How to rebuild Ukrainian astronomy?

Event held at Leiden University's Old Observatory brought together more than two dozen high-level Ukrainian astronomers and the representatives of the main Dutch institutions of the field to kickstart a plan towards rebuilding Ukrainian astronomy facilities and further integrating its community with the European scientific ecosystem.

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When peace finally breaks out, the war-stricken Ukrainian astronomy should be able to fully recover while building stronger connections with European research institutions. Although the war still rages on and the path towards a diplomatic solution seems filled with thorny unanswered questions, the first step towards that goal was taken with the meeting *Recovery plan for Ukrainian astronomy*, organized by Leiden Observatory and the European Regional Office of Astronomy for Development of the International Astronomical Union (IAU-EROAD). The event was held on the 10th and 11th of June at the historic building of the Old Observatory (Oude Sterrewacht) in Leiden.

The meeting kickstarted a dialogue process between the Ukrainian and the Dutch and European astronomy communities focused on establishing the foundations of a strategic recovery plan, hopefully ready to get traction once the war ends. The future plan would include rebuilding destroyed or damaged facilities, exchanging educational practices and strengthening collaborations of Ukrainian astronomers with the European and the wider international community.

For Kateryna Frantseva, coordinator of the IAU-EROAD, one of the meeting's core principles was to move beyond support for Ukraine and build partnerships. "We aimed to work towards a future where Ukrainian astronomy is not only rebuilt, but integrated as an equal and active player in the European and global scientific landscape", said Frantseva, herself a Ukrainian-born astronomer and one of the main organizers of the event alongside Pedro Russo, associate professor at Leiden University in Astronomy & Society and manager of the IAU-EROAD.

The event was a unique opportunity for Ukrainian astronomers to present the current state of their research and educational system, while also showing part of the destruction and damage to scientific infrastructure. Some of their presentations included images of rocket missiles landed right next to research facilities, damaged telescopes, destroyed cameras and equipment looted by Russian occupiers. They spoke about the experience of researching during wartime, while also celebrating the occasion to be heard among themselves: they very rarely have the chance to meet in person since the full-scale invasion began in February 2022.

During the first day, the representatives of the main Dutch and other international astronomy institutions – including NWO, NOVA, ASTRON, SRON, EAS, NAOJ and IAU – also presented their roles in the international astronomy ecosystem. The second day was dedicated to collaborative work. Workgroups were dedicated to thematic efforts, focusing on establishing the vision and needs for the future of Ukrainian astronomy's human capital, the infrastructures and research facilities in need of rebuilding, the future of the integration between astronomy and economic development and prospects for astronomy education and public engagement in the country. Preliminary results from these group sessions were presented, seeds from which a more concrete plan would stem in the near future.

The Dutch perspective

For Saskia Matheussen, team leader of astronomy at the Dutch Research Council (NWO) and deputy chair of ASTRONET (a planned and advisory network for European astronomy), it's an enormous challenge to rebuild all of the structures that were lost. "It was good to share how we approach things in astronomy in the Netherlands and in Europe", said Matheussen, for whom Dutch organizations' capacity of setting priorities and coordinating efforts could be beneficial for Ukraine. "It's important to keep the momentum. It was the first big step but there is a long way to go. I'm looking forward to hearing about the future strategic plans", stated her.

According to the executive director of the Netherlands Research School for Astronomy (NOVA), Michiel Rodenhuis, an important role Dutch astronomers can play is that of

external observers and advisors. While stressing the importance of organization, Rodenhuis explained how it's very useful for scientific institutions to get an outside perspective every now and then: "[In the Netherlands] we invite a completely external overview and international experts give us advice. We tried to fill that role in these two days. We listened to the issues Ukrainian astronomy faces and we could give some of our perspectives on that". He adds an important caveat, though: "we shouldn't be arrogant and overestimate ourselves. The context is different in Ukraine and maybe different solutions will work best there."

A different kind of damage: brain drain

Countering the brain drain caused by the war was a recurrent theme in some of the workgroups. One of the main goals of Iryna Vavilova, the head of the department of extragalactic astronomy and astro-informatics of the Main Astronomical Observatory of Kyiv, was to show the losses in human resources for Ukrainian astronomy and to stress the need to find a way to stop them. According to Vavilova, Ukrainian astronomy saw a 15% drop in the number of researchers and PhDs during the last few years, while the losses of young scientists was even more dramatic: there are now 41% less of them than in 2020.

These losses were even more pronounced in regions that suffered directly from the Russian invasion. The director of the Astronomy Research Institute of the Karazin Kharkiv National University, Vadym Kaydash, said that his institution, located on the northeast of the country, saw a drop of up to 50% in new astronomy students since the war began. Even when researchers and students continue working, disruption is very common. According to Kaydash, during the first year of the war, around 75% of the teachers and researchers and 50% of the astronomy students in Kharkiv had to relocate, driving them to online education. Due to the region's proximity to the frontlines, shelling and power outages are very common.

Visits and future perspectives

The event was also an opportunity for the Ukrainian astronomers to visit a few state-of-the-art Dutch astronomy installations. At the SRON, they were updated about the latest technologies being developed for future space missions like the New Advanced Telescope for High ENergy Astrophysics (New Athena). On Friday, visits to the ASTRON, LOFAR ERIC and JIV-ERIC facilities were of special significance for the radioastronomers. Volodymyr Reshetnyk, associate professor of the Taras Shevchenko Kyiv National University, was one of the most interested in those technologies. According to him, during this fall the Ukrainians plan to create a detailed strategy to rebuild Ukrainian astronomy, with attention to topics that the Dutch would be able to assist. In his view, one of the goals of next

activities should be to increase the interdependence of astronomy and technological innovations in the future of Ukraine. “Now it’s still too complicated, but I hope we can do it and the Dutch astronomy is a very good example of how to do it”, said Reshetnyk.

Yaroslav Yatskiv, the director of the Main Astronomical Observatory of Kyiv, said the event was very useful to exchange information with the European community: “from the scientific point of view, we gained new knowledge about the radioastronomy in the Netherlands”. For the 85-year-old Yatskiv, a prominent figure of Ukrainian astronomy, the final results of the efforts kickstarted by the event are not easy to predict. “A lot depends on high-level decisions in my country about following or not the recommendations that will come out of this meeting”, said Yatskiv, who maintained an optimistic stance for the future despite the adversities.

The attendees from the international community were struck by the resilience of the Ukrainian astronomers, who kept doing science in difficult and, sometimes, dire conditions. In spite of problems like destroyed, damaged or looted equipment and the lack of continuous electrical power – in some regions, the energy grid could go down for most of the time – teaching, exams and research projects continued functioning. In Kaydash’s words, Ukrainian astronomy was blinded by the destruction of observational stations and the loss of equipment. And yet, it kept moving.