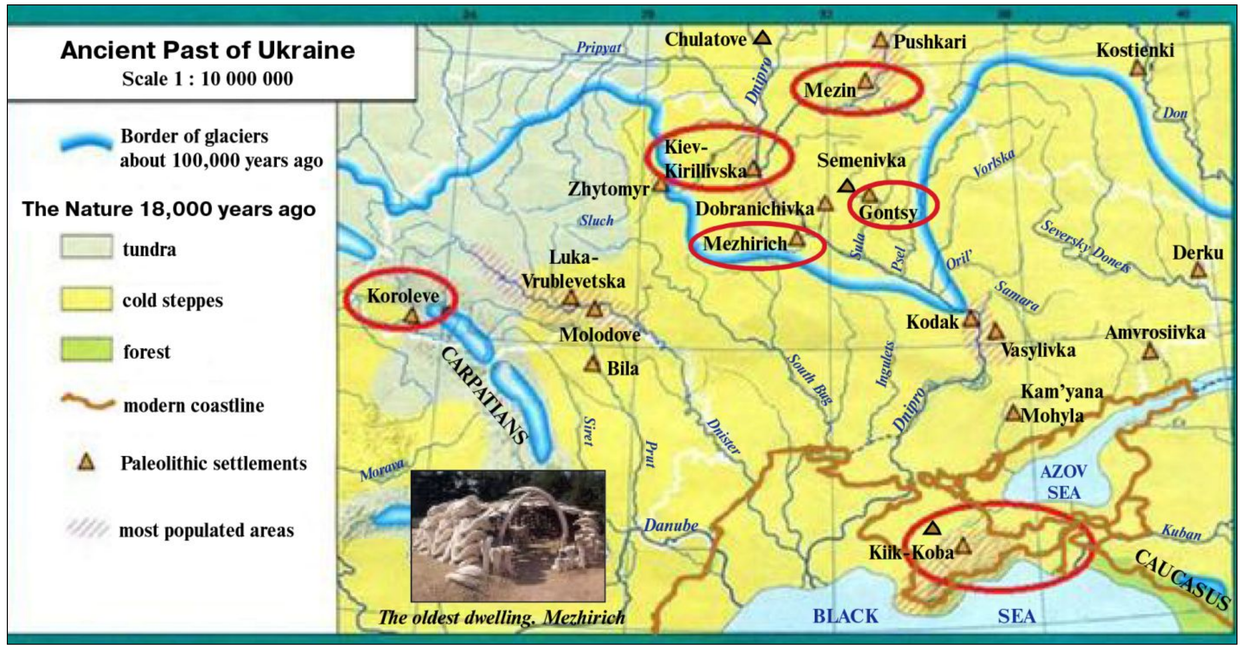
# Astronomy in Ukraine: landscape, resilience, and the impact of war

## Ukrainian Astronomical Association (UAA)

**Yaroslav Yatskiv, Iryna Vavilova, and Ihor Lukianyk**

***June 12, 2025, Leiden Onservatory***

# ArcheoAstronomy Finds at the settlements in the territory of Ukraine. Paleolithic era




A map showing Paleolithic settlements in the territory of Ukraine, including Dobranichivka, Gontsy, Kiev-Kirilllovskaya, Kiik-Koba, Kodak, Mezhirich, Mezin, Molodove and others

A close-up of the right-hand end of the engraved mammoth tusk fragment from Kiev-Kirillovskaya (National Museum of History of Ukraine, Kyiv)

The Mezin composite (left) and wide (right) bracelets, which are considered as the paleo-astronomical calendars (National Science Museum of Natural History in Kyiv (left), National Museum of History of Ukraine in Kyiv (righr))

# ArcheoAstronomy Finds at the settlements in the territory of Ukraine. From e-Neolithic era to the V century


The ancient vessels (Trypillya culture, IV–II Millennium B.C.) with the astronomical symbolic



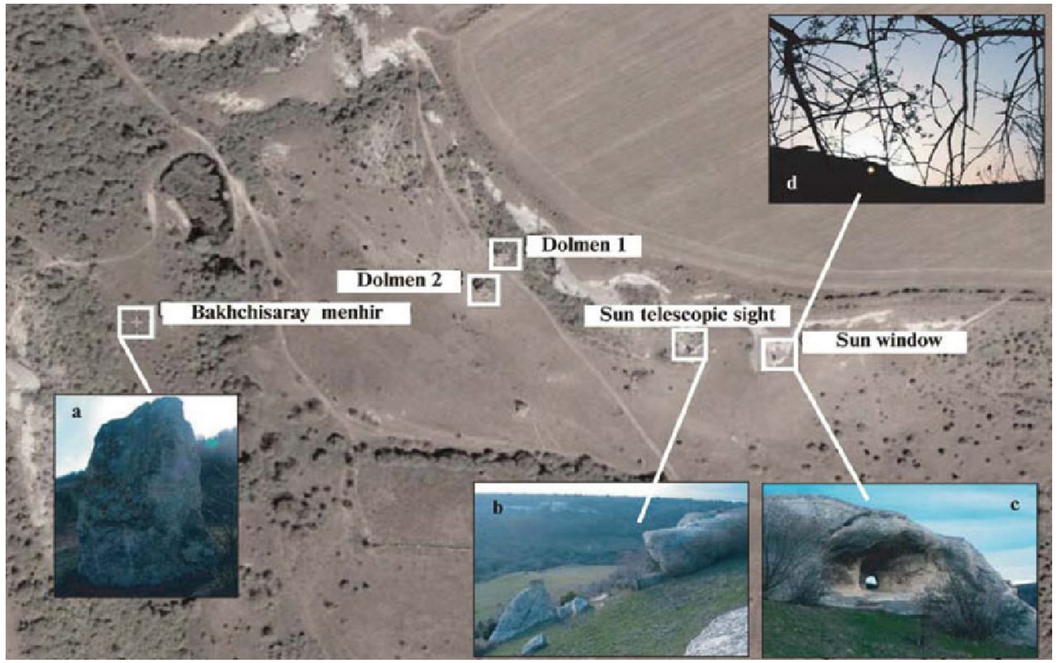
*The first Slavic tribes* have appeared during I Millenium B.C. At the Ukrainian territory there are two most studied *Slavic cultures*: *Zarubinetska culture* and *Chernyakhiv culture* (II - V centuries).

(left) Vessel-calendar from *Romashky* (Kyiv region).

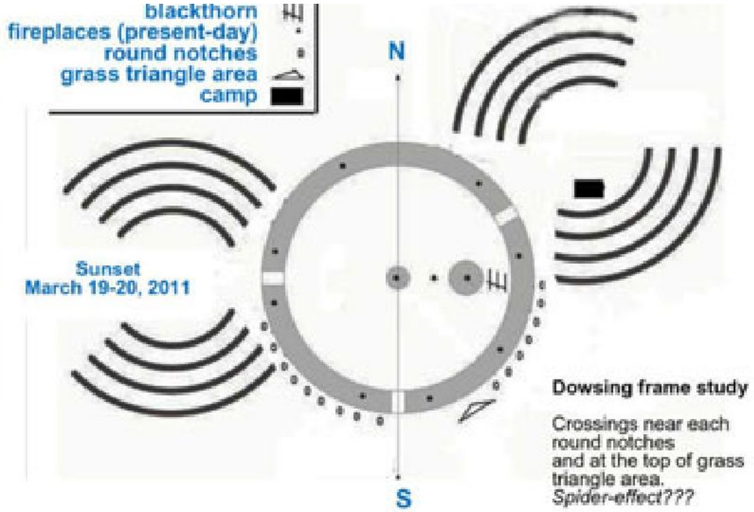
(right) The pattern was correctly interpreted by Prof. B. Rybakov as an agriculture calendar from May 2 to August 7 (day of young shoots and holiday of harvesting), this period is just a season of maturing of wheat in Kyiv region.

National Museum of History of Ukraine, Kyiv

# The oldest astronomical sites




The Bakhchysaray Menhirs,
Crimea, Ukraine (II Millennium BC)
at the Google Earth map.
Photos by A. Terebizh




The Mavrin Maidan, Dnipro region, Ukraine (II Millennium BC).

# Astrochronicles dated by the Kievan Rus' time

**The first astronomical observations and their writing records are dated to the times of Kievan Rus' (X-XIII centuries). For example, the authors of the *Lavrentievsky chronicle* described the solar eclipses of 1064, 1091, 1115, and 1230 years and the lunar eclipses of 1161 year as well as the first authentic Comet Galley observation at the Kievan Rus' territory in 1066.**


*Рис. 2. Ізборник Святослава, 1073 р. Знаки зодіака на арк. 251.*

*Рис. 3. Наочно-образне сприйняття знамень. Радзивиллівський літопис, арк. 152.*

# Astronomy as the Natural Philosophy at the first Universities

- In 1483 the first printed book on astronomy was written by physician and astronomer **Georgii Drohobich (1450-1494)**, who was a well-known author of Ukrainian origin.

G. Drogobich

- Systematic learning in astronomy is connected with the activity of the first Ukrainian universities in the XVII-XVIII centuries, namely the Ostroh Academy (A. Rymsha (1550-1595), astronomical cabinet in 1617-1630), the L'viv University (astronomical observatory in 1769) as well as the Kyiv-Mohyla Academy (astronomical cabinet in 1783).


Ostroh Academy, 1576

Lviv University Observatory, 1771


Kyiv-Mohyla Academy, 1783

# Astronomy as the Natural Philosophy at the Kyiv-Mohyla Academia

- A graduate of the Kyiv-Mohyla Academy, **Ivan Kopievsky (1651-1714),** issued the first stellar map in the Slavic language in Amsterdam in 1699 and the basics of naval astronomy in 1701.

- The prominent Ukrainian-Russian philosopher, scientist and religious figure, **Pheophan Prokopovich (1681-1736)**, who worked at the Kyiv-Mohyla Academy in 1705 – 1716 (he was the rector of this academy in 1711 – 1716), lectured astronomical courses based on theories of Copernicus and Galileo. He also developed the philosophical foundation of the unity of matter and motion, which was generalized later on by Mikhail Lomonosov.

- The prominent Ukrainian philosopher, scientist and religious figure **Irynei (Ivan Falkovsky (1762-1823)**

Ph. Prokopovych

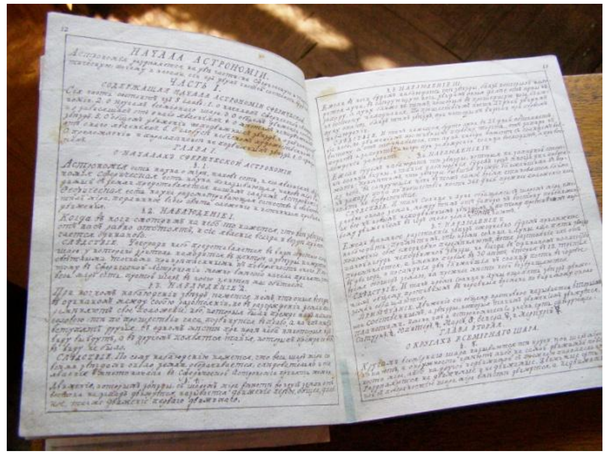
Світ… не є нескінченним, але замкненим та обмеженим певними границями…

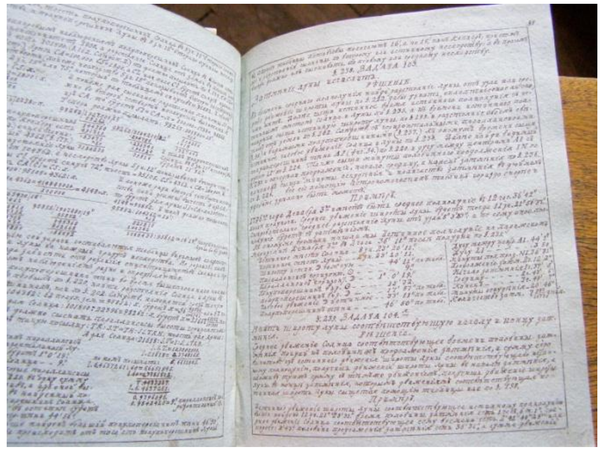
Передусім, треба знати, що рух із часом має дуже тісний зв'язок так, що ніщо не рухається інакше як у часі і ніщо не вимірюється часом, якщо не рухається…

Матерію не можна ніколи створити, ані зруйнувати, також ні збільшити, ні зменшити ту, яку створив Бог на початку світу, і якою і в якій кількості створена, такою залишається досі й буде залишатися завжди…

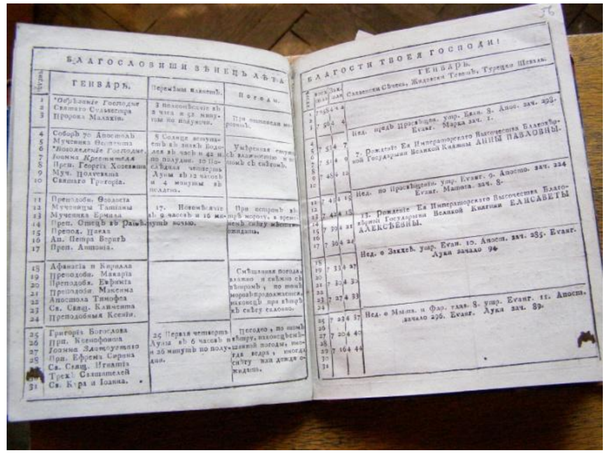
# Astronomy as the Natural Philosophy at the Kyiv-Mohyla Academia

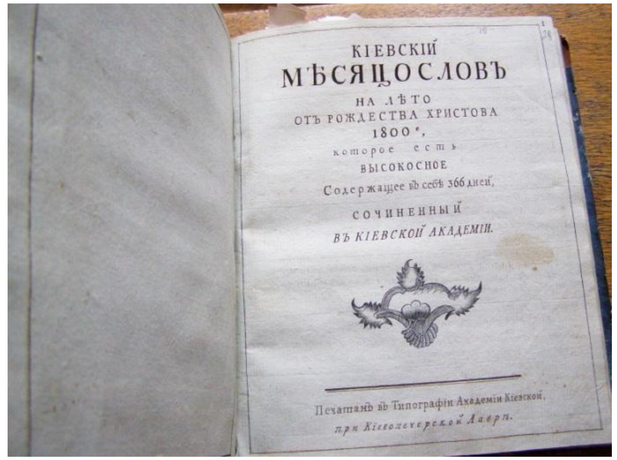
I. Falkovsky





“Скорочення змішаної математики” (ліворуч)
“Задача з обчислення затемнення Місяця” (праворуч)






Київський Місяцеслов на 1799 р. (ліворуч) і 1800 р. (праворуч)

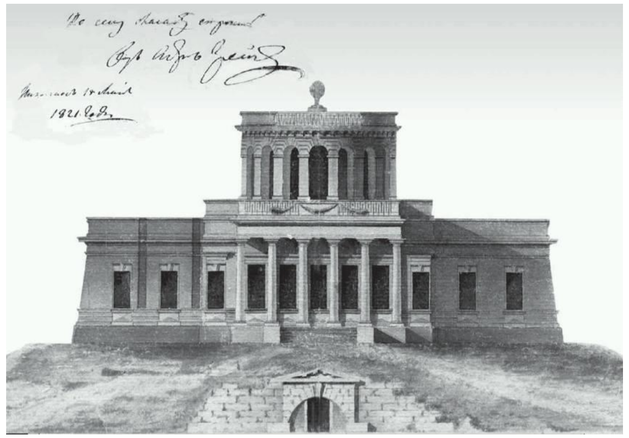
- Scientific research in astronomy was started in the XVIIIth century with establishment of *University astronomical observatories in L'viv, Kharkiv, Kyiv, Odesa.*

- In 1821 the *Naval Observatory* was founded in *Mykolaiv* (later on as a department of the Pulkovo Observatory)

- New impetus for development of astronomical research were connected with the foundation of institutions of the Russian Academy of Sciences (later on the USSR Academy of Sciences) and the *All-Ukrainian Academy of Science* (later on the UkrSSR AS, and the NAS of Ukraine)

# Astronomical Observatories in Universities

- Astronomy as a scientific discipline began to develop at the territory of modern Ukraine in the late XVIIIth and early XIXth centuries. Besides the Mykolaiv Marine Observatory (1821), the university' observatories were established in L'viv (1771), Kharkiv (1824), Kyiv (1840), and Odesa (1871). The early research were related to the observations of stars (positional astronomy) and the Solar system bodies (ephemeris astronomy). Later, in XX cent., these studies were supplemented with new research fields of astrophysics, heliophysics, planetology, extragalactic astronomy, cosmology.



# Astronomical Institutions in Academia of Sciences

A new era in the development of astronomical research in Ukraine began after World War II. The Main Astronomical Observatory of the AS UkrSSR (MAO) and the Crimean Astrophysical Observatory of the AS USSR (CrAO) were established in 1944 and 1945. Somewhat later, the High Altitude Astrophysical Branch of the MAO (1970, now ICAMER NAS of Ukraine) in the Elbrus region (Russian Federation), the Institute of Radio Astronomy of the AS UkrSSR in Kharkiv (1985), and the Institute of Space Research of the NASU and SSAU (1995) were established.

# Astronomy in Ukraine. Management

Governmental level

***Ministry of Education and Science of Ukraine***:

- astronomical departments and observatories in universities

***National Academy of Sciences of Ukraine***

- institutions and observatories

***Other management***

- planetariums,

Non-Governmental level,

***Private astronomical observatories and facilities, amateur society***

***Ukrainian Astronomical Association***


- **In 1991**, as concerning with the acquisition of Independence by Ukraine, the significant changes took place in governmental organizations of our country, including in science and education management.

- The **Ukrainian Astronomical Association (UAA)** was established as a national committee of astronomers, which represents Ukraine in the international organizations, namely IAU and EAS. Through its sijnificant collective role, the UAA helps to promote the interest of Ukrainian astronomy and to define the priorities of research strategies as the Road Map.

# Ukraine is a well-known astronomical country in Europe

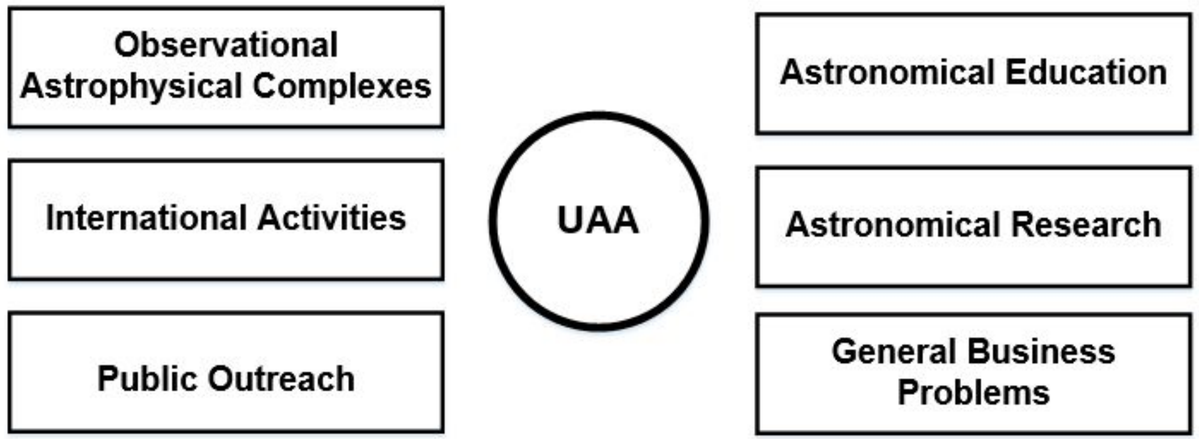

**Ukrainian Astronomical Association 1991 year**

- Main Astronomical Observatory (Kyiv 1944)
- Crimean Astrophysical Observatory (Simeiz 1908; Naukove 1945)
- Institute of Radio Astronomy (Kharkiv 1950-ies)
- Mykolaiv Astronomical Observatory (1821)
- Astronomical Observatory Kyiv Nat. University (1845)
- Astronomical Observatory L'viv Nat. University
- Astronomical Observatory Odesa Nat. University (1871)
-- Institute of Astronomy Kharkiv Nat. University
-- ICAMER (p. Terskol, North Caucasus, RF, 1970-ies)
- Space research Laboratory Uzhgorod Nat. Univ., 1957

# UAA's mission

UAA's benefits to astronomical society are in various areas, namely

- **Science and engineering**
- **Education and outreach**
- **International collaboration**
- **Innovation for security and economy.**




Astronomy is one of the most ancient sciences, which has enriched mankind with new knowledge about the Universe and our ability to explore it. Astronomical science and engineering are currently experiencing rapid development.

**What is the place of Ukraine in this astronomical world?**

# UAA's mission.
# Road Map for Science and Engineering

UAA's impact of Science and Engineering  covers several important areas of activity:

- **Structuring, coordination and consolidation effects of astronomy in Ukraine**
- **Increase of scientific and technological levels  of research**
- **Involving more people in astronomical science and engineering**
- **Contribution to scientific ethics.**

And finally, last but not the least, **formation of priorities for the development of astronomy in Ukraine**.

# Status of astronomical research institutions before 2014

| Institutions | Number of Scientists | Number of Cand. Sci. | Number of Dr. Sci. |
|---|---|---|---|
| **Institutions of the National Academy of Sciences of Ukraine (NASU)** | | | |
| Main Astronomical Observatory of NASU<br>www.mao.kiev.ua | 102 | 52 | 20 |
| Institute of Radio Astronomy of NASU<br>www.ri.kharkov.ua | 168 | 55 | 17 |
| Laboratory of Astrophysics and Cosmology of Bogolyubov Institute of Theoretical Physics of NASU<br>http://www.bitp.kiev.ua/en/aep/staff.html | 6 | 4 | 1 |
| International Center for Astronomical, Medical, and Ecological Research of NASU<br>http://www.terskol.com/ | 20 | 8 | 1 |
| **Institutions of the Ministry for Education and Science of Ukraine** | | | |
| SRI "Crimean Astrophysical Observatory"<br>www.crao.crimea.ua | 86 | 33 | 16 |
| Astronomical Observatory of Taras Shevchenko National University of Kyiv<br>www.univ.astro.kiev.ua | 26 | 19 | 6 |
| Astronomical Observatory of I.Franko National University of L'viv<br>http://astro.franko.lviv.ua/ | 22 | 5 | 2 |
| SRI “Astronomical Observatory” of I.I. Mechnikov National University of Odessa<br>http://www.astro-observ.odessa.ua/ | 61 | 14 | 5 |

# Status of astronomical research institutions before 2014

| | | | |
|---|---|---|---|
| **SR Institute of Astronomy of V.N. Karazin National University of Kharkiv** http://ru.astron.kharkov.ua/ | **32** | **15** | **6** |
| **SRI "Nikolaev Astronomical Observatory"** http://www.nao.nikolaev.ua/ | **15** | **8** | **1** |
| **Laboratiry of Space Researches of the Uzhgorod National University** http://www.univ.uzhgorod.ua/static/ndi/pndl/ | **12** | **3** | **0** |
| **Department of High and Applied Mathematics,. Odessa National Maritime University** http://www.osmu.odessa.ua/application/page?name=vpm | **7** | **3** | **1** |
| **Department of Astronomy and Space Physics, Taras Shevchenko National University of Kyiv** http://space.univ.kiev.ua/viewpage.php?page_id=1 | **21** | **9** | **2** |
| **Department of Astrophysics of I. Franko National University of L'viv** http://www.physics.lnu.edu.ua/depts/KAF/index.htm | **10** | **3** | **2** |
| **Department of Astronomy of I.I. Mechnikov National University of Odessa** http://onu.edu.ua/uk/structure/faculty/phys/astronomy | **8 (7)** | **4** | **2 (1)** |
| **Department of Astronomy of V.N. Karazin National University of Kharkiv** http://www.univer.kharkov.ua/ua/departments/physics/ | **8 (3)** | **4 (1)** | **3 (0)** |
| **Astronomical Institutions of the NAS of Ukraine** | **296** | **119** | **39** |
| **Astronomical Institutions of the Ministry for Education and Science of Ukraine** | **302** | **117** | **42** |
| **Total** | **598** | **236** | **81** |

* Post-graduated students are not included in this table

# The largest astronomical facilities of Ukraine

| Institution | Facilities |
|---|---|
| Main Astronomical Observatory of the NAS of Ukraine | Twin astrograph (0.4 m), AZT-2 (0.7 m), Horizontal Solar Telescope, SLR, GPS |
| Crimean Astrophysical Observatory of the MES of Ukraine | ZTSh (2.6 m), AZT-11 (1.25-m), AZT (0.5-m), AZT-8 (0.7-m), AZT (1.0-m), RT-22, GT-48, Solar Tower Telescope, MTM-500 |
| Institute of Radio Astronomy of the NAS of Ukraine | UTR-2, (operating range 8 – 40 MHz; URAN- Network (operating range 10-30 MHz), GURT |
| Astronomical Observatory of the Taras Shevchenko Kyiv National University | AZT-8, AZT-14, Horizontal Solar Telescope |
| International Center for Astronomical & Medical-Ecological Research | Zeiss 2000, Zeiss 600, 1-m Solar Telescope |
| Astronomical Observatory of the I.I.Mechnikov Odesa National University | 1-m, two 0.8-m, 0.6-m, two 0.5- m telescopes |
| Institute of Astronomy of V.N.Karazin Kharkiv National University | AZT-8 (0.7-m) |
| Mykolaiv Astronomical Observatory of the MES of Ukraine | Axial Meridian Circle, Multi-Channel Telescope, GPS |

# Ukrainian Astronomical Association
# 2014 year


The situation worsened even more after the occupation of Crimea by Russia and the unleashing of the Russian-Ukrainian war in the east of Ukraine (Donetskj and Luhansk regions.

This led to the termination of cooperation with Russian astronomers, which traditionally has been very wide.

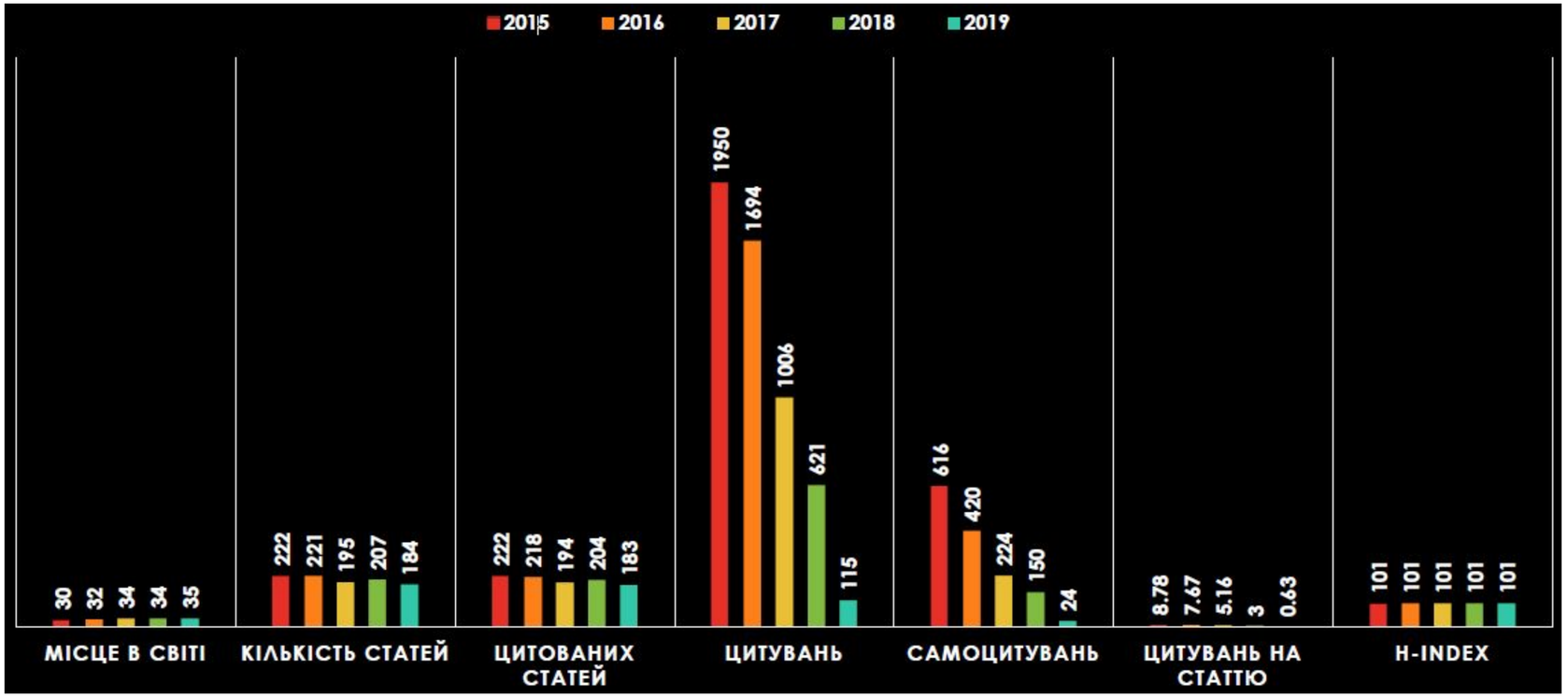
All these factors resulted, e.g., in the loss of observational facilities –

- Crimean AO of the Shevchenko National University of Kyiv (Observatory in Bakhchisarai, RT-22 and Laser Station in Simeiz)
- Crimean Department (Laser Station) of MAO NASU in Katsiveli,
- RadioAstronomy Department (RT-70) in Yevpatoria of IRA NASU and the National Space Facilities Control and Test Center
- Alchevsk Lazer Station (Luhansk region)

# Astronomy of Ukraine at the turn of the XX-XXI centuries

Despite of these circumstances the Ukrainian astronomers have succeeded to obtain some pioneering results in many fields of astronomy and publish many papers in recognized scientific periodicals (as follows from database one paper per person and per year).

Now we are faced with the task of modernization of observation complex, the involvement of young scientists in astronomy and space research as well as the strengthening of international cooperation.



# Research institutes & Universities 2025

## National Academy of Sciences of Ukraine

- Main Astronomical Observatory of the National Academy of Science of Ukraine
- Mykolaiv Astronomical Observatory – joined as the Dep of MAO NASU in 2025

  Astrometry and Space Geodynamics; Near-earth astronomy; Heliophysics; Sub-stellar and planetary systems; Interstellar media; Astrophysics; Extragalactic Astronomy; High-energy Astrophysics; Ground-based and Space-born Instrumentation; Numerical simulation; Cosmology
- Institute of Radio Astronomy of the National Academy of Science of Ukraine

  Radio Astronomy: low frequency Radio Astronomy, Radio Physics; Ground-based Instrumentation; Astrophysics;
- International Center for Astronomical & Medical-Ecological Research, Terskol, North Caucasus, Russia

  Optical Observational Astronomy
- Poltava gravimetrical observatory, Geophysical institute of NAS of Ukraine

  Geodynamics; Low frequency Radio Astronomy
- Space Research Institute of NASU and SSAU

  Ionospheric researches; Heliophysics
- Bogolyubov Institute for Theoretical Physics of the NAS of Ukraine

  Extragalactic Astronomy; Cosmology
- Pidstryhach Institute for Applied Problems of Mechanics and Mathematics of the NAS of Ukraine

  High-energy Astrophysics;

# Research institutes & Universities 2025

## Ministry of Education and Science of Ukraine

- Astronomical Observatory of the Taras Shevchenko Kyiv National University
  - Astrometry; Near-earth astronomy; Heliophysics; Small system bodys; High-energy Astrophysics; Cosmology
- Astronomical Observatory of the Ivan Franko L'viv National University
  - Positional Astronomy; Astrophysics: Sun, Stars, Extragalactic Astronomy, high-energy astrophysics; Cosmology
- Astronomical Observatory of the I.I.Mechnikov Odessa National University
  - Optical Observational Astronomy
- Institute of Astronomy of the V.N.Karazin Kharkiv National University
  - Physical conditions at the Moon and Small Solar System Bodies; Astrophysics;
- Odesa National Maritime University
  - Astrophysics
- Kharkiv National University of Radio Electronics
  - Metiorastronomy
- National University Lviv Polytechica
  - Space Geodynamics; Celestial Mechanics
- Vinnytsya Kotsyubynsky Pedagogocal University
  - Teacher astronomy training
- Dragomanov Ukrainian State University
  - Teacher astronomy training
- Dnipro National University
  - Relativity theory


STAFF COMPOSITION IN INSTITUTIONS (2020–2025)
400
300
200
100
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368
212
68
361
207
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355
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197
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323
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2020
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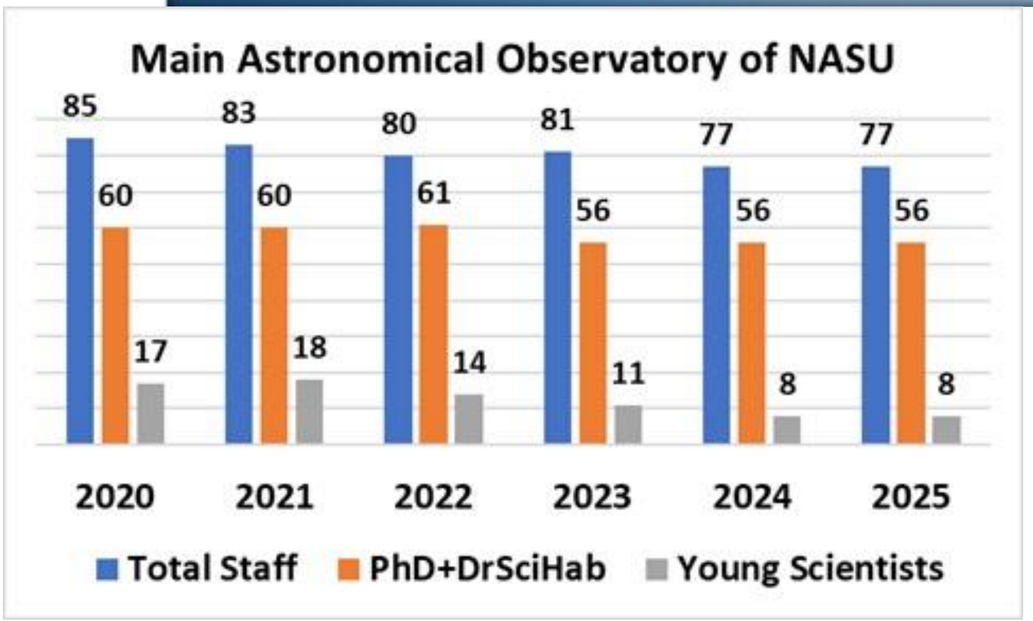
Total Staff
PhD+DrSciHab
Young Scientists
-15%
-15%
-41%


Main Astronomical Observatory of NASU
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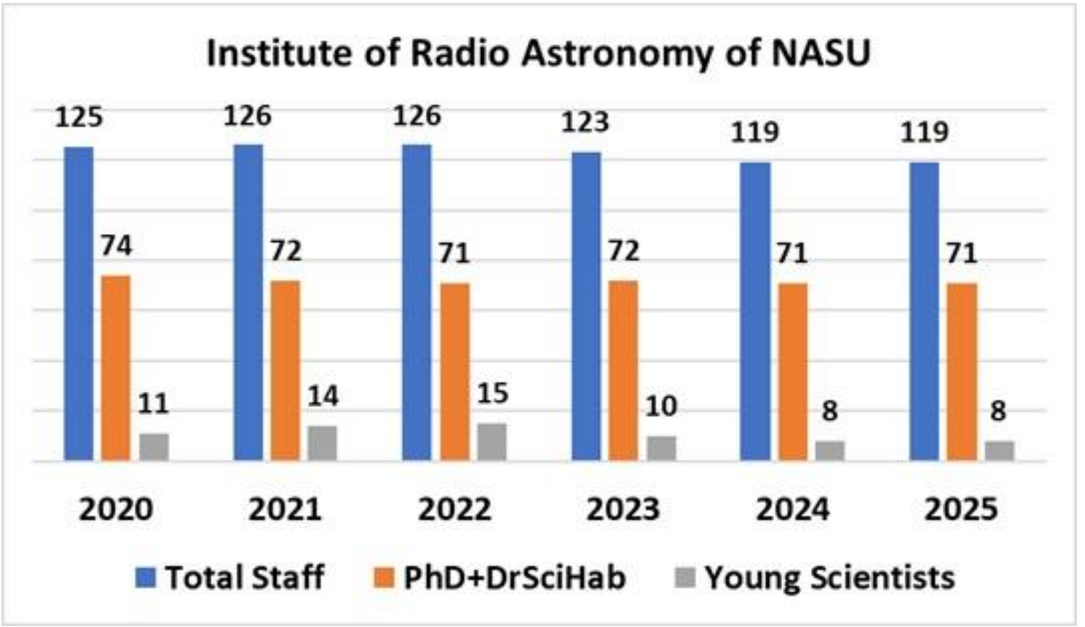
Total Staff
PhD+DrSciHab
Young Scientists


Institute of Radio Astronomy of NASU
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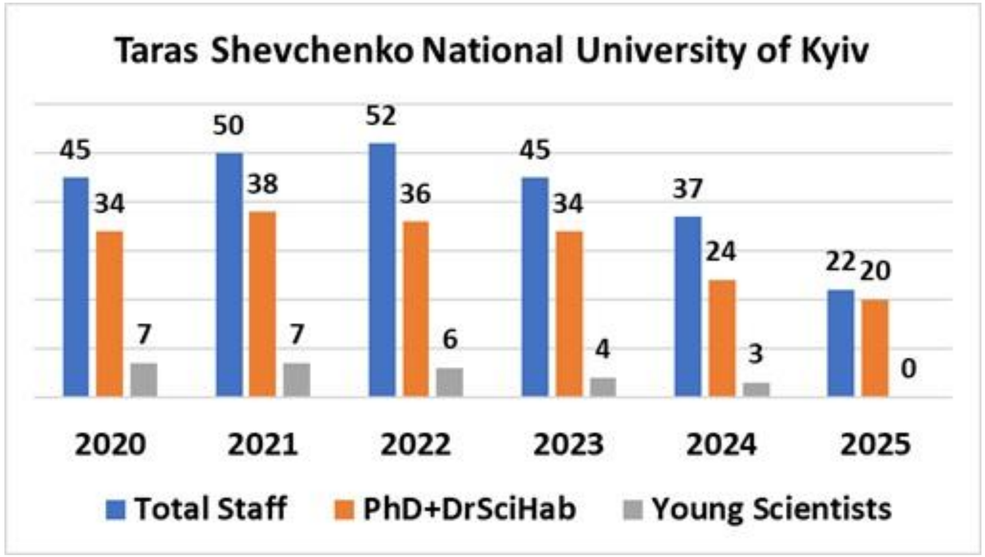
Taras Shevchenko National University of Kyiv
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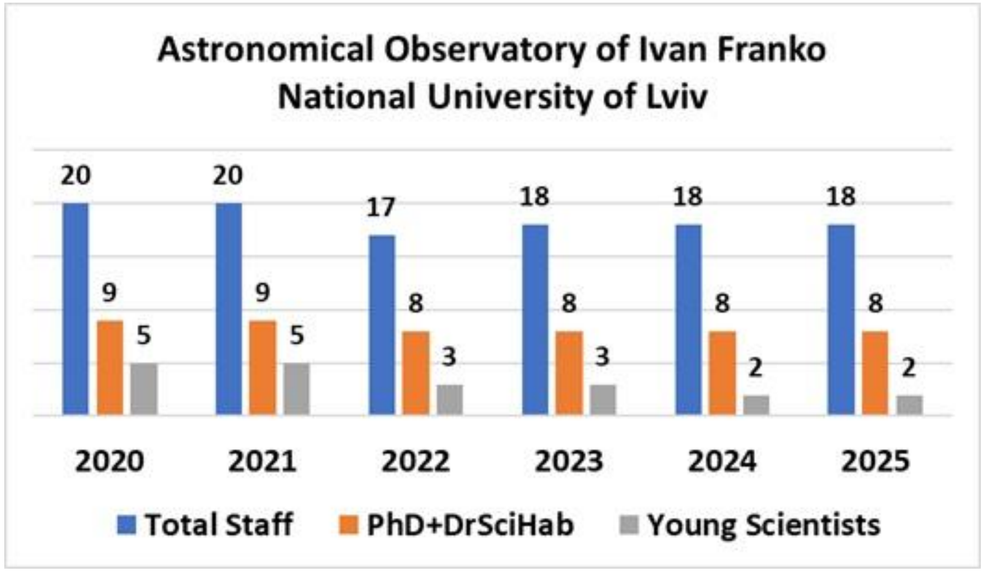
Astronomical Observatory of Ivan Franko National University of Lviv
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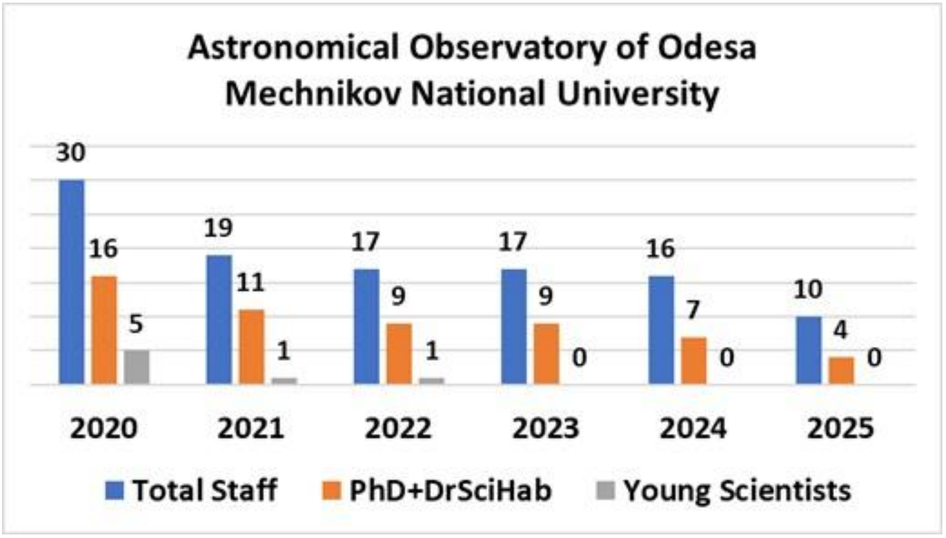
Astronomical Observatory of Odesa Mechnikov National University
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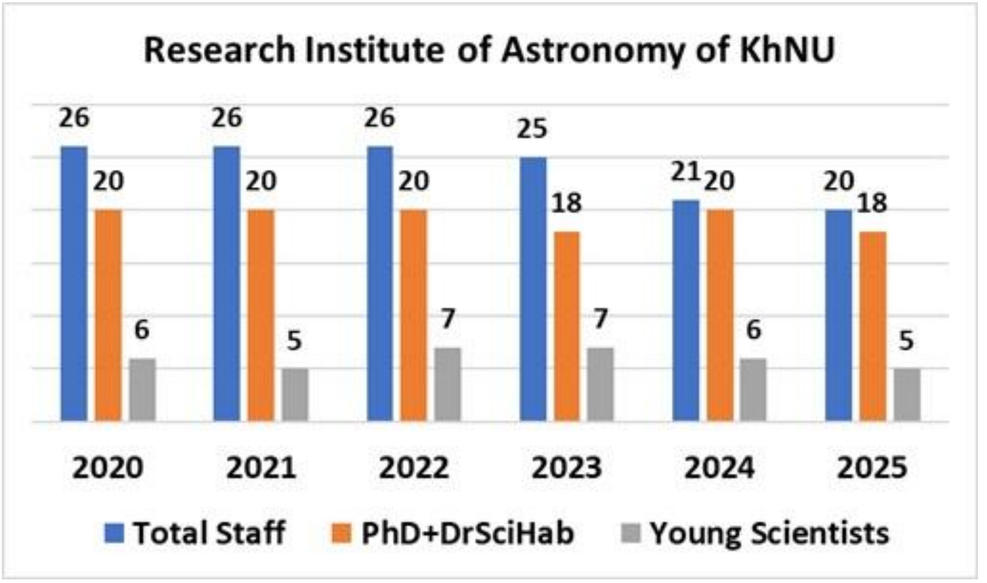
Research Institute of Astronomy of KhNU
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2025
Total Staff
PhD+DrSciHab
Young Scientists

**A number of well-known astronomical achievements is connected with activities of so-called “scientific schools”, namely founded by**
**Alexander Ya. Orlov, Nikolai P. Barabashov,**
**Grigory A. Shajn, Vladimir P. Tsesevich,**
**Sergei K. Vsekhsvyatsky,  Andrei B. Severny, Semen Ya. Braude and others.**

# Short-term priorities of astronomical research in Ukraine

- Low Frequencies radio astronomical research of various objects of Universe.
- Study of long-term variations of the Sun radiation in the optical range of frequencies
- Study of selected celestial bodies based on photometric and spectrophotometric observations
- Study of the early stages of the Universe, its evolution and formation of the large-scale structure
- Exploration of the near Earth space based on various types of observations of artificial and natural celestial bodies

# Long-term priorities of astronomical observations in Ukraine

- **Further development of the ground-based and space radio astronomy**

Collaborative observations in the **URAN** and **GURT** systems. Space project **BRAUDE-Selena** implementation. Development of astronomical research with **RT-32** (Zolochiv)

- **Projects for study of ionosphere and global climate changes**

Collaborative space projects **MicroSat**, **Aerosol-UA**

- **Participation in the formation of international astronomical databases and the implementation of various studies on their basis.**

Creation and support of the activities of a National center of astronomical data ( **UkrVO?** )

- **Formation of a promising target program for the development of ground-based and space astrophysical research.**

Proposal for the creation of an observational base (in Ukraine or abroad), equipped with modern telescopes,to National Fund of Research of Ukraine (**infrastructure project**), target programs of the NAS of Ukraine

- **Development and implementation of modern instruments and technologies for astronomical observations**

Creation of a special design office and pilot production of modern techniques for astronomical observations.

# UAA members 2025

- **Total: 300**

**Dr.Hab. 55 PhDs 128 YoungSci 40**

- **(15% working abroad)**
- **EAS members: 118**
- **IAU members: 173**

# Astronomy Under Wartime Conditions

- Crimean Astronomical facilities

  **Annexed**

- The world's largest decimeter radio telescope UTR-2

  **Rigged with explosives**

- Observation station of the Institute of Astronomy of Kharkiv National University in Chuhuiv

  **Destroyed**

- Telescopes of International Center for Astronomical & Medical-Ecological Research,Terskol, North Caucasus, Russia

  **We have no access**

- Observation station of Astronomical Observatory of Odesa National University in Mayaky

  **Not working because of high-risk area**

# Astronomy in 2024

- **Nevertheless, during these difficult times, we continue to work:**

- High publication activity (articles in Q1-Q4, monograph “Optics of the Moon” Shkuratov Yu. et al, Elsevier)

- Government-funded projects from the National Research Foundation, the Ministry of Education and Science of Ukraine, and the National Academy of Sciences of Ukraine

- We organized 6 conferences: Young Scientists' and Annual Conferences of KNU (April and May, Kyiv), Gamow Conference (August, Odesa), Conference dedicated to the 80th anniversary of MAO NASU (July), International Conference “Current Problems in Astronomy and Astrophysics” (September, Lviv)

- The first scientific school in Astronomy and Astrophysics for young scientists, “Through the Milky Way into the Universe” (MAO NASU, August)

- 2 UAA Council Meetings

# International Support in 2022-2024

- Many astronomers abroad have Marie Curie 4 Ukraine grants, or individual grants (Chech Republic, France, Germany, Italy, Lithuania, Poland, Slovakia, Spain, Netherlands and others).

- Europe grant: ACME, DESY, DFG, ERASMUS+, Polish AS + NSF 4 Ukraine and others

- Support of observations program: IAC (Spain), LOFAR (Netherland), VIRAC (Latvia) and others.

- IAU (no membership payment)

- Astron. & Astrophys., MNRAS  and other

journals support our publication activity.

**Publications with the first author from Ukraine**

# Some decisions during the war' time

Participation of Ukrainian astronomers currently working in Ukraine in likely Horizon Europe projects (EURIZON, DESY), or bilateral projects between countries, can be used by the STCU to draw up agreements.

Are MSCA4Ukraine for astronomers working in Ukraine.

Membership contributions of the Russian Federation to the International Astronomical Union should be directed to the restoration of the telescope infrastructure of Ukraine or to support scientific schools for young astronomers, etc.

Access (on a competitive basis) to international programs that provide participation in the processing and formulation of scientific tasks, for example, LSST, DZA, CTA, etc.

- Our heartfelt gratitude for your unwavering support and assistance during this difficult time.
- Your compassion and solidarity have been a true lifeline for Ukrainian astronomy amidst the ongoing war.
- Without your help, our efforts and achievements might have been impossible.
- Thank you for your dedication and professionalism!
- Together, we can overcome these challenges and continue advancing science,

which is vital for our future.

We are working on a Roadmap for the development of astronomy after the war.