data that will be produced during supported campaigns will be made publicly available, ideally through the Virtual Observatory of VESPA. A Memorandum of Understanding (MoU) was set up to facilitate the collaboration between Europlanet 2024 RI and the telescope facilities.

In this project year, the overall objectives of this task are:

- Supporting researchers and amateurs to observe at the telescope network (MS117)
- Organisation of an Observational Workshop.

Due to the Russian invasion of Ukraine, we have lost contact with the Ukrainian telescope sites.

1.4 Explanation of the work carried out per WP

1.4.1 Task 12.1: Management of the Work Package

The management structure of NA2 was established at the beginning of the project with IWF-OEAW (Günter Kargl and Manuel Scherf [until 30. 9. 2023]) leading the project and UoE (Colin Snodgrass) as deputy. The core team of NA2 is further supported by all other beneficiaries within NA2, i.e., UPV/EHU (Ricardo Hueso and Itziar Garate-Lopez), AMU (Edyta Podlewska-Gaca and Emil Wilawer), VU (Gražina Tautvaišienė and Sarunas Mikolaitis), and OBSPARIS (Francois Colas).

NA2 website (part of MS13)

The website of NA2 (<https://www.europlanet-society.org/europlanet-2024-ri/telescope-network/>), as part of the main Europlanet website, was prepared and put online on June 1, 2020, together with the NA2 Call for Observations (MS4, <https://bit.ly/EPNObservationCall>). The website is continuously updated to disseminate the information provided by NA2. It lists all workshops organised by NA2 and all proposals that were granted to observe in the Europlanet Telescope Network.

Support and communication within NA2

Task 12.1 further coordinated the communication and collaboration between the different tasks of NA2 and with Europlanet 2024 RI. NA2 telecons combining all tasks and beneficiaries took place on a bi-monthly basis. In addition, further online meetings were regularly organized to discuss amateur workshops and proposals to the NA2 Call for observations and other NA2 related issues.

For dissemination activities see Section 2.

1.4.2 Task 12.2: Coordination of Observations

The main objective of this task was the establishment of a network of telescopes providing their facilities for observations to the planetary science community. This network, named Europlanet Telescope Network, was established over the first months of the project and officially kicked off with the start of the so-called NA2 Call for Observations on June 1 2020 at <https://bit.ly/EPNObservationCall>. Through this open call, observers – professionals and amateurs – can apply to observe at the facilities in the network (see Task 12.4 for a full description of the application form and procedure). The Europlanet Telescope Network initially contained 15 different facilities from Europe and beyond and was, by now, extended to 18 observatories by the end of 2023.

The Ussuriysk telescope in Russia was permanently suspended due to imposed EU sanctions and the contact to the three Ukrainian telescopes was lost due to the war.

The current facilities in the network are:

- **Pic du Midi Observatory**, France, 1.06 m
- **Moletai Astronomical Observatory**, Lithuania, 1.65 m and 35/51 cm
- **Kryoneri Observatory**, Greece, 1.2 m

- **Skalnate Pleso Observatory**, Slovakia, 1.3 m and 61 cm
- **Faulkes Telescope Project**, worldwide, two 2 m, nine 1 m, and ten 40 cm robotic
- **Tartu Observatory**, Estonia, 1.5 m and 60 cm, and 30 cm robotic
- **Danish Telescope at La Silla Observatory**, Chile, 1.54 m
- **Beacon Observatory**, UK, 42 cm
- **Observatorio del Teide**, Spain, 82 cm and 45 cm
- **Calar Alto Observatory**, Spain, 1.23 m
- **Konkoly Observatory**, Hungary, 1 m and 80 cm
- **Rozhen Observatory**, Bulgaria, 2 m, 60 cm and 50/70 cm
- **Observatorio Astrofísico de Javalambre**, Spain, 80 cm
- **Observatori del Montsec**, Spain, 80 cm **(NEW)**

Facilities that are affected by the Russian-Ukrainian war:

- **Lisnyky Observation Station**, Ukraine, 70 cm **Currently not available**
- **Chuguev Observatory**, Ukraine, 70 cm **Currently not available**
- **Terskol Peak Observatory**, Ukraine, 2 m and 60 cm **Currently not available**
- **Ussuriysk Astrophysical Observatory**, Russia, 25 cm and 50 cm **Observatory removed from Europlanet because of EU sanctions imposed on Russia.**

Out of the remaining 13 facilities, 6 are in under-represented countries. Further details on the different observatories, including their equipment, costs, and nights/hours provided to Europlanet 2024 RI can be found on the NA2 Call for Observations website (<https://bit.ly/EPNObservationCall>) and, particularly, in a comprehensive telescope summary table (https://bit.ly/EPN_2024RI_Telescope_Network_list) that was worked out by Task 12.4 in collaboration with the different facilities. A graphical visualisation of the location can be found at https://bit.ly/EPN-2024RI_Telescopes.

To counteract travel restrictions in view of COVID-19, most of the observatories can provide remote observations, i.e., the observer does not necessarily have to physically go to these facilities. As it turns out even after the lifting of the travel restrictions, we still receive proposals where remote observations were requested instead of physical travel.

Observatories

- Pic du Midi
- Molėtai Astronomical Observatory
- Calar Alto Observatory
- Krionery Observatory, Greece
- Teide Observatory (IAC80 & Faulkes Telescope...
- Skalnaté Pleso Observatory
- Rozhen Observatory, Bulgaria
- Beacon Observatory
- Danish 1.54m at La Silla, Chile
- Terskol Peak Observatory
- Konkoly Thege Miklos Astronomical Institute
- Kharkiv Observatory
- Tartu Observatory
- Taras Shevchenko National University of Kyiv
- Observatorio Astronómico Nacional de Rozhen
- Faulkes Telescope Network - Las Cumbres Obs...
- Faulkes Telescope Network - Las Cumbres Obs...
- Faulkes Telescope Project - Las Cumbres Obse...
- Faulkes Telescope Project - Las Cumbres Obse...
- Faulkes Telescope Project - Las Cumbres Obse...
- Faulkes Telescope Project - Las Cumbres Obse...
- Observatorio Astrofísico de Javalambre
- Observatori del Montsec

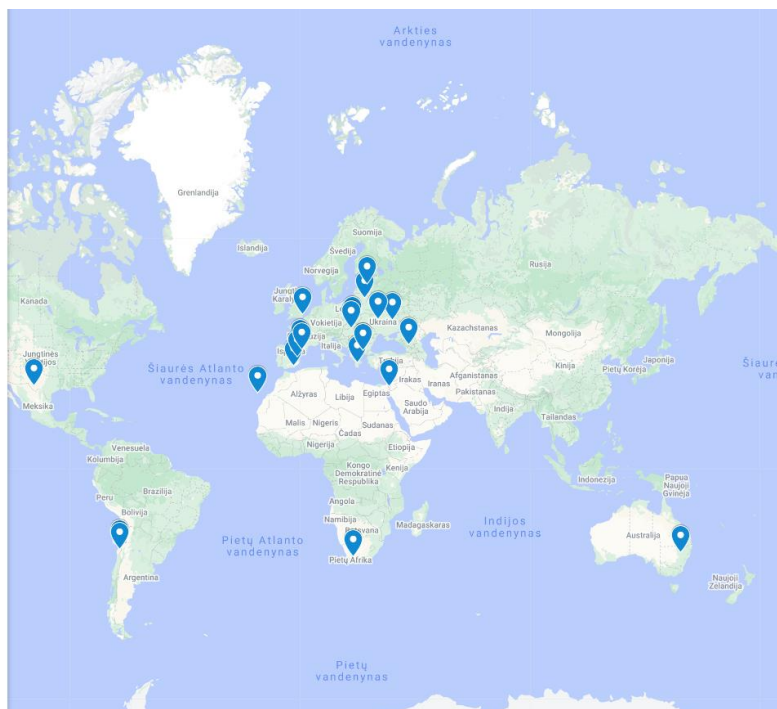


Figure 1. Location of the different facilities within the Europlanet Telescope Network.

Science Advisory Panel:

- **Head:** Colin Snodgrass, UoE, UK (Co-PI of Comet Interceptor)
- **Deputy:** Alessandra Migliorini, INAF, Italy (Deputy)
- **Fireballs** (including Lunar Impact Flashes and Jovian fireballs): Detlef Koschny, ESA, The Netherlands
- **Stellar Occultation:** Josselin Desmars, OBSPARIS, France
- **Planetary Observations** (in support of upcoming missions such as Juno, BepiColombo, JUICE): Ricardo Hueso, UPV/EHU, Spain
- **Asteroid Light Curves** (including NEOS): Anna Marciniak, AMU, Poland
- **Comets** (upcoming mission Comet Interceptor): Oleksandra Ivanova, Astronomical Institute SAS, Slovakia
- **Exoplanets** (CHEOPS and upcoming missions such as PLATO, Ariel): Monika Lendl, Univ. Geneva, Switzerland

The SAP meets on a roughly bi-monthly basis depending on the incoming observation proposals to discuss, review and rate incoming applications.

Maintenance and update of the observational campaign website and observational alert system (M115)

The aim of this subtask, led by AMU, is to develop a generalized alert system for observations, which will notify and allow participating observatories to select appropriate targets across a diverse range of planetary science topics. This provides both regular monitoring of targets and alerts for events requiring time-critical and/or spatially distributed observations (e.g., stellar occultation by asteroids). The service is based on the existing alert system software created to coordinate amateur observations of asteroids in support of the ESA Gaia mission (Gaia-

GOSA, www.gaiagosa.eu) which currently provides targets for asteroid light curve observations based on the observer's location and the available targets at the time. Targets of interest of the new service will involve atmospheres of the giant planets (like convective storms or planetary disturbances), Mars and Venus observations, and ephemeris for their observation, asteroids, comets, exoplanets and other targets for which observations are needed.

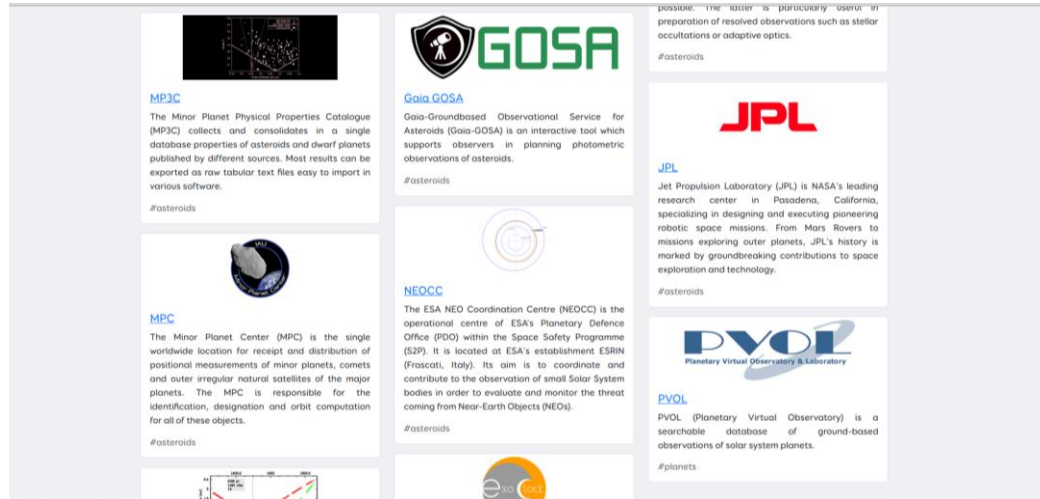


Figure 2. A PARSEC-Alert System webpage with links to the services related to planetary sciences.

The service was finished by the end of 2023 and can be found online at a new dedicated webpage <http://www.parsec-europlanet.eu/>; internal tests of the service have started. For further information on the service, check the presentation at <https://bit.ly/3luMUuN> and the report on D12.1.

Moreover, we have developed a database for collecting observations from the Europlanet Telescope Network. The database is connected to VESPA, where the data becomes available after one year of embargo. Such a solution is more convenient for users who don't have to learn how to transfer data to VESPA; they simply upload the data to our database.

Five alerts were issued via the PVOL system in year 4. These are:

- 2023-05-17- Venus and Asteroid 2021PH27 (close encounter with a potential cometary-like active asteroid with Venus on June 7, 2023).
- 2023-08-29 – New impact flash in Jupiter discovered on August 28, 2023.
- 2023-09-18 – The New Horizons Uranus/Neptune Observation Campaign.
- 2023-11-04 – Juno call for Jupiter high-resolution observations in November 2023.
- 2023-11-16 – New impact flash in Jupiter discovered on November 15, 2023.

There were much more observational alerts on the dedicated services that are linked to PARSEC-Alert System (e.g. ExoClock, PVOL, GaiaGOSA).

On GaiaGOSA we have 190 registered users, and we have received 68 nights of observations last year. In total we have more than 1000 nights of observations. Basing on the predictions of Gaia mission transits for the Solar System objects, new alerts are constantly updated.

1.4.3 Task 12.3: Amateur Education & Training

During year 4 the following regional amateur training workshops were organized:

Meeting Title: Europlanet Pro-Am Training Workshop on Calar Alto, Almería, Spain
 Website: http://www.ajax.ehu.es/CalarAlto_Europlanet_Workshop/
 Meeting Date: June 2-5, 2023
 Meeting Location: Calar Alto Observatory, Almería, Spain (In presence only)
 Audience(s): Amateur astronomers
 Total Number of Attendees: 16 (including 2 organizers)
 Number of Female Attendees: 8
 Number of Early Career Attendees: 1.

DPS-EPSC joint meeting in 2023: Given that the EPSC meeting was held as a joint meeting with the DPS in San Antonio, Texas and the high costs to organize activities in this meeting, no activity was organized this year through NA2. Amateur astronomy-related workshops similar to those generally organized during EPSC meetings were organized during the ERIM meeting in Bratislava.

ERIM meeting

The 2023 meeting in Bratislava was held as a hybrid conference. Several hybrid sessions were organized by NA2.

The statistics of these sessions are:

Meeting Title: Europlanet Telescope Network: Solar System Planets
 Meeting Date: June 19, 2023 (1h30 min)
 Meeting Location: In presence & Online
 Audience(s): Scientists, amateur astronomers and citizen scientists.
 Total Number of Attendees: 25 on site plus 12 online.
 Speakers: 5 (1 Female, 3 amateur)
 Session video available on <https://www.youtube.com/watch?v=P6M9T9vPuTs>

Meeting Title: Europlanet Telescope Network: Exoplanets
 Meeting Date: June 20, 2023 (1h30 min)
 Meeting Location: In presence & Online
 Audience(s): Scientists, amateur astronomers and citizen scientists.
 Total Number of Attendees: 30 on site plus 35 online.
 Speakers: 6 (3 Female, 1 amateur)
 Session video available on <https://www.youtube.com/watch?v=-5VTakBbs4I>

Meeting Title: Europlanet Telescope Network: Minor Solar System Bodies
 Meeting Date: June 21, 2023 (1h30 min)
 Meeting Location: In presence & Online
 Audience(s): Scientists, amateur astronomers and citizen scientists.
 Total Number of Attendees: 25 on site plus 35 online.
 Speakers: 6 (2 Female)
 Session video available on https://www.youtube.com/watch?v=x_PSuyAaOcg

In addition, NA2 collaborated with the ExoClock project linked with the Ariel mission (ESA) to organize two ExoClock amateur astronomy sessions during ERIM.

The observational workshops are described in Section 1.4.4. A list of workshops can be found in Annex 2.

1.4.4 Task 12.4: Ground-based Observations Support

After the lifting of COVID travel restrictions, we still receive a significant number of proposals requesting remote observations. It is likely that this trend will continue and has to be seen positively in light of a still-existing COVID risk and vastly increased transport costs and the environmental impact. So far, we had a request for 335,5 observation nights, out of which 209,5 have been granted and 9 more applications are under review – this is even more than it was initially planned in the project.

Europlanet Observational Workshops

In collaboration with Task 12.3 (Amateur Education and Training) and WP11, Task 4 (Support of Ground-based Observations) has organised the Europlanet Summer School “**Space missions: ground-based observations and science communication**”. It was held at the Moletai Astronomical Observatory on 8-18 August, 2023, <http://mao.tfai.vu.lt/europlanet2023>.

21 on-site and 47 online participants from 20 countries were trained by 11 lecturers and instructors. The aim of the course was to give participants a thorough, multidisciplinary introduction into space missions and the ground-based observations required by space missions before and after launch, as well as an introduction to science communication. More general subjects about specific space missions (TESS, JWST, PLATO...), planetary systems, habitability of planets, photometric and spectroscopic techniques were presented. Participants had hands-on experience with analysis of stellar chemical composition, detection of stellar variability and/or exoplanets.



Participants of the Europlanet Summer School “Space missions: ground-based observations and science communication” at the Moletai Astronomical Observatory, Lithuania, 2023.

In collaboration with Task 12.3 (Amateur Education and Training), Task 4 (Support of Ground-based Observations) has organised the Europlanet Observational Workshop “Asteroid Research” at the Tartu Astronomical Observatory in Estonia. The workshop was held on 21-25 August 2023, <https://asteroids2023.ut.ee>. 19 on-site and 23 online participants were trained by 13 lecturers and instructors. The aim of the workshop was to give an introduction to the ground-based and space observations of asteroids. Participants had hands-on experience in CCD photometry and spectroscopy of asteroids using three telescopes and in analysing the observational data. The participants were trained in writing and submitting observing proposals and mentorship possibilities between professional astronomers and amateurs were presented.



Participants of the Europlanet Observational Workshop “Asteroid Research” at the Tartu Observatory, Estonia, 2023.

During the fourth year the Task 4 team has participated in many astronomy conferences and presented the Europlanet Telescope Network:

Europlanet Research Infrastructure Meeting (ERIM). 19-21 June, 2023. Contributed talk: Europlanet Telescope Network for exoplanetary research;

European Astronomical Society Annual Meeting. 10 July – 14 July, 2023. Development & Outreach - SS38: European Forum of Astronomical Communities. Invited talk: Opportunities within the Europlanet 2024 Research Infrastructure Project;

Asteroid Research Training Workshop (Hybrid), 21-25 August 2023, Tartu Observatory, Estonia. Contributed talk: Europlanet 2024 Infrastructure Project;






Opticon Radionet Pilot Consortium meeting. 21-23 November, 2023. Invited talk: Opportunities within the Europlanet 2024 Research Infrastructure Project.

Europlanet Workshops on Fireball observations

In 2023 one more workshop on Fireball observations was held in online form.

The fourth and final workshop of the series was held from 12–13 May 2023 in an online format since this was more suitable for the international community. The topics were centered on fireball observations and in particular Lunar impact flashes. There was a total of 65 people registered for the event with a varying presence during the workshop due to the global audience and thus many different time zones. As a result of the Fireball workshop series a new common data format was developed by the community which will allow a rapid exchange of observation data between the camera networks and thus will enable a much better reconstruction of the actual flight path of a fireball. At the time of the workshop, a large number of camera networks had already implemented the new common data format which was fostered during these workshops. A couple of other networks have at least a reading capability for this data format but have not yet implemented a data export functionality.

Implementation of the Global Fireball Exchange (GFE) format

Winchcombe Image	Network	Can read GFE?	Can write GFE?	Status
	Desert Fireball Network	Yes	Compatible but not yet identical	Will be fully implemented as native format by Q1 2022
	Global Meteor Network	Yes	Yes	Done. The GFE (aka "ECSV") file is now the GMN internal format
	FRIPON	Not yet	Not yet	Will implement (TBC). Jupyter converter used now
	AllSkyCams	Yes	Planned	Implementation had been planned for 2021
	MetRec	N/A	Yes	Writing completed. MetRec does not read fireball data.
	UFO	No	No	Coded in UFOAnalyzer but not released, no release imminent
	CAMS	No	No	Will implement if standard read and write "C" functions provided
	NASA, Czech, Polish, Finnish, Spanish networks			Not yet approached

1.5 Impact

The Europlanet Telescope Network, which was established during the first project year, is the first network of its kind worldwide that combines a diverse set of small-scale observational facilities in Europe and beyond. Besides space missions, and the well-known big ground-based observatories, relatively small telescopes cover a niche that is, more than ever, particularly important for planetary sciences and for the characterization of exoplanets. Studying planets, asteroids or comets can require either long-term monitoring or precise timing and collaboration between facilities in different locations around the Earth. A network of small telescope facilities, but also the amateur community, achieve these requirements but can also react relatively fast. All these characteristics provide a unique opportunity that can be covered by the Europlanet Telescope Network.

In 2023 EPSC was held as a joint conference with the US DPS meeting in San Antonio, Texas. Thus, no Europlanet NA2-related splinter meetings could be organised. Instead, a series of telescope network and amateur training workshops was held during the ERIM meeting in June 2023.

Since the beginning of the telescope network there is a clear indication that we have attracted many observation applications from amateurs who want to support community-based observations such as the Ariel mission's ExoClock. From the 50 proposals submitted to the telescope network so far, 23 were led by amateur astronomers, out of which 17 were finally granted and 4 more still pending decision by the SAP (including proposals for the observation of exoplanet transits that feed into ExoClock).

Besides amateur astronomers, NA2 also tried to draw in early career scientists, females and researchers from under-represented states in collaboration with NA1 and the Europlanet Society Regional Hubs, particularly with the Central European Hub. This effort resulted in 12 proposals, as of December 2023. Out of 52 proposals in total submitted to the NA2 Call for Observations there were 24 being led by women.

A major outcome was the initialisation of a common data format which most European meteor networks agreed to implement as part of their observation results. Thus, the exchange of observation data is much easier and thus the finding of freshly fallen meteors facilitated.

Due to the lower cost of virtual workshops in total a larger number of workshops was possible. However, the available workshop budget was exhausted already in fall 2023.

In 2023 we had a total of 16 peer reviewed publications credited to the telescope network.

1.6 Access provisions to Research Infrastructures (if applicable)

Access provision to the Research Infrastructure within NA2 is provided through the telescope facilities in the Europlanet Telescope Network, for which the service costs for observations of successful applicants are reimbursed. An overview of granted observations at these facilities is summarized in the table in Annex I.

2 Update of exploitation & dissemination plan

Since the EPSC 2023 was held as a joint meeting with DPS in San Antonio, Texas, no Europlanet NA2 sessions were held. Instead, a couple of workshops were organised during the Europlanet Research Infrastructure (ERIM) 2023 meeting in Bratislava, Slovakia.

3 Update of Data Management Plan

NA2 contributed to the general Data Management Plan (DMP) of Europlanet 2024-RI (D1.3); at the current stage of the project no update to the DMP is needed from the side of NA2.

4 Deviations from Annex 1 (DoA)

4.1 Tasks

Because of the war in Ukraine, four telescopes of the network (3 Ukraine, 1 Russian) are not available for the moment, and it is unlikely that they will become available again during the remainder of the project.

Because of COVID-19, activities related to the Europlanet Telescope Network have been delayed due to difficulties accessing the sites, however during the post-pandemic years the deviations have been overcome. By now most observatories can provide remote or service observations. As it turned out even, after the lifting of travel restrictions we still received a significant number of proposals requesting remote observations. It is likely that this trend will continue and has to be seen positively in light of a still existing COVID risk and vastly increased transport costs and the environmental impact. So far, we had a request for 335,5 observation nights, out of which 209,5 have been granted. This is even more than were initially planned. Right at the end of the deadline for the observation call we received another nine applications with a majority of amateur and early career scientists (4 Am, 4 Early career, 1 Pro) where the approval is still pending at the time of this report.

4.2 Use of Resources

As mentioned in the previous section, costs for face-to-face workshops could not be used in project years 1 and 2. All these workshops were held later in the project or were replaced with more online workshops which are less costly. During the end of the third year more requests and proposals for workshops were received. The budget reserved for workshops will be used up until the end of the project. It should be noted that, due to the organising of virtual workshops, the actual number of held workshops was larger than would have otherwise been possible with face-to-face workshops only.

5 Annex 1 – Proposals submitted to the NA2 Call for Observations

Observation proposals

Nr.	Title	Category	Country	Gender	Career status	Facility	nights/ hours	Funded
#01	Reducing the selection effects in asteroid spins, shapes, and thermal parameters	asteroids	Poland	female	senior researcher	Moletai Astronomical Observatory	7 nights	yes
#02	Characterization of V-type asteroids outside the dynamical Vesta family	asteroids	Poland	female	senior researcher	Chuguev Observatory	8 nights	yes
#03	Precise asteroid volumes from Gaia and ground-based observations I	asteroids	Poland	female	post-doc	Tartu Observatory	6 nights	yes
#04	Precise asteroid volumes from Gaia and ground-based observations II	asteroids	Poland	female	post-doc	Observatorio del Teide	5 nights	yes
#05	High-precision photometry of known exoplanets and planetary candidates	exoplanets	Russia	male	senior researcher	Moletai Astronomical Observatory	14 nights	no
#06	Variable Nebulae: Understanding the protostar environment	other/astronomy	UK	male	amateur	Beacon Observatory	39 hours	yes
#07	Project Near Super Earth	exoplanets	Spain	male	senior researcher	LCO	39 hours	no
#08	Photometric follow-up observations of transiting extrasolar planets and related science	exoplanets	Poland	male	senior researcher	1.5m Danish Telescope	14 nights	yes
#09	High-resolution spectroscopic follow-up of known exoplanet-hosts and candidates	exoplanets	Poland	female	Senior researcher	Moletai Astronomical Observatory	7 nights	yes
#10	Observation of Corot-10b and WASP-156b exoplanet transits to help preparing Ariel mission	exoplanets	Spain	female	amateur	Observatorio del Teide	1 night	yes
#12	Photometric follow-up observations of transiting extrasolar planets and related science.	exoplanets	poland	male	Senior researcher	La Silla, Chile	14	yes
#13	High-resolution spectroscopic follow-up of known exoplanet-hosts and candidates: star-planet connection	exoplanets	Lithuania	male	Post-doc	Moletai Astronomical Observatory	10	yes
#14	Revisiting past binary and planetary microlensing events to resolve microlensing degeneracy	exoplanets	Iran	female	Senior researcher	La Silla, Chile	14	Yes, without travel cost

#15	ROBOTIC RECONNAISSANCE OF DIPPING DOUBLES (R2-D2)	exoplanets	UK	female	Senior researcher	La Silla, Chile	14	No
#16	Rotational lightcurves, absolute magnitudes, and accurate astrometry of selected occultation-relevant trans-Neptunian objects.	Trans Neptunian objects	Spain	male	Student	La Silla, Chile	8	yes
#17	A New Look at the Sodium Nebula Surrounding the Jupiter System	Jupiter	Cyprus	male	amateur	Pic Du Midi		Proposal withdrawn after request for revision
#18	OBSERVATION OF WASP-186b EXOPLANET TRANSITS TO HELP PREPARING ARIEL MISSION	exoplanets	Spain	female	amateur	Teide Observatory	2	yes
#19	OBSERVATION OF WASP-148b EXOPLANET TRANSITS TO HELP PREPARING ARIEL MISSION	exoplanets	Spain	Male	amateur	Teide Observatory	1	yes
#20	Eclipsing binary stars as an extra tool in asteroseismology	exoplanets	Lithuania	Female	Senior researcher	Moletai Astronomical Observatory	8	yes
#21	Polish-Lithuanian Black Hole hunt	Black holes	Lithuania	male	Senior researcher	Moletai Astronomical Observatory	12	yes
#22	OBSERVATION OF MASCARA-1b EXOPLANET TRANSITS TO HELP PREPARING ARIEL MISSION	exoplanets	Spain	male	amateur	Teide Observatory	2	yes
#23	OBSERVATION OF WASP-59b EXOPLANET TRANSIT TO HELP PREPARING ARIEL MISSION	Exoplanets	Spain	Female	Amateur	Teide Observatory	1	yes
#24	Asteroseismology of variable white dwarf star PG2303+243	White dwarf stars	Lithuania	Female	Student	Moletai Astronomical Observatory	7	yes
#25	ExoClock photometric follow-up of confirmed transiting exoplanets	exoplanets	Brazil	Male	Amateur	Moletai Astronomical Observatory	10	yes
#26	Photometric follow-up observations of transiting extrasolar planets and related science using DFOSC and TCI instruments	exoplanets	Poland	Male	Senior researcher	La Silla, Chile	14	no
#27	OBSERVATION OF HAT-P-64B & HATS-18B EXOPLANET TRANSITS IN PREPARATION OF THE ARIEL MISSION	exoplanets	UK	Male	Student	Teide Observatory	1	no
#28	OBSERVATION OF GAIA-2b EXOPLANET TRANSIT TO HELP PREPARING ARIEL	exoplanets	Spain	Female	Amateur	Teide Observatory	1	yes
#29	OBSERVATION OF EXOPLANETS TRANSITS: WASP-157b TO HELP PREPARING ARIEL MISSION AND WD 1145+017b, FIRST OBJECT ORBITING A WHITE DWARF	exoplanets	Spain	Male	Amateur	Teide Observatory	1	yes
#30	OBSERVATION OF EXOPLANETS TRANSITS: TOI 1272b TO HELP PREPARING ARIEL	exoplanets	Spain	Female	Amateur	Teide Observatory	1	yes
#31	ROBOTIC RECONNAISSANCE OF DIPPING DOUBLES	exoplanets	UK	Female	Senior researcher	La Silla, Chile	14	yes

	(R2-D2)							
#32	Lucky Imaging detection of archival microlensing planets and binary	exoplanets	Italy	Male	Student	La Silla, Chile	12	yes
#33	High-resolution spectroscopic follow-up of known exoplanet-hosts and candidates: star-planet connection	exoplanets	Lithuania	Female	Senior researcher	Moletai Astronomical Observatory	15	yes
#34	Determination of the synodic rotation period of member/s pertaining to the Koronis Asteroid Family	exoplanets	Malta	Male	Amateur	Teide Observatory	3	yes
#35	ExoClock photometric follow-up of confirmed transiting exoplanets	exoplanets	Brazil	Male	Amateur	Moletai Astronomical Observatory	14	yes
#36	Observing asteroids 5780-Lafontaine and 9560-Anguita and find their rotation periods	asteroids	Spain	Male	Amateur	Calar Alto Observatory	3	yes
#37	Constraining the luminous efficiency of lunar impact flash by observations during the 2023 Perseids meteoroid stream	meteoroids	Germany	Male	Amateur	Kryoneri Observatory	4	yes
#38	Observation of several exoplanet transits, to help preparing Ariel mission	exoplanets	Spain	Female	Amateur	Calar Alto Observatory	2	yes
#39	Observation of exoplanet transits: LHS-1478b (TOI-1640b) and TOI-1601b to help preparing Ariel mission	exoplanets	Spain	Female	Amateur	Calar Alto Observatory	1,5	yes
#40	Binarity in Hydrogen-Deficient Stars with Time-series Echelle Spectroscopy	binary stars	Israel	Male	Yearly career researcher	Moletai Astronomical Observatory	3	yes
#41	Determination of the rotation period of asteroids 1485-Isa and 2134-Dennispalm	asteroids	Spain	Male	Amateur	Calar Alto Observatory	3	yes
#42	Exoplanet hunters	exoplanets	Spain	Male	Amateur	Calar Alto Observatory	3	yes
#43	Physical characterisation of Potentially Hazardous Asteroid	asteroids	UK	Female	Yearly career researcher	Calar Alto Observatory	3	yes
#44	High-resolution spectroscopic observations of NASA TESS project exoplanet-host candidates	exoplanets	Lithuania	Female	Senior researcher	Moletai Astronomical Observatory	15	To be decided
#45	OBSERVATION OF LTT3780c EXOPLANET TRANSIT TO HELP PREPARING ARIEL MISSION	exoplanets	Spain	Female	Amateur	Teide Observatory	1	To be decided
#46	OBSERVATION OF EXOPLANET TRANSITS: TOI-532b AND NGTS-10b TO HELP PREPARING ARIEL MISSION.	exoplanets	Spain	Male	Amateur	Teide Observatory	1	To be decided
#47	Newly discovered systems as stellar merger candidates	stellar evolution	Greece	Female	Student	Kryoneri Observatory	6	To be decided

#48	ExoClock photometric follow-up of confirmed transiting exoplanets	exoplanets	Brazil	Male	Amateur	Moletai Astronomical Observatory	10	To be decided
#49	PLATO photometric follow-up of reference detached eclipsing	Eclipsing binaries	Brazil	Male	Amateur	Moletai Astronomical Observatory	2	To be decided
#50	Rotational characterisation of 311P/PanSTARRS active asteroid	asteroids	Greece	Male	Student	Kryoneri Observatory	6	To be decided
#51	EPHEMERIS MONITORING OF K DWARF TRANSITING EXOPLANETS IN MULTIPLANETARY SYSTEMS (K2-348b AND TOI-1260d) IN SUPPORT OF THE ARIEL MISSION	exoplanets	UK	Female	Student	Calar Alto Observatory	2	To be decided
#52	Unlocking the internal mechanisms of centaur 29P/Schwassmann-Wachmann	comets	UK		Student	Skalnáté Pleso	3	To be decided

6 Annex 2 – Workshops organised by NA2

Name	Organizer	Date	Participants	Comments
NA2 Kick-Off Meeting	M. Scherf	March 30, 2020	37	WP kick-off meeting
The Europlanet TelescopeNetwork	M. Scherf	September 30, 2020	ca.30	Splinter EPSC 2020 /Amateur training WS
Juno Ground-Based Support from Amateur Astronomers	R. Hueso	September 21, 2020	ca.50	Splinter EPSC 2020 /Amateur trainingWS
The Ariel mission for exoplanets and support from amateurs	A. Kokori	September 28, 2020	ca. 50	Splinter EPSC 2020 /Amateur training WS
Virtual Fireballs Workshop #1 on Fireball Databases and Machine Learning	M. Scherf, U. Amerstorfer, G. Kargl, D. Koschny	June 11-12, 2021	100	Pro-Am Workshop
Virtual Workshop on the use of the Europlanet Telescope Network for amateur astronomers	R. Hueso, I. Garate-Lopez	May 15-16, 2021	ca. 70	Amateur training workshop + remote observations at Calar Alto Obs.
Pro-Am collaborations (I): Juno's Extended Mission at Jupiter	R. Hueso	September 17, 2021	ca. 45	Splinter EPSC 2021 / Amateur Training WS
Pro-Am collaborations (II): JWST and the exploration of Giant Planets	L. Fletcher	September 24, 2021	ca. 50	Splinter EPSC 2021 / Amateur Training WS
Pro-Am collaborations (III): the EuropanetTelescope Network and ExoClockproject	M. Scherf	September 22, 2021	ca. 30	Splinter EPSC 2021 / Amateur Training WS
Europlanet Telescope Network Science Workshop	G. Tautvasiene, R. Hueso, G. Kargl, S. Mikolaitis, E. Podlowska-Gaca, C. Snodgrass	February 9. – 11. 2022	210	Amateur Training WS
Virtual Fireballs Workshop #2 on Fireball Databases and Machine Learning	G. Kargl, U. Amerstorfer, D. Koschny	February 4. – 5. 2022	ca. 45 online	Pro-Am Workshop
Pro-Am Comet Workshop	H. Usher	June 10. – 12. 2022	ca. 35 on site, 45 online	Pro-Am Workshop
Virtual Fireballs Workshop #3 on Fireball Databases and Lunar impacts	G. Kargl, D. Koschny, M. Scherf	August, 13. – 14., 2022	ca. 15 on site, 45 online	Pro-Am Workshop
Exoclock and Amateur Astronomy contribution Exoplanet Science	A. Kokori, R. Hueso	Sept. 21, 2022	10 on site, 5 online	Pro-Am Workshop
Amateur Observations of Outer planets	R. Hueso	Sept. 21, 2022	25 on site, 7 online	Pro-Am Workshop
Virtual Fireballs Workshop #4 on Fireball Databases and Machine Learning	G. Kargl, M. Scherf, D. Koschny	May 12-12, 2023	25	Amateur Training WS
Europlanet Pro-Am Training Workshop	R. Hueso, I. Garate-Lopez	June 2-5, 2023	16 on site	Pro-Am Regional Workshop

Europlanet Telescope Network: Solar System Planets	R. Hueso, I. Garate-Lopez	June 19, 2023	25 on site, 12 online	Pro-Am Workshop
Europlanet Telescope Network: Exoplanets	G. Tautvasiene	June 20, 2023	30 on site, 35 online	Pro-Am Workshop
Europlanet Telescope Network: Minor Solar System Bodies	E. Podlowska-Gaca	June 21, 2023	30 on site, 35 online	Pro-Am Workshop
Space missions: ground-based observations and science communication	G. Tautvasiene	August 8-18, 2023	21 on site and 47 online from 20 countries	Observational Workshop
Asteroid Research	H. Ramler, G. Tautvasiene, E. Podlowska-Gaca	August 21-25, 2023	19 on site and 23 online	Observational Workshop