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Integration Activity: ASTERICS grand event

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Abstract

The culmination of the ASTERICS activities has been a grand integrating event that shared the results of the project with the scientific community and that showcased their relevance to the ESFRI facilities and other stakeholders. The event was deliverable D1.5. It was held in Groningen, the Netherlands, from March 25 to 29, 2019. The meeting was a success that enabled the exchange of scientific and technological results with a wider international community.

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II. DELIVERY SLIP

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III. DOCUMENT LOG

Issue	Date	Comment	Author/Partner
1	10/05/2019	First draft	G. Cimò
2	16/06/2019	Second draft	G. Cimò

IV. APPLICATION AREA

This document is a formal deliverable for the GA of the project, applicable to all members of the ASTERICS project, beneficiaries and third parties, as well as its collaborating projects.

V. PROJECT SUMMARY

ASTERICS (Astronomy ESFRI & Research Infrastructure Cluster) aims to address the cross-cutting synergies and common challenges shared by the various Astronomy ESFRI facilities (SKA, CTA, KM3Net & E-ELT). It brings together for the first time, the astronomy, astrophysics and particle astrophysics communities, in addition to other related research infrastructures. The major objectives of ASTERICS are to support and accelerate the implementation of the ESFRI telescopes, to enhance their performance beyond the current state-of-the-art, and to see them interoperate as an integrated, multi-wavelength and multi-messenger facility. An important focal point is the management, processing and scientific exploitation of the huge datasets the ESFRI facilities will generate. ASTERICS will seek solutions to these problems outside of the traditional channels by directly engaging and collaborating with industry and specialised SMEs. The various ESFRI pathfinders and precursors will present the perfect proving ground for new methodologies and prototype systems. In addition, ASTERICS will enable astronomers from across the member states to have broad access to the reduced data products of the ESFRI telescopes via a seamless interface to the Virtual Observatory framework. This will massively increase the scientific impact of the telescopes, and greatly encourage use (and re-use) of the data in new and novel ways, typically not foreseen in the original proposals. By demonstrating cross-facility synchronicity, and by harmonising various policy aspects, ASTERICS will realise a distributed and interoperable approach that ushers in a new multi-messenger era for astronomy. Through an active dissemination programme, including direct engagement with all relevant stakeholders, and via the development of citizen scientist mass participation experiments, ASTERICS has the ambition to be a flagship for the scientific, industrial and societal impact ESFRI projects can deliver.

VI. EXECUTIVE SUMMARY

The "Integration Activity" was envisioned at the time of the project's proposal as a Grand Integrating Event to showcase the final results of the ASTERICS project and engage with all relevant stakeholders. This was the culmination of the ASTERICS activities, aimed to share the results of the project with the scientific community and to showcase their relevance to the ESFRI facilities and other stakeholders. The event was hosted by the Netherlands Institute for Radio Astronomy (ASTRON) on behalf of the ASTERICS collaboration at Martini Plaza in Groningen, The Netherlands, from March 25 to 29, 2019.

The idea was to have a conference on multi-messenger astrophysics with a strong technological component represented by ASTERICS results. The meeting was a success and it enabled the exchange of scientific and technological results with a wider international community.

At the proposal stage, we just envisioned a large event. Halfway through the project we decided it should be built around multi-messenger astrophysics and at the time of the conference, there were several multi-messenger events, showing that we could not have chosen a better time and subject, as exchange of ideas, status of developments and results in this area are hot at the start of Observing run 3 and 2 of the Gravitational facilities LIGO and Virgo.

In this document, we will describe the goal of the event and how these have been achieved. We will also present the program of the meeting and the dissemination of the ASTERICS results among the scientific community, the policymakers, the software and hardware developers, and the general public.

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1. Introduction

The Grand Integrating Event, as the culmination of the ASTERICS activities, was envisioned during the proposal as a showcase of the ASTERICS activities. The event was held from March 25 to 29, 2019 at Martini Plaza in Groningen and was hosted by the Netherlands Institute for Radio Astronomy (ASTRON) on behalf of ASTERICS.

In order to showcase the ASTERICS results in the field of multi-messenger astrophysics, one first needs to set the stage for the needs of the communities in this field. The need for such an event became evident to WP1 staff by attending a number of meetings where scientists and other stakeholders regretted the lack of the coordination and technology drive between different communities. This lack of coordination is something where ASTERICS could provide support and it was also urged by the astronomy and astroparticle physics communities.

The target audience of such an integrating event consisted of ASTERICS partners and external stakeholders that use, or potentially use, ASTERICS results. We aimed to Integrate ASTERICS results in the most relevant contexts of current multi-messenger astrophysics research.

In this way, we achieved to join different audiences in integrated sessions around common themes for science, technology and policy. Such integrated sessions had proactive chairpersons who provided an introduction, connections and bridges between presentations and conclusion to the sessions. Each thematic session contained something of interest for the different audiences to stimulate their integration. Scientific talks and ASTERICS results were presented in these integrated sessions. Furthermore, ASTERICS booths (VO, multi-messenger platform, ...) and focus sessions in the form of workshops (policy forum and alert mechanisms) helped facilitate the overall integration of science, technology, policy and dissemination.

To extend the reach of the event beyond the participants during the week, and for future reference, we will produce online proceedings and provide the presentations on the event website.



ASTERICS Symposium
25-29 March 2019
Groningen, The Netherlands

The New Era of Multi-Messenger Astrophysics



KEY THEMES

- Electromagnetic transients in multi-messenger signals
- Multi-messenger technology and multi-facility collaborations
- Sources of high-energy particles
- Multi-messenger technology and interoperability
- Alert mechanism systems and fast response of facilities
- The principles of Open Science

INVITED SPEAKERS

Imre Bartos - University of Florida (USA)
Elisa Bernardini - Deutsches Elektronen-Synchrotron (Germany)
Françoise Genova - Centre de Données astronomiques de Strasbourg (France)
Giancarlo Ghirlanda - INAF, Brera Astronomical Observatory (Italy)
Piotr Homola - Institute of Nuclear Physics PAS (Poland)
Samaya Nissanke - University of Amsterdam (Netherlands)
Judith Racusin - NASA/GSFC (USA)
Jason Hessels - ASTRON / University of Amsterdam (Netherlands)

SCIENTIFIC ORGANISERS

Carole Jackson - ASTRON (Netherlands)
 Giuseppe Cimo - ASTRON / JIVE (Netherlands)

SCIENTIFIC ORGANISING COMMITTEE

Gemma Anderson - Curtin University (Australia)
 Dipankar Bhattacharya - Inter-University Centre for Astronomy and Astrophysics (India)
 Marica Branchesi - INFN (Italy)
 Eric Chassande-Mottin - CNRS, APC (France)
 Alessandra Corsi - Texas Tech University (USA)
 Anna Franckowiak - DESY (Germany)
 Aart Heijboer - Nikhef (Netherlands)
 Mansi M. Kasliwal - California Institute of Technology (USA)
 Sera Markoff - University of Amsterdam (Netherlands)
 Tara Murphy - University of Sydney (Australia)
 Zsolt Paragi - Joint Institute for VLBI ERIC (Netherlands)
 Fabio Pasian - INAF, Astronomical Observatory of Trieste (Italy)
 Enrico Ramirez Ruiz - University of California, Santa Cruz (USA)
 Patrick Woudt - University of Cape Town (South Africa)
 Feng Yuan - Shanghai Observatory (China)

For more information and registration please visit:
multi-messenger.asterics2020.eu









2. Scientific rationale

Having in mind the goal of integrating ASTERICS and the scientific communities around multi-messenger astrophysics, we invited astronomers, (astro-)particle physicists, engineers and policymakers to discuss the recent developments in the fields of gravitational waves, astrophysical neutrinos, the highly energetic dynamic sky, and to explore new methods for multi-messenger science and the related research infrastructures.

The past few years have been pivotal for multi-messenger astrophysics, with the first detection of gravitational waves from the merging of two neutron stars and the recent announcement of a high-energy neutrino event detected by IceCube coincident in direction and time with a gamma-ray flare from a blazar detected by Fermi. Gravitational Wave and Neutrino sources and their electromagnetic counterparts, together with new developments in transient EM astronomy, are a vibrant field where the nature of many phenomena is still unknown or debated. Furthermore, the generation of new sensitive, wide-field instrumentation across the entire electromagnetic and astroparticle spectrum (SKA, CTA, KM3NeT, ELT, Athena) are set to radically change the way we perceive the Universe. In the next decade, space and ground-based detectors will jointly explore the Universe through all its messengers. Adequate e-infrastructures and algorithms will be needed to manage and analyse the data.

The following scientific topics and focus sessions were decided by the Scientific Organizing Committee (see section 3.2) in collaboration with ASTERICS.

- Multi-Messenger observations of GW and search for counterparts
- Fast Radio Bursts
- Multi-Messenger observations of Neutrinos and search for counterparts
- Software and technology for multi-messenger observations and data analysis
- Data access and the principles of Open Science
- International Coordination
- Alert Mechanisms and multi-messenger coordination platforms

3. Organizational Approach

The event was organized by ASTRON from 25 to 29 March 2019 in Groningen, a university city in the north of the Netherlands. We installed a dedicated Local organising committee (LOC) with full organisational responsibility for the event. After the approval and support of the AGA, the ASTERICS Management and support team (AMST) and ASTERICS executive board took the lead in the overall decision taking and planning, and were informed regularly during all stages of the conference organization. In particular the AEB has provided very useful feedback and support.

For dissemination, we relied on email communications as well as social media. We requested ASTERICS members to disseminate the event announcement within their respective institutions, ESFRI projects, as well as contacts in the national astronomical societies. We have also advertised the conference in the Astronomer's Telegram, a website and mailing list that alerts astronomers of transient events from radio to gamma-rays.

We opened the online registration at <http://multi-messenger.asterics2020.eu> in August 2018, so interested parties could register early.

The registration fee per participant was set to 300 Euros, with an early-bird fee of 250 Euros and a late fee of 350 Euros. We provided a fee waiver for the SOC members who travelled from overseas to attend the conference and for the invited speakers. The latter had also their accommodation and travel expenses reimbursed.

The registration for abstracts for presentations and posters was 5 December, so the SOC did have time to review and select contributions for the programme.



3.1. Local Organizing Committee

The members of the Local Organizing Committee (LOC) were:

- Christine Werkhoven - ASTRON (Netherlands) – **Chair**
- John McKean - Kapteyn Astronomical Institute, University of Groningen (Netherlands)
- Giuseppe Cimo' - ASTRON / JIVE (Netherlands)
- Jet de Vries - ASTRON (Netherlands)

3.2. Scientific Organizing Committee

Since the very first moments of the organization of the conference, the ASTERICS Executive Board (AEB) has been involved. Each Work Package (WP) leader has contributed to the conference by inviting scientists and developers to present the activities financed by ASTERICS and by presenting the results of the WP during the conference.

The AEB has also suggested names for the Scientific Organizing Committee (SOC) of the conference to collect an international group of experts in the many aspects of multi-messenger astrophysics.

The members of the SOC were:

- Giuseppe Cimo' - ASTRON / JIVE (Netherlands) - **Chair**
- Gemma Anderson - Curtin University (Australia)
- Dipankar Bhattacharya - Inter-University Centre for Astronomy and Astrophysics (India)
- Marica Branchesi - INFN (Italy)
- Eric Chassande-Mottin - CNRS (France)
- Alessandra Corsi - Texas Tech University (USA)
- Anna Franckowiak - Desy (Germany)
- Aart Heijboer - Nikhef (Netherlands)

- Mansi M. Kasliwal - California Institute of Technology (USA)
- Sera Markoff - University of Amsterdam (Netherlands)
- Tara Murphy - University of Sydney (Australia)
- Zsolt Paragi - Joint Institute for VLBI ERIC (Netherlands)
- Fabio Pasian - INAF (Italy)
- Enrico Ramirez-Ruiz - University of California, Santa Cruz (USA)
- Patrick Woudt - University of Cape Town (South Africa)
- Feng Yuan - Shanghai Observatory (China)

3.3. Invited speakers

- Imre Bartos, University of Florida, United States of America
- Elisa Bernardini, DESY, Germany
- Françoise Genova, CNRS - Centre de Données astronomiques de Strasbourg, France
- Giancarlo Ghirlanda, INAF - Brera Astronomical Observatory, Italy
- Jason Hessels, ASTRON / University of Amsterdam, The Netherlands
- Piotr Homola, Institute of Nuclear Physics PAS, Poland
- Samaya Nissanke, University of Amsterdam, The Netherlands
- Judith Racusin, NASA Goddard Space Flight Center, United States of America

4. Scientific Programme

4.1. Main meeting

ASTERICS has facilitated the data collection, analysis and exploitation of multi-messenger science. The variety of presentations allowed us to discuss and address all the following open questions.

Multi-Messenger observations of GW and search for counterparts

- What do multi-messenger observations say about the physics of the central engine and jet production?
- Are GW170817 observations and the standard model for short GRB compatible?
- What is the expected rate of joint observations after GW170817?
- What are the consequences of GW170817 observations on kilonova modelling?
- What is the status and future of joint GW and EM constraints?

These questions were addressed in the presentations of:

Samaya Nissanke (Invited speaker)
Giancarlo Ghirlanda (Invited speaker)
Michal Bejger (ASTERICS speaker)
Kelly Gourdij (ASTERICS speaker)
and a number of contributed speakers (see Annex 1)

Fast Radio Bursts

- Can we develop a Multi-messenger view on Fast Radio Bursts?
- What are the search tools for multi-frequency and multi-messenger counterparts of FRBs?
- Will new alert mechanisms and fast response telescopes change FRB studies?

These questions were addressed in the talks of:

Jason Hessels (Invited speaker)
Emily Petroff (ASTERICS speaker)
and a number of contributed speakers (see Annex 1)

Multi-Messenger observations of Neutrinos and search for counterparts

- What have we learned from the detection of a high-energy neutrino from the flaring blazar TXS 0506+056? How does this finding fit together with the detection of an excess of neutrinos at TeV energies from the same blazar?
- How can we improve the search for neutrinos from blazars in the future?
- Are blazars the main contributors to the measured diffuse neutrino flux? What are other possible source candidates? Which multi-messenger observations are needed?
- What are the prospects of detecting high-energy neutrinos in the future with new detectors such as Km3NET, IceCube Gen2 and Baikal GVD?

These questions were addressed in the presentations of:

Elisa Bernardini (Invited speaker)
Imre Bartos (Invited speaker)
Cristiano Bozza (ASTERICS speaker)
and a number of contributed speakers (see Annex 1)

Software and technology for multi-messenger observations and data analysis

- Does the communication, storage and processing infrastructures for alert and follow-up observations need further development?
- What tools have been developed for multi-messenger astrophysics?
- Where will these tools and their interoperability lead us to?
- Is the current infrastructure going to scale in the next 10 years?
- What tools are still needed?

These questions were addressed in the talks of:

Thomas Vuillaume (ASTERICS speaker)
Daniel Morcuende (ASTERICS speaker)
Léa Jouvin (ASTERICS speaker)
Pep Colomé (ASTERICS speaker)
Chantal van Tour (ASTERICS speaker)
Paul Boven (ASTERICS speaker)
Aard Keimpema (ASTERICS speaker)
Harro Verkouter (ASTERICS speaker)
and a number of contributed speakers (see Annex 1)

Data access and the principles of Open Science

- What are the recent developments on accessing, discovering and interoperating multi-wavelength/multi-messenger data?
- Are open science and large scientific collaborations compatible?
- What is the impact of current open data on education at universities and the general public?

These questions were addressed in the talks of:

Francoise Genova (Invited and ASTERICS speaker)
Piotr Homola (Invited and ASTERICS speaker)
Mark Allen (ASTERICS speaker)
Ada Nebot (ASTERICS speaker)
Giuseppe Greco (ASTERICS speaker)
Marco Molinaro (ASTERICS speaker)
Catherine Boisson (ASTERICS speaker)
Johanna Jarvis (ASTERICS speaker)

4.2. Policy Forum

The results of the ASTERICS Policy Forum were presented during the session about International Coordination. During this session, a number of open questions were addressed:

- Will future infrastructures transform the field of multi-messenger astrophysics and how?
- What can be done to facilitate the collaboration of big infrastructures?
- What are the results of the ASTERICS policy forum?
- What will be the multi-messenger landscape in the next decade?
- Can a multi-messenger platform help the coordination of current and future facilities?
- Where else do the work of ASTERICS and the interoperability of multi-messenger instruments lead us?

In order to address these questions, representatives of the ESFRI facilities discussed the benefits of international collaborations for their respective key science projects. This session was also the occasion to listen to the vision on the coordination of big projects from NASA, LIGO/VIRGO, Athena and other next-generation facilities.

In particular:

Denis Mourard (ASTERICS speaker)
 Anna Bonaldi (SKA representative)
 Ulisses Barres de Almeida (CTA representative)
 Michael Sterzik (ESO representative)
 Damian Dornic (KM3NeT representative)

Judith Racusin (Invited speaker and NASA representative)
 Job de Kleuver (APPEC representative)
 Sarah Antier (VIRGO representative)
 Jacco Vink (Athena representative)
 John Lightfoot (ASTERICS speaker)

4.3. Alert mechanisms workshop

As a follow-up on the Radio-Gamma Transient Alert Mechanisms workshop organized by CLEOPATRA in Amsterdam in September 2017, the last day of the conference was dedicated to a workshop on transient alerts. Besides a discussion about VOEvent, there were discussions on joint observation planning/follow-ups, facilitating data sharing and facilitating joint analysis. Alert Mechanisms and multi-messenger coordination platforms.

The workshop consisted of 4 sessions. Each session was introduced by a talk and followed by interactive discussions guided by proactive chairpersons. The main topics were:

- Facilitating data sharing
- Facilitating data analysis
- Standardizing VOEvents and archives
- Joint observations: Planning and follow-ups

These specific topics led to a general discussion about the future of multi-messenger coordination after ASTERICS. A number of European scientists are looking with interest to US initiatives that follow the example of ASTERICS. In such an international landscape, it is important to be involved in the activities happening overseas. However, a common feeling is that Europe and the European scientists should continue the path started with ASTERICS and maintain a central in the multi-messenger discussion from the software to the policies needed for successful multi-disciplinary coordination.

4.4. Public lecture

A **public lecture** was organized together with Studium Generale and The Kapteyn Astronomical Institute of the University of Groningen.

The speaker was Stephen Serjeant, Professor of Astronomy at the Open University (UK) and WP2 DECS leader. On the evening of Wednesday 27 March 2019 at the Aula of the Academy Building, University of Groningen, Prof Serjeant gave a lecture about “Citizen Science and the data avalanche”. The following is the abstract of his talk.

Astronomy and particle physics have begun a new data-rich era of discovery, from finding warps in space and time to new particles in accelerators. But the data avalanche is so fast, so large and so complex that it's a challenge for computing. Artificial Intelligence regularly offers no easy solutions. Humans are still often much better than AI at classification tasks. This has led to a new way of doing science: crowdsourcing, with the help of citizen science volunteers. This gives members of the public genuine and valuable participation in scientific discovery, and there is a huge public appetite for taking part. This talk will show you how you can join in, and review some of the highlights of ASTERICS citizen science on the leading crowdsourcing platform, the Zooniverse.

The lecture was attended by about 50 people that were not participants of the conference, indicating that we succeeded in attracting the general public.

5. Outcomes of the meeting

The feedback during and after the meeting has been very positive. The scientists presented their work in high energy phenomena, transient astronomy, astrophysical neutrinos, and gravitational waves with their multi-messenger follow-ups. The ESFRI facilities, and pathfinders showed their potential in addressing the open scientific questions and technical challenges. ASTERICS partners demonstrated the technological advances developed within the project in the past four years. Furthermore, the ASTERICS Policy Forum facilitated the discussion on the status and future of multi-messenger.

All ASTERICS partners were involved and sent representatives to the conference to present their results. The meeting had the multiple outcome of a successful scientific symposium and of gathering both the developers and the users of the state-of-the-art multi-messenger technology.

Discussions on data access and practical sessions with VO experts at the DADI booth introduced participants to the use of VO instruments developed within the ASTERICS framework, ranging from high energy astrophysics to gravitational waves. Scientists from all fields benefit from common standards to share data in formats that are easily accessible by a wider community.

The conference offered astronomers and (astro-)particle physicists a space for discussing the challenges of big data (OBELICS) and time domain astronomy with developers and policymakers. Many scientific and technological issues in multi-messenger astrophysics are still open and ASTERICS has provided new tools for facilitating transient astrophysics, from the rescheduling for quick follow-up of hundreds of antennas operating at different regimes to fast response times of a large number of instruments (CLEOPATRA).

Besides the scientific and technical issues, policies and international coordination were discussed during a special session on policies and international collaborations. The grand event was a very suitable place for sharing the results of the ASTERICS Policy Forum with a wider community and for starting new fruitful discussions and future international collaborations.

Finally, with regard to dissemination and public engagement, the goal has been to explore current and new ways to engage with society at large by embracing the principles of Open Science. DECS has presented a number of applications of citizen science and the WP2 representatives have been approached by many participants to discuss ideas for deploying ambitious programs for public engagement.

5.1. Presentations and Proceedings

The presentations are available on [the conference website](#), where one can also find all abstracts:

Presentations:

<http://multi-messenger.asterics2020.eu/Presentations.htm>

Abstracts:

<http://multi-messenger.asterics2020.eu/abstracts.php>

With regard to the dissemination of the conference's outcomes, the contributions are also made public as proceedings in the Proceedings of Science website:

<https://pos.sissa.it/357>

The proceedings also contain an introductory article about the ASTERICS project, a policy document outlining the results of the ASTERICS Policy Forum, and a white paper with the conclusions of the alert mechanisms workshop.

5.2. Participants

The final number of attendees was 128, about one-third of which were women. On stage, this number improved given that the female speakers, invited and contributed, and chairwomen amount to about 40% of the total. It was a diverse conference with participants coming from 18 different countries. The final 89 contributions were selected based on their scientific relevance paying particular attention that early-career scientists had the possibility to present their work.

ANNEX 1 Conference programme

19:00 – 20:00 **Welcome reception** at the 'Spiegelzaal' in the [Academy Building](#) (F. Smit)

This reception is offered to you by the University of Groningen, the Municipality of Groningen and the Province of Groningen.

Tuesday 26 March

09:00 -- 09:30 Welcome to ASTERICS: Multi-messenger astrophysics and ASTERICS results (C. Jackson and ASTERICS leaders)

Convener: Eric Chassande-Mottin

09:30 -- 10:00 Gravitational waves and the birth of Multi-Messenger Astrophysics (S. Nissanke) **INVITED**

10:00 -- 10:15 Machine learning classification for gravitational-wave triggers in single-detector periods ([M. Beiger](#)) 10:15 -- 10:30 Hunting for elusive multi-messenger transients with INTEGRAL ([V. Savchenko](#))

10:30 -- 11:00 COFFEE BREAK

11:00 -- 11:30 Short Gamma Ray Bursts: what we have learnt from GW170817 ([G. Ghirlanda](#)) **INVITED**

11:30 -- 11:45 Multi-messenger characterization of BH-NS mergers ([O. Salafia](#))

11:45 -- 12:00 The binary neutron star merger rate via the luminosity function of gamma-ray bursts ([D. Paul](#))

12:00 -- 12:15 Joint gravitational wave - gamma-ray burst detection rates in the aftermath of GW170817 ([E. Howell](#))

12:15 -- 12:30 Neutron Star Merger Afterglows: Population Prospects for the Gravitational Wave Era ([R. Duque](#))

12:30 -- 13:30 LUNCH

Convener: T. Murphy

13:30 -- 13:45 Do some millisecond pulsars emit gravitational waves? ([S. Bhattacharyya](#))

13:45 -- 14:15 Multi-messenger Astroparticle Physics in the Gravitational-wave Era (I. Bartos) **INVITED**

14:15 -- 14:30 Searches for counterparts of Gravitational Waves with VHE gamma-ray observatories ([M. SeglarArroyo](#))

14:30 -- 14:45 Identifying EM counterparts to NS-NS mergers: an Optimized Radio Follow-up Strategy ([D. Carbone](#)) 14:45 -- 15:00 LOFAR triggered observations of gravitational wave merger events and GRBs ([K. Gourdij](#))

15:00 -- 15:30 COFFEE BREAK

Convener: Z. Paragi

15:30 -- 16:00 Fast Radio Bursts ([J. Hessels](#)) **INVITED**

16:00 -- 16:15 Observing a Fast Radio Burst from radio wavelengths to very high energy gamma-rays ([B. Marcote](#))

16:15 -- 16:30 Rapid-response radio telescopes in the era of multi-messenger astrophysics ([G. Anderson](#))

16:30 -- 16:45 A VEvent Standard for Fast Radio Bursts ([E. Petroff](#))

16:45 -- 17:00 VLITE-Fast: VLA's commensal FRB search engine ([S. Bethapudi](#)) - Speaker: M. Kerr)

17:00 -- 17:30 **DISCUSSION**

18:30 -- 21:30 [Conference Dinner \(Het Feithuis\)](#)



Wednesday 27 March

Convener: F. Pasian (INAF)

09:00 -- 09:30 Access, Discovery and Interoperability of multi-wavelength/multi-messenger data ([F. Genova](#))

INVITED

09:30 - 09:45 All-sky astrophysics enabled by innovative systems for indexing the sky ([M. Allen](#))

09:45 -- 10:00 Exploring Time Domain Multi-Messenger Astronomy through the Virtual Observatory ([A. Nebot](#))

10:00 -- 10:15 Coordinating observations among ground and space-based telescopes in the multi-messenger era ([E. Kuulkers](#))

10:15 -- 10:30 Working with Gravitational-Wave sky localizations: new methods and implementations ([G. Greco](#))

10:30 -- 11:00 COFFEE BREAK

11:00 -- 11:15 ESFRIs & VO: networking and discussing ([M. Molinaro](#))

11:15 -- 11:30 GWOSC: Gravitational Wave Open Science Center ([A. Trovato](#))

11:30 -- 11:45 Archiving data from a software telescope ([C. Boisson](#))

11:45 -- 12:00 The benefits of public engagement ([J. Jarvis](#))

12:00 -- 12:30 Public engagement as a scientific tool to implement multi-messenger strategies with the Cosmic-Ray Extremely Distributed Observatory ([P. Homola](#)) **INVITED**

12:30 -- 13:30 LUNCH

Convener: D. Mourard (CNRS) and S. Matheussen (NWO)

13:30 -- 13:45 About policies for multi-wavelengths/multi-messengers astrophysics ([D. Mourard](#))

13:45 -- 14:00 SKA science and multi-messenger synergies (A. Bonaldi)

14:00 -- 14:15 Science with the CTA ([U. Barres de Almeida](#))

14:15 -- 14:30 ELT science and its potential for multi-messenger astrophysics (M. Sterzik)

14:30 -- 14:45 KM3NeT science and multi-messenger synergies (D. Dornic)

14:45 -- 15:00 Multi-messenger science in the European Astroparticle Physics Strategy 2017-2026 ([J. de Kleuver](#))

15:00 -- 15:30 COFFEE BREAK

15:30 -- 16:00 Future NASA Missions for Multi-Messenger Astrophysics ([J. Racusin](#)) **INVITED**

16:00 -- 16:15 A Platform for Multi-Messenger Observing ([J. Lightfoot](#))

16:15 -- 16:30 Multi-messenger science with VIRGO (S. Antier)

16:30 -- 16:45 ENGRAVE: Gravitational Wave Follow-up at the European Southern Observatory ([A. Levan](#))

16:45 -- 17:00 The Athena X-ray mission and its synergy with the next generation of multi-messenger facilities ([J. Vink](#))

17:00 -- 17:15 J-GEM collaboration: an optical-infrared follow-up observation network ([M. Yoshida](#))

17:15 -- 17:30 **DISCUSSION**

20:00 -- 21:00 Public Lecture (Aula, Academy Building)

Thursday 28 March

Convener: A. Franckowiak

09:00 -- 09:30 Astrophysical Neutrinos (E. Bernardini) **INVITED**

09:30 -- 09:45 On the sources of high energy neutrinos ([A. Palladino](#))

09:45 -- 10:00 Neutrinos on ice - Blazars as counterparts to neutrinos above 100 TeV ([F. Krauss](#))

10:00 -- 10:15 Neutrinos from TXS 0506+056 ([S. Britzen](#))

10:15 -- 10:30 Constraints on neutrino emission in the local universe using 2MASS redshift survey with IceCube ([S. Sclafani](#))

10:30 -- 11:00 COFFEE BREAK

11:00 -- 11:15 Multi-messenger real-time analysis framework of the KM3NeT neutrino telescope ([D. Dornic](#))

11:15 -- 11:30 Searching for Optical Counterparts to High-Energy Neutrino Sources with ZTF ([L. Rauch](#))

11:30 -- 11:45 Search for High-Energy Neutrinos from Populations of Optical Transients ([R. Stein](#))

11:45 -- 12:00 Multimessenger searches with the ANTARES and KM3NeT neutrino telescopes ([M. Colomer Molla](#))

12:00 -- 12:15 Supernova detection and real-time alerts with the KM3NeT neutrino telescopes ([M. Lincetto](#))

12:15 -- 12:40 Multi-messenger Astroparticle Physics in the Gravitational-wave Era (I. Bartos) **INVITED**

12:40 -- 13:30 LUNCH

Convener: R. van der Meer

13:30 -- 13:45 Searches for ultra-high-energy photons at the Pierre Auger Observatory ([P. Ruehl](#))

13:45 -- 14:00 Follow-up observations of multi-messenger alerts with H.E.S.S. ([H. Prokoph](#))

14:00 -- 14:15 The H.E.S.S. transients alert system ([C. Hoischen](#))

14:15 -- 14:30 Glowbug, a Gamma-Ray Telescope for Bursts and Other Transients ([M. Kerr](#))

14:30 -- 14:45 Gemini Operations for Multi-Messenger Astronomy ([B. Miller](#))

14:45 -- 15:00 Discovering electromagnetic counterparts with ZTF, DECam, and GROWTH facilities ([I. Andreoni](#))

15:00 -- 15:30 COFFEE BREAK

15:30 -- 15:50 Observatory e-environments linked by common challenges (T. Vuillaume)

15:50 -- 16:00 High Performance Computing applied to the Cherenkov Telescope Array data analysis ([T. Vuillaume](#))

16:00 -- 16:15 Simulation of fluorescence radiation for Cherenkov observatories ([D. Morcuende](#))

16:15 -- 16:30 pLISA: a parallel Library for Identification and Study of Astroparticles and its application to KM3NeT ([C. Bozza](#))

16:30 -- 16:45 Open data and tools for gamma-ray astronomy ([L. Jouvin](#))

16:45 -- 17:00 Telescope and space mission scheduling towards a multi-observatory framework ([P. Colomé](#))

17:00 -- 17:15 White rabbit time and frequency transfer in SURFnet8 network for VLBI purposes ([C. van Tour](#))

17:15 -- 17:30 Dwingeloo telescope VLBI with a remote maser ([P. Boven](#))

17:30 -- 17:45 Efficient remote interactive pipelines using CASA and Jupyter ([A. Keimpema](#))

17:45 -- 18:00 Are you up for faster dissemination of your data? ([H. Verkouter](#))

Friday 29 March

Convener: G. Anderson

09:00 -- 09:15 **Joint Observation planning and Follow-ups** ([G. Anderson](#))

09:15 -- 09:30 AMON: Multimessenger alerts from high-energy gamma rays and neutrinos ([H. Ayala](#)) 09:30 -- 10:30 **DISCUSSION**

How to implement more flexible operating models for joint observations or ToOs?

10:30 -- 11:00 COFFEE BREAK

Convener: E. Petroff

11:00 -- 11:15 **Standardizing of VOEvent and archives** (E. Petroff)

11:15 -- 11:30 VOEvents and standards (D. Morris)

11:30 -- 12:30 **DISCUSSION**

VOEvents contain information that is useful for later analysis; how do we store that information in a way that can be easily extracted and interpreted later?

12:30 -- 13:30 LUNCH

Convener: S. Matheussen

13:30 -- 13:45 **Facilitating Data sharing** (S. Matheussen)

13:45 -- 14:00 Towards a framework for multi-messenger data sharing (D. Berge – Speaker: M. Kowalski)

14:00 -- 14:30 **DISCUSSION**

How to reconcile the data practices of facilities with the needs of information sharing policies of the multimessenger landscape?

15:00 -- 15:30 COFFEE BREAK

15:30 -- 15:45 **Facilitating Joint Analysis** (C. Boisson)

15:45 -- 16:00 AMPEL: a streaming data analysis framework (L. Rauch)

16:00 -- 17:00 **DISCUSSION**

How can we best facilitate joint analysis of MM alerts/events?

17:00 -- 17:15 Conclusions and Final remarks (ASTERICS, SOC, LOC)

POSTERS

1. Operational Concepts of the CTA Observatory in the Time Domain Astronomy ([M. Fuessling](#))
2. Data and Software Preservation through Containerisation in KM3NeT ([T. Gal](#))
3. The Rate of Short Duration Gamma-Ray Bursts in the Local Universe ([S. Mandhai](#))
4. Prospects for kilonova signals in the gravitational wave era ([R. Mochkovitch](#))
5. The detection of high energy spectral cutoff of bright GRBs detected via Fermi telescope ([E. Moneer](#))
6. MAGIC follow-up of gravitational wave events in the third LIGO/Virgo observation run ([M. Ribó](#))
7. MAGIC as a Neutrino Follow-Up Instrument ([M. Ribó](#))
8. The limited contribution of gamma-ray bursts to ultra-high energy cosmic rays ([F. Samuelsson](#))
9. Astrophysical Online Data Analysis powered by provenance data model ([V. Savchenko](#))
10. The ASTERICS VO schools. Getting closer to the astronomical community ([E. Solano](#))
11. The SVO Discovery Tool ([E. Solano](#))
12. ROAst (ROot extension for Astronomy) ([B. Spisso](#))
13. CORELib: COsmic Ray Event Library ([S. Stellacci](#))
14. RISCAPe: European Research Infrastructures in the International Landscape ([R. van der Meer](#))
15. LOFAR's fast response capabilities ([S. ter Veen](#))
16. Continuous gravitational waves from axion clouds ([S. Zhu](#))