International Astronomical Union
Union Astronomique Internationale

POST MEETING REPORT FORM

1. **Meeting Identification Number:** Symposium 397
2. **Meeting Title:** UniversAI: Exploring the Universe with artificial intelligence
3. **Coordinating Division:** Division B – Facilities, Technologies and Data Science
4. **Dedication of meeting (if any): N/A**
5. **Location (city, country):** Athens, Greece
6. **Dates of meeting:** June 2-6, 2025
7. **Number of participants:** 109
8. **Total Amount of IAU Grant funds received (in euros):** 20,000
9. **Number of IAU Grant recipients:** 33
10. **List of represented countries:** 28
11. **Anticipated number of separate papers in the proceedings:** 50
12. **Report submitted by:** Ioannis Liodakis & Vasilis Efthymiou
13. **Date and place:** Heraklion, Greece, July 15 2025.
14. **Signature of SOC Chairperson:**

Dr. Ioannis Liodakis

Dr. Vasilis Efthymiou

Summary of the IAU Symposium 397

UniversAI: Exploring the Universe with artificial intelligence

Date: 2025 June 2 - 6

Venue: Harokopio University, Athens, Greece

Coordinating IAU Division: Division B – Facilities, Technologies and Data Science

Scientific Organizing Committee (Female 5/Male 8):

Co-chairs:
Ioannis Liodakis (M), IA, Greece
Vasilis Efthymiou (M), HUA, Greece

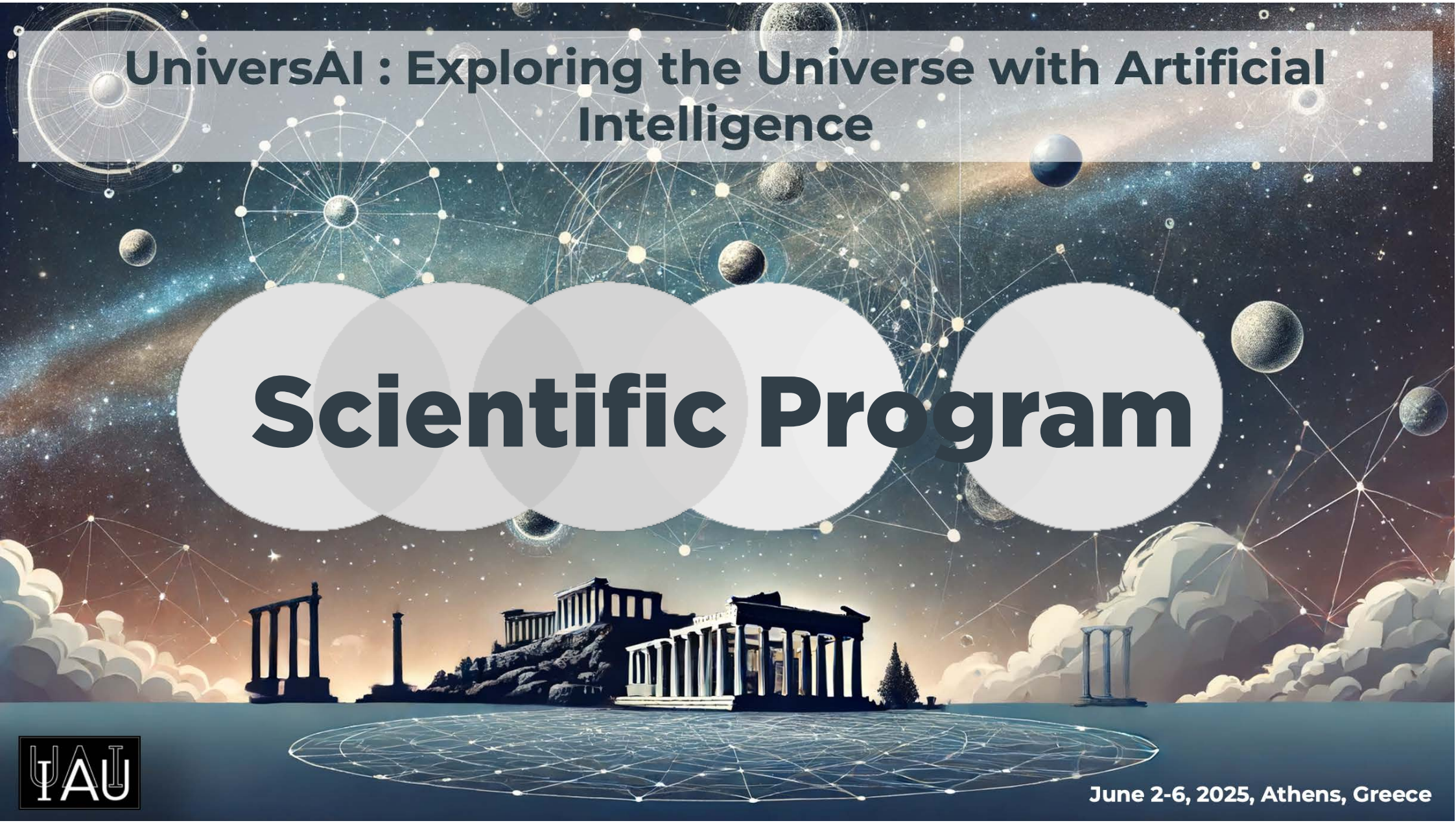
Members:
Maria Dainotti (F), NAOJ, Japan
Michico Fujii (F), U. Tokyo, Japan
Oktie Hassanzadeh (M), IBM, USA
Lorena Hernandez Garcia (F), MAS, Chile
Daniel Gruen (M), LMU, Germany
Tomasz Kacprzak (M), ETH, Switzerland
Jae-Young Kim (M), KNU, South Korea
Catia Pesquita (F), ULisboa, Portugal
Abdul Quamar (M), Google, USA
Hideaki Takeda (M), NII, Japan
Risa Wechsler (F), KIPAC, USA

Local Organizing Committee (Female 1/Male 2):
Dr. Vasilis Efthymiou, Harokopio University of Athens, Greece
Dr. Fiori Metallynoy, National Observatory of Athens, Greece
Mr. Kostas Petrakis, Net Company, Greece

Invited Speakers (Female 4/Male 8):
Federica Bianco (F), U. Delaware, USA
Meghyn Bienvenu (F), CNRS, France
Angela Bonifati (F), U. Lyon 1 – CNRS, France
Christos Diou (M), HUA, Greece
Torsten Enslin (M), MPA, Germany
Laurent Eyer (M), U. Geneva, Switzerland
Georgia Koutrika (F), Athena RC
Tyson Littenberg (M), NASA/MSFC, USA
Hendrik Müller (M), NRAO, USA
Themis Palpanas (M), U. Paris Cite, France
Jean-Luc Starck (M), CEA-Saclay, France
Grigorios Tsagkatakis (M), ICS-FORTH, Greece

UniversAI : Exploring the Universe with Artificial Intelligence

Scientific Program



June 2-6, 2025, Athens, Greece

Monday, June 2nd, 2025

08:00-09:00 Registration

09:00-09:30 **Welcome** Chair: **Vasilis Efthymiou**, *Harokopio University of Athens*

Welcome Addresses

09:00-09:10 **Vasilis Efthymiou,** *Harokopio University of Athens*

09:10-09:20 **Georgios Dedousis,** *Rector of Harokopio University of Athens*

09:20-09:30 **Spyros Basilakos,** *President of National Observatory of Athens*

09:30-11:00 **Session 1** Chair: **Ethan Partington**, *FORTH Institute of Astrophysics*

09:30-10:00 **Keynote Lecture**

Perspectives on the Past, Present, and Future of Astronomical Image Deconvolution

Jean-Luc Starck, *CEA-Saclay*

10:00-10:15 Combining machine learning and forward-modelling of Stage IV galaxy surveys for precise cosmological measurements

Luca Tortorelli, *LMU Munich*

10:15-10:30 Accelerating Astrophysical Simulations with Neural Operators: Precision and Efficiency Beyond Traditional Neural Networks

Lorenzo Branca, *University of Heidelberg*

10:30-10:45 Using CNNs for Precision Shear Measurement in Stage IV Surveys

Lisa Voigt, *University of Essex*

Monday, June 2nd, 2025

11:00-11:30	**Coffee break/ Poster Session**
11:30-12:30	**Session 2** Chair: Christos Diou, *Harokopio University of Athens*
11:30-11:45	Bridging the Gap: Predicting Galaxy Spectra from Photometric Images Using Generative, AI **Eva Sextl,** *LMU Munich / University Observatory*
11:45-12:00	The use of ANNs for solving different physical and astrophysical phenomena, **Yosry Azzam,** *NRIAG*
12:00-12:15	UNEZ: An Unsupervised Physics-Informed Neural Network for Redshift and Line Strength Prediction, **Asha Abd,** *Swinburne University of Technology*
12:15-12:30	A Versatile Framework for Analyzing Galaxy Structures by Implanting Human-in-the- loop on a Foundation Vision Model, **Nan Li,** *National Astronomical Observatories of China*
12:30-14:00	**Lunch break / Poster Session**
14:00-15:15	**Session 3** Chair: Themis Palpanas, *French University Institute*
14:00-14:30	**Keynote Lecture** Using regional effect plots for machine learning model interpretation: The Effector python package, **Christos Diou,** *Harokopio University of Athens*

Monday, June 2nd, 2025

14:30-14:45 A Benchmark Dataset for Filament Extraction Using Generative Machine Learning, **Loris Berthelot,** *Laboratoire d'Informatique et Système*

14:45-15:00 A data-driven approach for star formation parameterization using symbolic regression, **Diane Salim,** *Rutgers University*

15:00-15:15 **Coffee break/ Poster Session**

15:15-16:00 **Session 4** Chair: **Maria Giovanna Dainotti,** *National Astronomical Observatory of Japan*

15:15-15:30 Star-by-star Galaxy Simulations Accelerated by Surrogate Modeling for Supernova Feedback, **Keiya Hirashima,** *University of Tokyo*

15:30-15:45 Fast Spectral Energy Distribution Fitting with Radiative Transfer Models, **Klea Panayidou,** *European University Cyprus & FORTH*

15:45-16:00 Determining the time before or after a galaxy merger with deep learning, **William Pearson,** *Narodowe Centrum Badań Jądrowych*

16:00-16:15 Bridging observations and simulations: a machine learning approach to galaxy clusters, **Efrain Gatuzz,** *Max-Planck Institute for Extraterrestrial Physics (MPE)*

21:00 **Public Talk in Greek & Stargazing @NOA, Thissio Visitor Center**

Tuesday, June 3rd, 2025

8:00-9:00	Registration
9:00-10:30	**Session 5** Chair: **Grigoris Maravelias**, *PeriAstron, IA-FORTH*
09:00-09:30	**Keynote Lecture** Information Field Theory: Concepts and Astrophysical Applications, **Torsten Enslin**, *Max-Planck-Institute for Astrophysics*
09:30-09:45	EMBER-2: towards implicit emulators to constrain astrophysics in FIRE-based simulations, **Mauro Bernardini**, *University of Zurich*
09:45-10:00	AI4Astro: Exploring Star Formation and ISM through Artificial Intelligence, **Duo Xu,** *CITA, University of Toronto*
10:00-10:15	Detection of stellar wakes in the Milky Way: A deep learning approach, **Sven Põder,** *National Institute of Chemical Physics and Biophysics*
10:15-10:30	Investigation of Galactic Populations and Merger Processes Using Machine Learning Methods, **Olcay Plevne,** *Istanbul University*
10:30-11:00	**Coffee break/ Poster Session**

Tuesday, June 3rd, 2025

11:00-12:30 **Session 6** Chair: Torsten Enslin, *Max-Planck-Institute for Astrophysics*

11:00-11:30 **Keynote Lecture**
Easy, Accurate, and Fast Machine Learning on Very Large Data Series Collections: Similarity Search and Subsequence Anomaly Detection, **Themis Palpanas,** *French University Institute*

11:30-11:45 Recent Results in the Application of AI to Astronomy Problems, **Vicky Kalogera,** *Northwestern University*

11:45-12:00 Diffusion Models for Emulating the Large-Scale Structure of the Universe in Modified Gravity Cosmologies, **Jorge Enrique García Farieta,** *University of Córdoba*

12:00-12:15 Extracting Early Universe Physics from The First Lunar-Based Observations of the 21 Cm Signal with A Novel Memory-Based Emulator, **John Dorigo Jones,** *University of Colorado, Boulder*

12:15-12:30 Enhancing Photometric Redshift Catalogs Through Color-Space Analysis: Application to KiDS-Bright Galaxies, **Priyanka Jalan,** *Center for Theoretical Physics, Polish Academy of Sciences*

12:30-13:45 **Lunch break/ Poster Session**

Tuesday, June 3rd, 2025

13:45-14:30 **Session 7** Chair: Eleni Vardoulaki, *National Observatory Athens*

13:45-14:00 Lux: A generative, multi-output, latent-variable model for astronomical data with noisy labels, **Daniel Horta Darrington**, *University of Edinburgh*

14:00-14:15 Towards Understanding the Milky Way's Matter Field and Dynamical Accretion History based on AI-GS^3 Hunter, **Haifeng Wang,** *Padova university*

14:15-14:30 Comparison of Photometric and Spectroscopic Labels in Classifying Dusty Stellar Sources Using Machine Learning in the Magellanic Clouds, **Sepideh Ghaziasgar,** *Institute for Research in Fundamental Sciences (IPM)*

14:30-15:00 **Coffee break/ Poster Session**

15:00-16:15 **Session 8** Chair: Georgios Vasilopoulos, *NKUA*

15:00-15:15 Machine Learning Unveils AGB Stars in Gaia DR3, **Tanya Kushwahaa,** *Cardiff University*

Tuesday, June 3rd, 2025

15:15-15:30 Leveraging Machine-Learning Methods to Study the Populations of Massive Evolved Stars in Various Galaxies, **Grigoris Maravelias,** *PeriAstron, IA-FORTH*

15:30-15:45 SpecCLIP: Combing and translating spectroscopic measurements for stars, **Yang Huang,** *University of Chinese Academy of Sciences*

15:45-16:00 Radio Galaxy Zoo EMU: Harnessing Citizen Science and AI to Advance Open Science Catalogs, **Eleni Vardoulaki,** *National Observatory Athens*

16:00-16:15 Transforming Astronomy Education and Science Communication: The Multifaceted Role of Artificial Intelligence, **Exodus Chun-Long Sit,** *IAU NAEC & NOC Hong Kong, China*

16:15-16:45 **Keynote Lecture**
The co-evolution of gravitational wave astrophysics and artificial intelligence
Tyson Littenberg, *Marshall Space Flight Center* (remote)

19:00 -20:00 **Astrophotography and AI @ Ceremony Hall of Harokopio University**

21:00 **Stargazing @Harokopio University of Athens**

Wednesday, June 4th, 2025

8:00-9:00	Registration
9:00-10:30	**Session 9** Chair: **Meghyn Bienvenu**, *CNRS*
09:00-09:30	**Keynote Lecture** Repairing Graphs with Users and AI, **Angela Bonifati,** *Lyon 1 University*
09:30-09:45	Automated development of an astrophysical semantic catalogue in PARSEC, **Iosif Oikonomakis,** *ICS FORTH*
09:45-10:00	EMUSE: Evolutionary Map of the Universe Search Engine, **Minh Huynh,** *CSIRO*
10:00-10:15	Learning the distribution of astrophysical spectra with generative models, **Nikolas Frediani,** *LMU Munich, University Observatory*
10:15-10:30	Explainability Of Astronomical Anomalies with Signatures, **Emmanuel Gangler,** *LPCA Université Clermont Auvergne*
10:30-11:00	**Coffee break/ Poster Session**

Wednesday, June 4th, 2025

11:00-12:15 **Session 10** Chair: Grigoris Tsagatakis, *University of Crete*

11:00-11:30 **Keynote Lecture**
A brief introduction to ontology-based data access, **Meghyn Bienvenu,** *CNRS*

11:30-11:45 Centralized vs Decentralized Agencies in Space Missions: A Game-Theoretic Approach, **Konstantinos Varsos,** *FORTH*

11:45-12:00 Statistical pitfalls when mining large databases, and how to deal with them, **Chris Koen,** *University of the Western Cape*

12:00-12:15 aweSOM: an Open-source Python Package for Efficient Clustering of Intermittency in Magnetized Plasma Turbulence, **Trung Ha,** *University of Massachusetts Amherst*

12:15-13:30 **Lunch break/ Poster Session**

13:30-15:00 **Session 11** Chair: Konstantinos Varsos, *FORTH*

13:30-14:00 **Keynote Lecture**
The Variable Universe with the Gaia Mission and AI Methods, **Laurent Eyer,** *Geneva Astronomical Observatory*

Wednesday, June 4th, 2025

14:00-14:15	SWAAT: An Automated Framework for Space Weather Data Analysis and Prediction, **Felipe Meza-Obando,** *Costa Rica Institute of Technology*
14:15-14:30	Servimon: Ai-driven Predictive Maintenance and Real-time Monitoring for Astronomical Observatories, **Kevin Munari**, *INAF - National Institute for Astrophysics*
14:30-14:45	Decoding Galaxy Evolution Models with cINNs via SDSS-like Spectrophotometric Data, **Nils Candebat,** *INAF - Arcetri Astrophysical Observatory*
14:45-15:00	Unlikely Pairs: A Reevaluation of CLIP Robustnes, **Helen Qu,** *Flatiron Institute*
15:00-15:30	**Coffee break/ / Poster Session**
15:30-16:30	**Session 12** Chair: **Laurent Eyer**, *Geneva Astronomical Observatory*
15:30-15:45	Accelerating SED Modeling of Astrophysical Objects Using Neural Networks, **Georgios Vasilopoulos,** *National and Kapodistrian University of Athens*
15:45-16:00	Evaluating small vision-language models as AI assistants for radio astronomical source analysis tasks, **Simone Riggi,** *Istituto Nazionale di Astrofisica (INAF)*
16:00-16:15	Estimating Fluxes Densities of Extended Cosmological Radio Sources Exploiting Vision Transformers, **Nicoletta Sanvitale,** *INAF - Institute for Radioastronomy*
16:15-16:30	Simulating realistic radio continuum survey maps with diffusion models, **Tobias Vicanek Martinez,** *Hamburg Observatory*
21:00	**Public Talk in Greek& Stargazing @N.O.A., Thissio Visitor Center**

Thursday, June 5th, 2025

8:00-9:00 Registration

9:00-10:30 **Session 13** Chair: **Dragana Ilic**, *University of Belgrade*

09:00-09:30 **Keynote Lecture**
Do Androids Dream of Exploding Stars and Receding Galaxies, **Federica Bianco,** *University of Delaware*

09:30-09:45 Metalearning and AI for Time-Domain Astrophysics of AGNs in the Era of Large-Scale Surveys, **Andjelka Kovacevic,** *University of Belgrade*

09:45-10:00 Casting a wide net in the search for supermassive black hole binaries with null-signal templates, **Ethan Partington,** *FORTH Institute of Astrophysics*

10:00-10:15 The ALeRCE Broker, **Lorena Hernandez Garcia,** *University of Valparaiso*

10:15-10:30 Early Identification of Optical Tidal Disruption Events with The Fink Broker, **Miguel Llamas Lanza,** *Fink broker*

10:30-11:00 **Coffee break / Poster Session**

Thursday, June 5th, 2025

11:00-12:30 **Session 14** Chair: Federica Bianco,

11:00-11:30 **Keynote Lecture**

Cosmic Conversations: Unleashing the Power of Natural Language Interfaces in Science and Astrophysics, **Georgia Koutrika,** *Athena Research Center*

11:30-11:45 There they are! Identifying outliers in source catalogues, **Holger Stiele,** *Jülich Supercomputing Centre*

11:45-12:00 Harnessing the power of future surveys with AI, **Miguel Llamas Lanza,** *Fink broker*

12:00-12:15 Application of Ensemble Learning Algorithms for Robust Identification of Wolf-Rayet Stars, **Rajorshi Bhattacharya,** *University of New Mexico*

12:15-12:30 Tracing Galactic Mergers: A Data-Driven Search for Enceladus Stars in the Solar Neighborhood, **Olcay Plevne,** *Istanbul University*

12:30-13:30 **Lunch break / Poster Session**

13:30-15:45 **Session 15** Chair: **Georgia Koutrika**, *Athena Research Center*

13:30-13:45 MUSE@M33: Classifying Spectra of Emission-Line Regions with Neural Networks, **Caterina Bracci,** *University of Florence / INAF*

Thursday, June 5th, 2025

13:45-14:00 Extending the EVA Platform with LLM+RAG Capabilities to Infer Astronomical Object Types from Scientific Publications within ESASky, **Miguel Doctor Yuste,** *Telespazio UK for ESA*

14:00-14:15 Modern Deep Learning Approaches to Galaxy Classification, **Dimitrios Katsaros,** *University of Thessaly*

14:15-14:30 Application Of Machine Learning Methods to The Identification of Star-Forming Regions, **Karolina Plakitina,** *Institute of Astronomy of the Russian Academy of Sciences*

14:30-14:45 Coffee break / Poster Session

14:45-15:00 Unsupervised Classification of Gamma-Ray Bursts from Blazars (GRBBLs) with Machine Learning, **Matteo Cerruti,** *Université Paris Cité - Astroparticles and Cosmology (APC)*

15:00-15:15 Detection of lensed quasars with ALeRCE, **Consuelo Núñez,** *Universidad de Valparaíso*

Thursday, June 5th, 2025

15:15-15:30 FALCO: a Foundation model of Astronomical Light Curves for time domain astronomy, **Xiaoxiong Zuo,** *University Observatory Munich / National, Astronomical Observatories of Chinese Academy of Sciences*
Yihan Tao*, National Astronomical Observatories,Chinese Academy of Sciences*

15:30-15:45 CLONES: Digital Twins of the Local Universe for Bias-Free Inference, **Jenny Sorce,** *CNRS CRIStAL / IAS*

18:00-23:00 **Tour & Gala Dinner**
@National Observatory of Athens, Thissio Visitor Center

Friday, June 6th, 2025

8:00-9:00	Registration
9:00-10:30	**Session 16** Chair: **Andjelka Kovacevic**, *University of Belgrade*
09:00-09:30	**Keynote Lecture** To CLEAN or not to CLEAN: Data Processing in the ngVLA era, **Hendrik Mueller,** *NRAO*
09:30-09:45	Reinforcement Learning for Radio Interferometry Data Processing, **Brian Kirk,** *New Mexico Institute of Mining and Technology/ NRAO*
09:45-10:00	Maria Goes Nifty - Simulation, Gaussian Process-Based Reconstruction and Denoising of (Sub-)Millimetre Single-Dish Telescope Data, **Jonas Würzinger,** *Technical University of Munich*
10:00-10:15	Learning from the present for the future: the Jülich LOFAR Long-term Archive, **Holger Stiele,** *Jülich Supercomputing Centre*
10:15-10:30	DIReCT - Deep learning Image Reconstruction with Closure Terms for Very Long Baseline Interferometry, **Samuel Lai,** *CSIRO*
10:30-11:00	**Coffee break / Poster Session**

Friday, June 6th, 2025

11:00-12:15 **Session 17** Chair: Jean-Luc Starck,

11:00-11:30 **Keynote Lecture**
Uncertainty-Aware Machine Learning for Astronomical Data Analysis,
Grigoris Tsagatakis, *University of Crete*

11:30-11:45 Inferring the redshift of Gamma-Ray Bursts with Machine learning tools,
Maria Giovanna Dainotti, *National Astronomical Observatory of Japan*

11:45-12:00 From Noise to Knowledge: Diffusion Models for Probabilistic Interpolation of Sagittarius A*'s Multi-Wavelength Data, **Gabriel Sasseville,** *University of Montreal*

12:00-12:15 Potential of Feature Extraction Methods Using Kernel PCA and Kernel SHAP in Astronomy, **Hiroma Okubo,** *University of Tsukuba*

12:15-13:30 **Lunch break / Poster Session**

Friday, June 6th, 2025

13:30-14:30 **Session 18** Chair: Hendrik Mueller, *NRAO*

13:30-13:45 An optical gamma-ray burst catalogue with measured redshift - I. Data release of 535 gamma-ray bursts and colour evolution, **Maria Giovanna Dainotti,** *National Astronomical Observatory of Japan*

13:45-14:00 A Natural Language Interface for Efficient Data Retrieval in SDSS, **Prathamesh Tamhane,** *University of Alabama in Huntsville*

14:00-14:15 Neural Networks for Spectral Analysis: Continuum Reconstruction and Metal Absorber Identification in Quasar Observations, **Francesco Pistis,** *Università degli studi di Milano-Bicocca*

14:15-14:30 Hyperspectral fusion with surrogate model fitting for X-ray astrophysics, **Julia Lascar,** *CEA / University Paris Saclay*

14:30 **Closing** Chair: Yannis Liodakis, *Institute of Astrophysics - FORTH*

POSTER SESSION LIST

P01 Machine Learning-Enhanced Radio Footprint Analysis for Improved Cosmic Ray Detection in the GRAND Experiment, **Luana Melnek dos Anjos,** *San Francisco State University*

P02 Exploring the outskirts of galaxies with the Minkowski functionals and machine learning, **Li Wen Liao,** *Institute of Space Science-CSIC; IEEC*

P03 Super-Resolution Imaging in the Mid-Infrared: A CycleGAN Approach for the Galactic Center, **Jiwon Han,** *Ewha Womans University*

P04 Characterization of Polycyclic Aromatic Hydrocarbons in the Local Universe using Machine Learning Techniques, **Subhajit Kar,** *S.N. Bose National Centre for Basic Science*

P05 Machine-Assisted Anatomy of Galactic Environments: Deep Insights into Galaxy Distributions with the Variational Autoencoder, **Eun Taek Gim,** *Yonsei University*

P06 Optimized Multi-messenger Follow-up With The Zwicky Transient Facility, **Kira Nolan,** *CALTECH*

P07 Improving Tidal Disruption Event Classification with Multimodal Learning Using Late-Time Photometric Plateaus, **Vysakh Anilkumar**, *Leiden university*

POSTER SESSION LIST

P08 AI for primary students using spreadsheets, **Sze Leung Cheung, Stardusts**

P09 Emulating redshift-dependent blending in cosmic shear with boosted trees, **Zekang Zhang,** *LMU Munich*

P10 Sequencing Spectra of Young Planetary Systems to Decipher Planet Formation: Methodology for Unsupervised Clustering and CLUES Software Demonstration, **Cicero Lu,** *NOIRLab/ Gemini Observatory*

P11 GANexo v2.0: Enhancing Exoplanetary Transit Signal Analysis with Real Data Integration, **Felipe Meza-Obando,** *Costa Rica Institute of Technology*

P12 Unfolding Stellar Properties with Deep Learning, **Ilay Kamai,** *Israel Institute of Technology*

P13 Interacting Winds and Giant Eruptions in Massive Binaries, and the Effect they have on the Erupting and Accreting Stars, **Amit Kashi,** *Ariel University*

P14 Denoising and Signal Restoration for Multi-instrumentastrophysical Observations: From Simulations to Real Data, **Arnab Lahiry,** *Foundation for Research and Technology – Hellas*

POSTER SESSION LIST

P15 FLAME: Fitting LyAlpha Absorption lines using Machine Learning, **Priyanka Jalan,** *Center for Theoretical Physics, Polish Academy of Sciences*

P16 Comparing DDPMs and Unets for scientific hydrodynamical emulations, **Alessandro Ruzza,** *Università degli studi di Milano*

P17 AI-Powered Simulations and Deblending Strategies for CASTOR: Preparing for Next-Generation UV Space Observations, **Teimoorinia Hossen,** *NRC/CADC*

P18 Machine learning for the automatic identification of Planetary Nebulae and Symbiotic Stars using the Gaia DR3 spectra, **Luis José Corral Escobedo**, *Universidad de Guadalajara*

(ii) Summary of the scientific highlights of the meeting

During the IAUS 397 we discussed 8 major themes,

1) Artificial intelligence
2) Data management
3) Knowledge Graphs
4) Knowledge representation and reasoning
5) Big data visualization
6) Data mining
7) Image processing/reconstruction
8) Astronomical databases

that encompassed 8 key topics in Astrophysics and Cosmology,

1) Space and Heliophysics
2) Cosmology and the physics of galaxies
3) Stellar and galactic science
4) Classification and brokers
5) Compact objects
6) Radio/ Very long baseline interferometry
7) Education
8) Other

Figures 1 shows the distribution of the contributions according to their thematic separation.

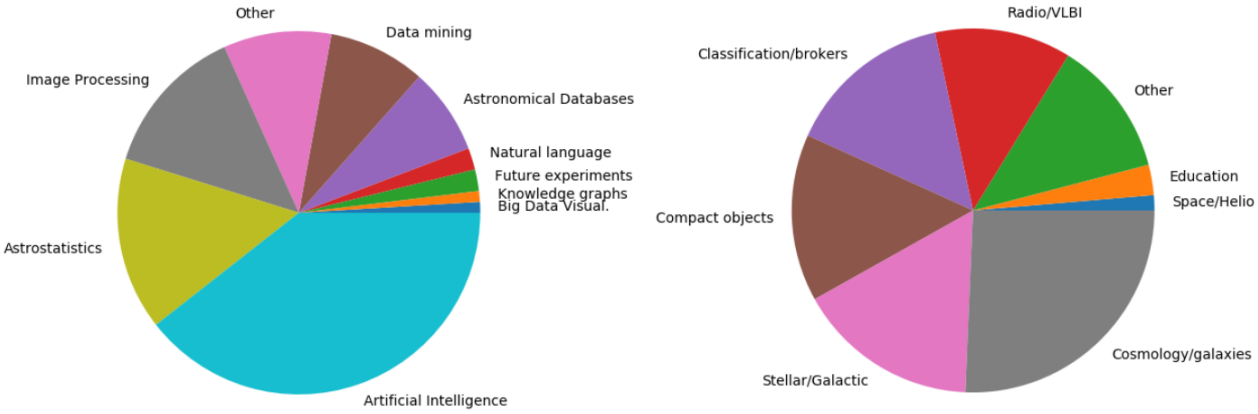


Figure 1. *Thematic separation according to Computer Science (left) and Astrophysics (right).*

We had a plethora of talks in the interface between computer science and astrophysics covering all the aforementioned topics. The scientific highlights of the meeting are best summarized by the talks of the keynote speakers:

Federica Bianco (F), U. Delaware, USA

Title: Do Androids Dream of Exploding Stars and Receding Galaxies

Abstract: The Vera C. Rubin Observatory Legacy Survey of Space and Time will scan a volume of the universe to this day unexplored, 20 orders of magnitude in distance scales and 60 orders of magnitude in energy scales, 20Tb of data

every night, opening regions of the parameter space unexplored to this day, With big data come big challenges, and the astrophysical community has risen up to the challenge, developing innovative data analysis paths. But only up to a point. What is there and what is missing in the AI approaches to Rubin LSST data?

Meghyn Bienvenu (F), CNRS, France

Title: A brief introduction to ontology-based data access

Abstract: This talk will provide a brief introduction to ontology-based data access (OBDA), a promising paradigm for designing intelligent information systems which has been extensively studied within the symbolic AI and database communities over past twenty years. In a nutshell, the idea is to enrich data with an ontology, which provides a user-friendly vocabulary as well as semantic knowledge about the application domain. The addition of an ontology brings several advantages: it can help to simplify query formulation, provide a means to integrate data from heterogeneous sources, and enable automated reasoning to identify data inconsistencies and provide more complete answers to queries. The hope is that this talk can serve as a basis for discussions on the role that OBDA can play in helping to organize, integrate, and query astrophysics and cosmology data.

Angela Bonifati (F), U. Lyon 1 – CNRS, France

Title: Repairing Graphs with Users and AI

Abstract: Graphs are increasingly used in real-world applications involving human users, yet they often suffer from inconsistencies that violate domain-specific constraints. Repairing graph errors typically requires expert knowledge and might lead to possible conflicts among violations. Meanwhile, generative AI has demonstrated the ability to produce commonsense knowledge, which can be valuable for graph correction. In this talk, I will present our work on generating high-quality graphs through a user-centric approach and a graph constraint mining method using large language models. Their interplay and integration highlights promising directions for future research around data engineering and AI .

Christos Diou (M), HUA, Greece

Title: Using regional effect plots for machine learning model interpretation: The Effector python package

Abstract: Machine learning (ML) is playing an increasingly vital role in astrophysics, enabling researchers to analyze large and complex datasets for tasks such as stellar object classification and gravitational wave detection. However, many ML models are highly non-linear and involve complex interactions among input features, making them difficult to interpret and are often perceived as "black boxes." Interpretability is therefore critical-not only for ensuring scientific validity and trust, but also for uncovering new scientific insights. Global feature effect methods help address this challenge by quantifying how each input feature influences the model’s output on average. For example, they can reveal how a specific photometric feature affects the predicted probability of an object class. While intuitive and accessible, these global explanations can be misleading when strong feature interactions cause individual behavior to deviate significantly from the average. To overcome this limitation, regional effect plots partition the feature space into a small number of more homogeneous subspaces and generate feature effect plots within each, capturing effect patterns more accurately. In this talk, we will briefly review the most widely used global feature effect methods and their regional extensions. We will also introduce Effector, an open-source Python package for generating both global and regional feature effect plots. Effector provides a unified, easy-to-use API for several global explanation methods and automatically identifies optimal subspaces that reduce heterogeneity for regional analysis. Documentation, tutorials, and source code are available at https://xai-effector.github.io/.

Torsten Enslin (M), MPA, Germany

Title: Information Field Theory: Concepts and Astrophysical Applications

Abstract: Fields play a central role in all areas of astrophysics, like the density, velocity, magnetic, or gravitational field. Inferring an astrophysical field from data is an ill posed problem, as the finite, noisy, and incomplete data can not alone constrain the infinite number of degrees of freedom of a function over continuous space. Domain knowledge has to regularize the set of possible solutions, however, usually significant uncertainties remain and need to be quantified. This can be done via information field theory (IFT), which is a mathematical formulation of probabilistic field inference. Here, the basic concepts of IFT and its numerical implementation are introduced and its application to astrophysical datasets is demonstrated.

Laurent Eyer (M), U. Geneva, Switzerland

Title: The Variable Universe with the Gaia Mission and AI Methods

Abstract: The Gaia mission has observed over two billion stars repeatedly across the entire sky over ten years, revealing the many astronomical objects that vary on human timescales from second to years. Its repeated astrometric, photometric, and spectroscopic measurements create an unprecedented dataset. To extract meaningful insights from these many time series, we have used machine learning techniques for crossmatching, variability detection, and variability classification. This approach has led to the largest catalogue of classified variable sources ever produced over the entire celestial sphere.

Georgia Koutrika (F), Athena RC

Title: Cosmic Conversations: Unleashing the Power of Natural Language Interfaces in Science and Astrophysics

Abstract: Natural language interfaces are revolutionizing the way researchers analyze vast datasets, making complex data accessible through intuitive queries. In this talk, we will explore the evolution of these systems, from their early beginnings to the cutting-edge neural-based innovations of today. We will also tackle the challenges that lie ahead, such as handling complex computations and enhancing the accuracy of natural language understanding. By bridging the gap between data analysis and cosmic exploration, we can pave the way for a future where natural language interfaces empower scientific discovery.

Tyson Littenberg (M), NASA/MSFC, USA

Title: The co-evolution of gravitational wave astrophysics and artificial intelligence

Abstract: The fields of Artificial Intelligence and Gravitational Wave Astrophysics have serendipitously come of age in parallel, revolutionizing what we are learning about the Universe and how we are learning it. This talk will survey the fundamentals of gravitational wave data analysis, highlight where AI methods have been applied, and forecast how the fields will continue to evolve together.

Hendrik Müller (M), NRAO, USA

Title: To CLEAN or not to CLEAN: Data Processing in the ngVLA era

Abstract: For decades, imaging in radio interferometry relied on CLEAN. Recently, RML, Bayesian, and AI methods have emerged, enabling high-quality, automated, super-resolved reconstructions. These methods excel especially in low-resource settings, where traditional techniques struggle to account for spatial and temporal correlations. Next-generation radio interferometers like ngVLA will bring a new data challenge due to large data volumes, potentially requiring a return to classical matching pursuit approaches within a major/minor loop framework due to their simplicity and consequentially their speed. NRAO is actively preparing for this era of big-data processing and is laying out the algorithmic and pipeline-heuristical foundations already now. In this talk, I will review recent approaches to data processing by NRAO to scale algorithms towards its next generation of flagship instruments. These include a novel software infrastructure envisioned to replace CASA, especially developed for scalable deployment on GPUs. Algorithmic-wise, the development of efficient, scalable and fast wide-band and wide-field multiscale deconvolution

algorithms is paramount. Much anticipated convergence acceleration is achieved by clustering components informed by Bayesian heuristics, applying concepts and ideas of convex optimization to the CLEAN framework, and the utilization of AI for efficient compressing among the spatial and spectral domain.

Themis Palpanas (M), U. Paris Cite, France

Title: Easy, Accurate, and Fast Machine Learning on Very Large Data Series Collections: Similarity Search and Subsequence Anomaly Detection

Abstract: There is an increasingly pressing need, by several applications in diverse domains, for developing techniques able to manage and analyze very large collections of sequences, or data series. Examples of such applications come from various monitoring applications, including in power utility companies, where we need to apply machine learning techniques for knowledge extraction. It is not unusual for these applications to involve numbers of data series in the order of hundreds of millions to billions, which are often times not analyzed in their full detail due to their sheer size. However, no existing data management solution can offer native support for sequences and the corresponding operators necessary for complex analytics. In this talk, we describe our efforts in designing techniques for indexing and analyzing truly massive collections of data series that enable scientists to run complex analytics on their data. These techniques are orders of magnitude faster than the state of the art. We also present our recent work on (essentially, parameter-free) subsequence anomaly detection and explanation, which is both more accurate and faster than competing approaches.

Jean-Luc Starck (M), CEA-Saclay, France

Title: Perspectives on the past, present, and future of astronomical imaging

Abstract: Radio astronomers were pioneers in developing deconvolution techniques, addressing unique challenges in imaging due to the nature of radio waves, with their long wavelengths leading to incomplete, noisy, or low-resolution data. Techniques such as CLEAN and Maximum Entropy Method were developed to reconstruct missing data and recover high-fidelity images, even with partial information. These methods provided a statistical basis for handling data sparsity and non-linear reconstruction challenges, establishing principles that later benefited optical and infrared astronomy and even medical imaging. The optical flaw in the Hubble Space Telescope (HST) following its 1990 launch further propelled advancements in deconvolution, as astronomers sought tools to overcome its spherical aberration. This period marked the emergence of wavelet-based deconvolution methods, which allowed multi-scale image analysis—critical for recovering both fine and diffuse details blurred by HST's optical issues. Wavelet methods became highly valued for addressing varied spatial scales in astronomical imaging, setting a new standard for restoration techniques. In the mid-2000s, the advent of compressed sensing (CS) provided a strong theoretical framework for wavelet and sparse deconvolution approaches. CS, showing that high-quality images could be reconstructed from fewer measurements if they were sparse in some basis, such as wavelets. This theoretical support significantly advanced deconvolution in astronomy and related fields, enabling more efficient and accurate data reconstruction. More recently, deep learning has revolutionized deconvolution and astronomical imaging techniques. Convolutional neural networks (CNNs) and generative models offer new ways to enhance image restoration, noise reduction, and feature extraction with unprecedented accuracy. Deep learning, critical for handling the vast data volumes in modern astronomy, has enabled detailed image processing across a range of observatories, from Hubble and ALMA to the upcoming JWST. However, deep learning also presents new challenges—such as interpretability, reliability, and the need for precise validation—that must be addressed for these methods to be fully trusted in scientific applications.

Grigorios Tsagkatakis (M), ICS-FORTH, Greece

Title: Uncertainty-Aware Machine Learning for Astronomical Data Analysis

Abstract: Machine learning, and particularly supervised deep learning, is reshaping astronomical data analysis. However, in contrast to standard domains such as computer vision, astronomy imposes stringent requirements not only on predictive accuracy but also on the reliable quantification of uncertainties. Two primary sources of uncertainty are

prevalent: label uncertainty, arising from measurement noise or intrinsic ambiguity, and model uncertainty, linked to limitations in generalization. This talk will present strategies for addressing label uncertainty through the design of probabilistic loss functions, enabling models to account for uncertain ground truth information during training. For model uncertainty quantification, we will explore both parametric methods, such as Bayesian deep learning and deep ensembles, and non-parametric approaches, with an emphasis on conformal prediction. These techniques will be illustrated through applications to key astronomical problems, including redshift estimation and gravitational lensing modeling, highlighting their impact on building reliable predictive models.

(iii) List of participants

The symposium was attended by a total of 109 participants from 28 countries.

Name	Affiliation	Country
Amit Kashi	Ariel University	Israel
Andjelka Kovacevic	University of Belgrade	Serbia
Angela Bonifati	Lyon 1 University	France
Antonios Nathanail	Research Center for Astronomy and Applied Mathematics	Greece
Arnab Lahiry	Foundation for Research and Technology - Hellas (FORTH)	Greece
Asha Abd	Swinburne University of Technology	Australia
Brian Kirk	New Mexico Institute of Mining and Technology/ NRAO	United States
Caterina Bracci	University of Florence / INAF	Italy
Chris Koen	University of the Western Cape	South Africa
Christos Diou	Department of Informatics and Telematics, Harokopio University of Athens	Greece
Cicero Lu	NOIRLab/Gemini Observatory	United States
Claudio Gheller	Intitute for Radioastronomy - INAF	Italy
Consuelo Nunez	Universidad de Valparaíso	Chile
Daniel Horta Darrington	University of Edinburgh	United Kingdom
Darren Croton	Swinburne University of Technology	Australia
Diane Salim	Rutgers University	United States
Dimitrios Katsaros	University of Thessaly	Greece
Dragana Ilic	University of Belgrade, Faculty of Mathematics	Serbia
Duo Xu	CITA, University of Toronto	Canada
Efrain Gatuzz	Max-Planck Institute for Extraterrestrial Physics (MPE)	Germany
Eleni Lavasa	NKUA & ATHENA RC	Greece
Eleni Vardoulaki	National Observatory Athens	Greece
Emmanuel Gangler	LPCA - Université Clermont Auvergne	France
Ethan Partington	FORTH Institute of Astrophysics	Greece
Eun Taek Gim	Yonsei University	South Korea
Eva Sextl	LMU Munich / University Observatory	Germany
Federica Bianco	University of Delaware	United States

Felipe Meza-Obando	Costa Rica Institute of Technology	Costa Rica
Francesco Pistis	Università degli studi di Milano-Bicocca	Italy
Gabriel Sasseville	University of Montreal	Canada
George Vasalos	National Observatory of Athens	Greece
Georgia Koutrika	Athena Research Center	Greece
Georgios Vasilopoulos	National and Kapodistrian University of Athens	Greece
Grigorios Tsagkatakis	FORTH	Greece
Grigoris Maravelias	PeriAstron, IA-FORTH	Greece
Haifeng Wang	Zhejiang Laboratory	China
Helen Qu	Flatiron Institute	United States
Hendrik Mueller	NRAO	United States
Hiroma Okubo	University of Tsukuba	Japan
Holger Stiele	Jülich Supercomputing Centre; Forschungszentrum Jülich	Germany
Hossen Teimoorinia	NRC/CADC	Canada
Huaxi Chen	Zhejiang Lab	China
Ilay Kamai	Israel Institute Of Technology	Israel
Ingyu Yun	sejong university	South Korea
Ioannis Liodakis	Institute of Astrophysics - FORTH	Greece
Iosif Oikonomakis	ICS FORTH	Greece
Jean-Luc Starck	University of Crete	Greece
Jenny Sorce	CNRS CRIStAL / IAS	France
Jiwon Han	Ewha Womans University	South Korea
John Dorigo Jones	University of Colorado, Boulder	United States
Jonas Würzinger	Technical University of Munich	Germany
Jorge Enrique Garcia Farieta	University of Córdoba	Spain
Julia Lascar	CEA / University Paris Saclay	France
Karl Glazebrook	Swinburne University of Technology	Australia
Karolina Plakitina	Institute of Astronomy of the Russian Academy of Sciences	Russia
Keiya Hirashima	The University of Tokyo	Japan
Kevin Munari	INAF - National Institute for Astrophysics	Italy
Kira Nolan	Caltech	United States
Klea Panayidou	European University Cyprus & Foundation for Research and Technology -Hellas (FORTH)	Cyprus
Konstantinos Varsos	Foundation for Research and Technology Hellas	Greece
Laurent Eyer	Geneva Astronomical Observatory	Switzerland
Lisa Voigt	University of Essex	United Kingdom
Li Wen Liao	Institute of Space Science-CSIC; IEEC	Spain
Lorena Hernadez Garcia	University of Valparaiso	Chile

Lorenzo Branca	University of Heidelberg	Germany
Luana Melnek dos Anjos	San Francisco State University	United States
Luca Tortorelli	LMU Munich	Germany
Luis Jose Corral	Universidad de Guadalajara	Mexico
Maria Giovanna Dainotti	National Astronomical Observatory of Japan	Japan
Matteo Cerruti	Université Paris Cité - Astroparticles and Cosmology (APC)	France
Mauro Bernardini	University of Zurich	Switzerland
Meghyn Bienvenu	CNRS	France
Mehdi Noor	Institut d'Astrophysique Spatiale	France
Miguel Doctor Yuste	Telespazio UK for ESA	Spain
Miguel Llamas Lanza	Fink broker	France
Minas Karamanis	University of California, Berkeley	United States
Minh Huynh	CSIRO	Australia
Nan Li	National Astronomical Observatories, Chinese Academy of Sciences	China
Nicoletta Sanvitale	INAF - Institute for Radioastronomy	Italy
Nikolas Frediani	LMU Munich, University Observatory	Germany
Nils Candebat	INAF - Arcetri Astrophysical Observatory,	Italy
Olcay Plevne	Istanbul University	Turkey
Prathamesh Tamhane	University of Alabama in Huntsville	United States
Priyanka Jalan	Center for Theoretical Physics, Polish Academy of Sciences	Poland
Rajorshi Bhattacharya	University of New Mexico	United States
Samuel Lai	CSIRO	Australia
Sayali Kulkarni	Centro de Estudios de FIsica del Cosmos de Aragon	Spain
Sepideh Ghaziasgar	Institute for Research in Fundamental Sciences (IPM)	Iran
Silvana G. Navarro-Jimenez	Universidad de Guadalajara	Mexico
Simone Riggi	Istituto Nazionale di Astrofisica (INAF)	Italy
Sven Poder	National Institute of Chemical Physics and Biophysics	Estonia
Sze Leung Cheung	Stardusts	Thailand
Tanya Kushwahaa	Cardiff University	United Kingdom
Themis Palpanas	French University Institute	France
Tobias Vicanek Martinez	Hamburg Observatory	Germany
Torsten Enslin	Max-Planck-Institute for Astrophysics	Germany
Trung Ha	University of Massachusetts Amherst	United States
Tyson Littenberg	NASA Marshall Space Flight Center	United States
Vasilis Efthymiou	Harokopio University of Athens	Greece
Vicky Kalogera	Northwestern University	United States
Vysakh Anilkumar	Leiden university	Netherlands

William Pearson	Narodowe Centrum Badań Jądrowych	Poland
Xiaoxiong Zuo	University Observatory Munich / National Astronomical Observatories of Chinese Academy of Sciences	Germany
Xiaoyu Tang	Zhejiang lab	China
Yangbin Xie	Zhejiang Lab	China
Yihan Tao	National Astronomical Observatories,Chinese Academy of Sciences	China
Yitian Xue	Zhejiang Lab	China
Yosry Azzam	NRIAG	Egypt
Zekang Zhang	LMU Munich	Germany

(iv) List of recipients of IAU grants

Name	Affiliation	Country	Gender	Amount
Iosif Oikonomakis	ICS-Forth	Greece	M	350.00 €
Yosry Azzam	National Research Institute of Astronomy and Geophysics (NRIAG)	Egypt	M	900.00 €
Tsoukalas Theofilos	Harokopio University	Greece	M	500.00 €
Francesco Pistis	Universita degli studi di Milano-Bicocca	Italy	M	500.00 €
Johnny Dorigo Jones	University of Colorado Boulder	USA	M	500.00 €
Nikolas Frediani	LMU	Germany	M	450.00 €
Luca Tortorelli	LMU	Germany	M	350.00 €
Miguel Llamas Lanza	Fink broker	France	M	400.00 €
Holger Stiele	Julich Supercomputing Center	Germany	M	400.00 €
Sepide Ghaziasgar	Institute for Research in Fundamental Sciences	Iran	F	350.00 €
Jiwon Han	Ewha Womans University	Japan	F	1,000.00 €
Keiya Hirashima	The University of Tokyo	Japan	M	1,000.00 €
Dragana Ilic	University of Belgrade	Serbia	F	350.00 €
Priyanka Jalan	Center of theoretical Physics	Poland	F	500.00 €
Amit Kashi	Ariel University	Israel	M	600.00 €
Dimitrios Katsaros	University of Thessaly	Greece	M	350.00 €

Grigoris Maravelias	Institute of Astrophysics - FORTH	Greece	M	450.00 €
Andjelka Kovacevic	University of Belgrade	Serbia	F	350.00 €
Tanya Kushwahaa	Cardiff University	UK	F	250.00 €
Samuel Lai	Commonwealth Scientific and Industrial Research	Australia	M	1,000.00 €
Li Wen Liao	Institute of Space Sciences	Spain	F	600.00 €
Felipe Meza Obando	Tecnologico de Costa Rica	Costa rica	M	1,500.00 €
Consuelo Nunez Pizarro	Universidad de Valparaiso	Chile	F	1,000.00 €
Hiroma Okubo	University of Tsukuba	Japan	M	1,200.00 €
Gabriel Sasseville	University of Montreal and McGill University	Canada	M	1,000.00 €
Karolina Plakitina	Institute of Astronomy of the Russian Academy of Sciences	Russia	F	500.00 €
Sven Põder	National Institute of Chemical Physics and Biophysics	Esthonia	M	500.00 €
Melnek Dos Anjos Luana	San Francisco State University	USA	F	500.00 €
Prathamesh Tamhane	University of Alabama Huntsville	USA	M	800.00 €
Anilkumar Vysakh	Leiden University	Netherlands	M	300.00 €
Antonis Nathanail	Academy of Athens	Greece	M	350.00 €
Sze-leung Cheung	Stardusts	Thailand	M	700.00 €
Olcay Plevne	Istanbul University	Turkey	M	500.00 €

Total number of recipients: 33 (Female 10 / Male 23) **Total: 20,000 €**

(v) An Executive Summary of the Meeting

The symposium took place on the grounds of the historical campus of the Harokopio University in Athens. Harokopio was established as a school for home economics in 1929 and converted to a University in 1990. The main campus is located in the neighborhood of Kallithea in Athens. We were hosted at the main amphitheater for all five days of the symposium and utilized the ceremony hall for outreach activities.

The symposium opened with a short greeting from the Rector of the Harokopio University, emphasizing on the importance of this event. During the meeting we covered all topics related to artificial intelligence. The days were roughly separated according to astrophysical relevance. On Monday, we focused more on applications of AI to cosmology and the science of galaxies. Tuesday, we focused on stellar and Galactic science, Wednesday on Space/Heliophysics and compact objects, and Thursday, on time-domain science and classification/brokers. On Friday, we focused on radio and Very Long Baseline interferometry. We closed the symposium with the customary, for computer science, statistics of the event, including the number of participants (109) and countries represented (28).

Figure 2. *Symposium photograph in front of the historic main building of the Harokopio University of Athens.*

On Thursday, we also had the symposium dinner at the historic grounds of the National Observatory of Athens in Thissio, overlooking the Acropolis. Part of the dinner was the tour of the observatory, and the Antikythera mechanism - the first computer ever made for astronomical applications (Fig. 3), as well as stargazing until late at night.

In addition to the scientific program, we had a lively outreach program in coordination with the National Observatory of Athens. We organized four public talks. Two of the talks took place at the National Observatory in Thissio on Monday and Wednesday. The first talk was on Computer Science and the second on Astrophysics. The talks were in Greek and open to the general public. Two more talks took place at Harokopio University on Tuesday on Astrophotography and AI. The talks were open to the general public and in English. We also organized a stargazing event at the main campus of the Harokopio University of Athens on Tuesday night (Fig. 4), supported by two Greek amateur astronomy clubs, the Greek Amateur Astronomical Union and the Astronomical Union of Sparta “DIOS KOUROI”. The event was meant for both the participants and the general public.

However, the outreach events continued even after the end of the symposium. The week after the symposium, an opinion article about the conclusions of the symposium was published on one of the biggest national newspapers in Greece (To VIMA), and two weeks after the symposium, an invited talk was given at the 19th Symposium and Summer School On Service-Oriented Computing, again, on the conclusions drawn from the UniversAI symposium.

Figure 3. *Tour by Dr. Eleni Vardoulaki of the National Observatory of Athens historical grounds at the hill of the nymphs overlooking the Acropolis. Left: The entrance of the historic building of the National observatory of Athens. Right: The replica of the antikythera mechanicm, the first computer for astronomical applications.*

Figure 4. Stargazing night with the help of amateur astronomers at the courtyard of the Harokopio University of Athens' main campus.