Finnish Centre for Astronomy with ESO

Annual Report

2025



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FINNISH CENTRE FOR ASTRONOMY WITH ESO, ANNUAL REPORT 2025

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Based on a template by Andrea Hidalgo.

September 2026

Cover: ESO NTT and 3.6m telescopes at La Silla. (Picture: Johanna Hartke)

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About FINCA

The Finnish Centre for Astronomy with ESO (FINCA) was founded in 2009 by an agreement between the University of Helsinki, the University of Oulu, the Aalto University, and the University of Turku (UT), the four universities engaging in astronomical research in Finland. FINCA started operations at the beginning of 2010 in Turku, where the headquarters of FINCA are located, supported by the he Ministry of Education and Culture (OKM) in addition to the participating universities. Administratively, FINCA is a Special Unit of the university of UT. The highest decision-making body is the Board, comprising of two members from each participating university, and one from FINCA staff. The Board is chaired by UTs Vice-Rector of research.

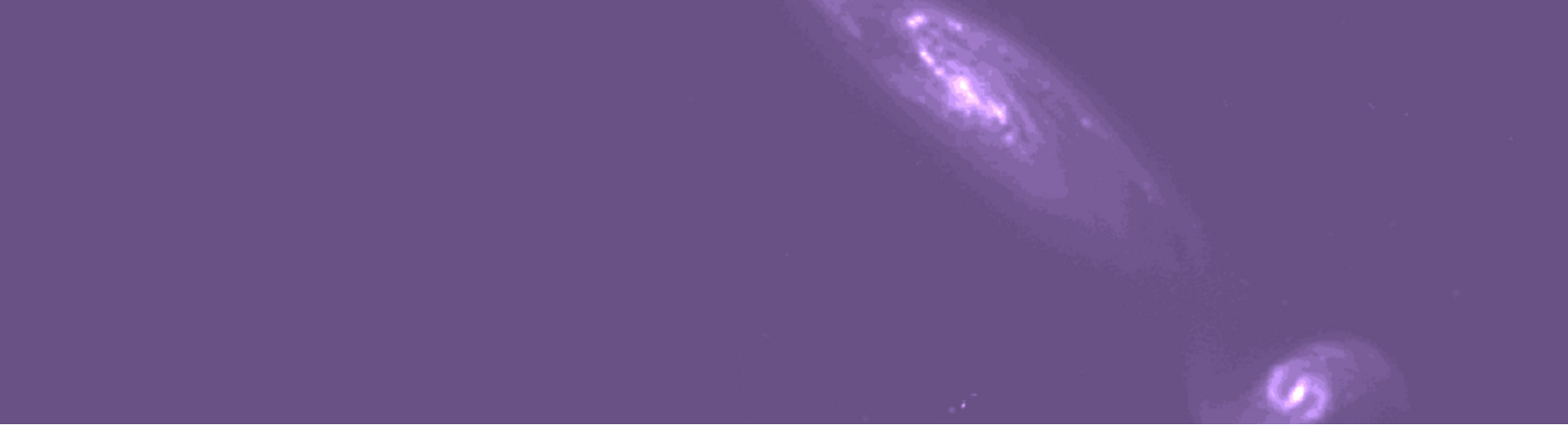
The European Southern Observatory (ESO) is a government-level treaty organisation founded in 1962. Its mandate is to create and operate “an observatory equipped with powerful instruments in the Southern Hemisphere and to promote and organise co-operation in astronomical research". ESO headquarters are located in Garching, Germany, and it operates its world-class observatories in Chile: the ESO Very Large Telescope (VLT) comprising four 8-m telescopes, the Atacama Large (Sub)Millimetre Array (ALMA), and the La Silla observatory telescopes. Furthermore, ESO is currently building the world’s largest telescope, the 39m Extremely Large Telescope (ELT) and is preparing operations for the Southern part of the large international gamma-ray facility, the Cherenkov Telescope Array Observatory (CTAO). ESO has grown into the world’s leading science and technology organisation in ground-based astronomy, with 16 member states currently, Finland joining in 2004.

Efficient utilisation of the investment made by Finland to join, and remain part of, ESO requires coordinated co-operation between the Finnish universities, and being an integral part of ESO’s world-leading science and technological development programs is essential for the Finnish astronomical community. These are the reasons why FINCA was established in 2009.

Accordingly, FINCA’s mandate, as specified in the founding document, can be summarised as:

- to take care of Finnish co-operation with ESO by networking into the international ESO infrastructure and projects
- to practise and promote high quality basic and applied research in astronomy, and ESO-related technological development work related to astronomy, and to participate in researcher training in astronomy
- to foster and implement ESO-related co-operation and joint projects of Finnish universities in the field of astronomy.

The ultimate goal of FINCA is to improve the scientific and industrial benefit of Finland’s membership in ESO, and Finland’s competitiveness and international visibility in astronomical research.



1. Foreword

Welcome to the FINCA Annual Report 2025, describing its operations on its 17^{th} year of existence.

As a national entity, we aim to promote all high-quality research in astronomy in the country. A particular focus is, naturally, the promotion, coordination, and facilitation of Finland-based researchers' utilisation of ESO infrastructure located at their cutting-edge observatories in Chile. FINCA also coordinates Finnish participation in ESO-related technology projects in astronomical instrumentation, and manages other ESO-facing activities. In 2025, a particular highlight of this theme was us hosting a MICADO Consortium Meeting in Turku, bringing a large contingent of engineers and scientists building the first-light instrument for the Extremely Large Telescope (ELT).

Furthermore, as best science is done collaboratively, and across multiple wavelengths, FINCA supports observational astronomy more broadly as well by, e.g., participating in researcher training in observational astronomy at the universities. We also hold a coordination role in Finland, with UT, regarding activities and training related to the Nordic Optical Telescope (NOT) on La Palma. NOT observations done by the Finnish community are directly funded by FINCA, including NOT schools for both high-school and university students, organised and run by UT-based astronomers. More details can be found later in this Report. FINCA plays a major role in NOT operations also in the sense that the FINCA director serves, on a part-time basis, as the director of the NOT.

To foster wide research collaboration in astronomy, FINCA funds, through the competitive *FINCA Visitor and Mobility program*, both visits of international research collaborators coming to Finland, and research visits outward to international research centres. This scheme is well-used, and one of the most visible FINCA activities for astronomers around the country. Listing of 2025 usage of the program can be found in this Report; a new aspect to the program was opening support also for astronomy students participating in international observational astronomy schools and workshops.

Another popular and well-received support structure that FINCA offers is the *ESO Incentive Grant* offered for Finland-based astronomers, who are successful in winning extremely competitive observing time from ESO facilities. Recipients of these grants in 2025 are also listed in this report.

As far as FINCA staff are concerned, our own research covers a wide range in contemporary astronomy all the way from Solar System objects, through stars and their explosions, and black holes, to star formation in the Milky Way, galaxies of different kinds, including active galactic nuclei, and

to cosmology, as can be seen from the science highlights presented in this Report. Some high-profile projects include, for example, participation of FINCA staff (*G. Fedorets*) and NOT in the campaign to characterise the orbit of YR4, the asteroid that for the first time ever triggered a "global planetary defense alert".

Overall, FINCA scientists published 107 officially recognised refereed journal papers during the course of 2025 – an excellent number considering the size of our unit. Most of these are listed at the end of this Report. Details of other research activities by staff members are also found herein, including teaching and thesis supervision, and a wide range of responsibilities in various committees and groups done in support of the astronomical community at large.

Recognition of highly competitive science, and projects, came in the form of *T. Hovatta* winning a coveted European Research Council (ERC) Consolidator Grant (right at the end of 2024) for her work on active galaxies and their jets, and *H. Kuncarayakti* being awarded two separate Research Council of Finland grants, one for a High Performance Computing project on simulations of Supernovae, and another in instrumentation (more on this below).

Regarding ESO-developments, the construction of ESO's ELT, the 39-m diameter giant for infrared and optical astronomy, is well underway. In 2025, the telescope/dome structure on the top of Cerro Armazones was nearly finished, and the mirror segments had arrived in Chile. ESO thus remains on track for the ELT to have first-light, and start operations, around 2029/2030. The ELT instrumentation brings an enormous leap forward in sensitivity and resolution for the global astronomy community, and we at FINCA are proud to be involved in these projects on behalf of the Finnish community. FINCA wants to intentionally focus on, and find new opportunities for, astronomical instrumentation projects and related funding.

Indeed, utilising a Research Council infrastructure (FIRI) grant, FINCA has already for several years participated in the ELT/MICADO near-infrared adaptive optics imager project. Work is being done in the PSF reconstruction work package, led by *H. Kuncarayakti*, with *J. Hartke*, and a Turku-based optical design company (*J. Achren, Incident Angle Oy*). We are also members of the MOSAIC Consortium, that is starting to build an optical and near-infrared multi-object spectrograph for the ELT. In 2025, the SOXS instrument built for the ESO 3.5-m New Technology Telescope (NTT) was finished, and was being commissioned at La Silla – the calibration unit for SOXS was built in Turku. Finally, an exciting new instrumentation project opened during the year, when *H. Kuncarayakti*, together with Aalto University, was awarded a Research Council of Finland 'Proof of Concept' grant. In this project, an Aalto-developed *Black Silicon* technology will be applied for the first time to large-format detectors used in astronomy. Practical work will begin in 2026, and will also involve the NOT.

In summary, 2025 has been another good, productive, and action-packed year in astronomy at FINCA, and the participating universities. I look forward to continuing work at FINCA, both in having fun and enjoying time together with staff and other colleagues, and producing exciting results together with the whole Finnish astronomical community, and come up with new avenues and ideas for both scientific and technological projects.

Petri Väisänen,
FINCA Director



2. Staff and Organisation

FINCA staff 2025

Director :	Petri Väisänen	Turku
Professor Emeritus :	Mauri Valtonen	Turku
University Researchers :	Roberto De Propris (on leave)	Turku
	Pasi Hakala	Turku
	Kari Nilsson	Turku
Senior Research Fellow	Talvikki Hovatta	Aalto/Turku
	Hanindyo Kuncarayakti	Turku
Academy Research Fellow	Tuomas Kangas	Turku
Collogium Research Fellow	Johanna Hartke	Turku
Postdoctoral Researchers	Vandad Fallah Ramazani	Aalto
	Grigori Fedorets	Helsinki
	Britton Jeter	Aalto
	Venkatessh Ramakrishnan	Aalto
	Quentin Salomé	Aalto
	Stefan Schuldt	Helsinki
FINCA affiliated Researchers	Jani Achrén	Incident Angle Oy
	Karri Koljonen	Trondheim
	Elina Lindfors	Turku
	Maria Babakhanyan Stone	INAF Roma

PhD Students	Jenni Jormanainen	Aalto/Turku
	Pouya Kouch	Aalto/Turku
	Timo Kravtsov	Turku
	Uliana Pylypenko	Turku
	Suman Sahu	Turku
	Mikael Turkki	Turku
Visiting researcher	Bela Dixit	Aalto
	Leo Tamminen	Aalto
FINCA summer Interns	Tuomas Hämäläinen	Turku
	Emma Johtela	Turku
	Venla Kangas	Turku

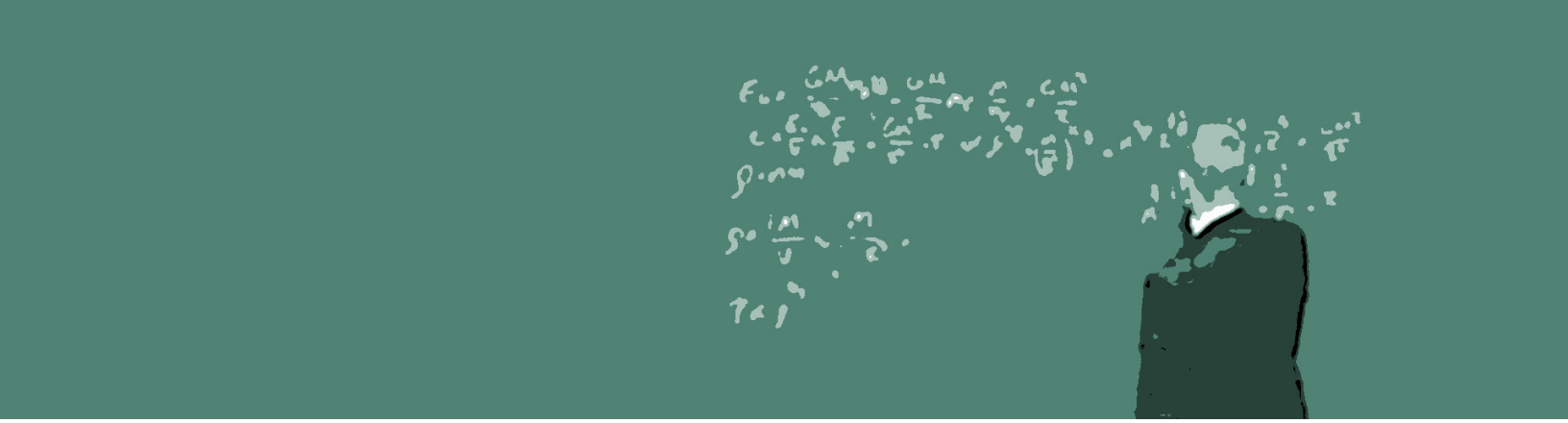
FINCA board

Members

Anne Lähteenmäki	Aalto
Merja Tornikoski	Aalto
Simo Huotari	Helsinki
Alexis Finoguenov	Helsinki
Vitaly Neustroev	Oulu
Piia Seppänen (Chair)	Turku
Seppo Mattila	Turku
Johanna Hartke (staff representative)	Turku

Deputy members

Tuomas Savolainen	Aalto
Joni Tammi	Aalto
Mikael Granvik	Helsinki
Mika Juvela	Helsinki
Aku Venhola	Oulu
Alt. to the Vice-Director	Turku
Juri Poutanen	Turku
Talvikki Hovatta (staff representative)	Turku



3. Research

3.1 Research Highlights

3.1.1 Solar system objects

Preparations for LSST: computations and observations

With Vera C. Rubin's Observatory's construction being complete in 2025, and its commissioning phase beginning, survey astronomy in general and Solar System science in particular is about to enter the decade of unprecedented discoveries with its upcoming Legacy Survey of Space and Time (LSST). Within LSST Solar System Collaboration, the Sorcha team (of which FINCA postdoctoral fellow **Grigori Fedorets** is a member) has achieved a significant milestone by publishing the eponymous Sorcha, a survey simulator for Solar System studies with LSST. The survey simulator has being built using a modular approach which allows its versatile use not only for observation predictions but also population modelling. The team has also published the first accurate predictions of LSST discoveries for various small Solar System body population using Sorcha. The applicability of Sorcha for real data was verified whilst searching for LSST verification survey images of the interstellar comet 3I. The accurate modelling of LSST field-of-view in Sorcha correctly predicted that in one of the images, 3I was not detectable despite predicted otherwise, due to its appearance in the chip gap.

With LSST data schema converging close to its final form, the preparation for receiving immediate LSST data through alert stream has become timely. Fedorets has established a collaboration on extracting the candidates for Earth's temporary satellites. During 2025, the collaboration has designed a dedicated LSST alert stream specific to Earth's temporary satellites taking into account the recent developments in alert streams and brokers. LSST's detections of temporary satellites will serve as a starting point for the charactersation of these objects. With that in mind, Fedorets has also joined a pan-European collaboration of astronomers to coordinate observations of small Solar System bodies that require very quick follow-up observations.

Very small asteroids

Fedorets has also continued carrying out the large programme at the Nordic Optical Telescope with the aim of characterising a statistically significant sample of very small asteroid originating from the distant outskirts of the main belt. The software for detection of small Solar System bodies at the

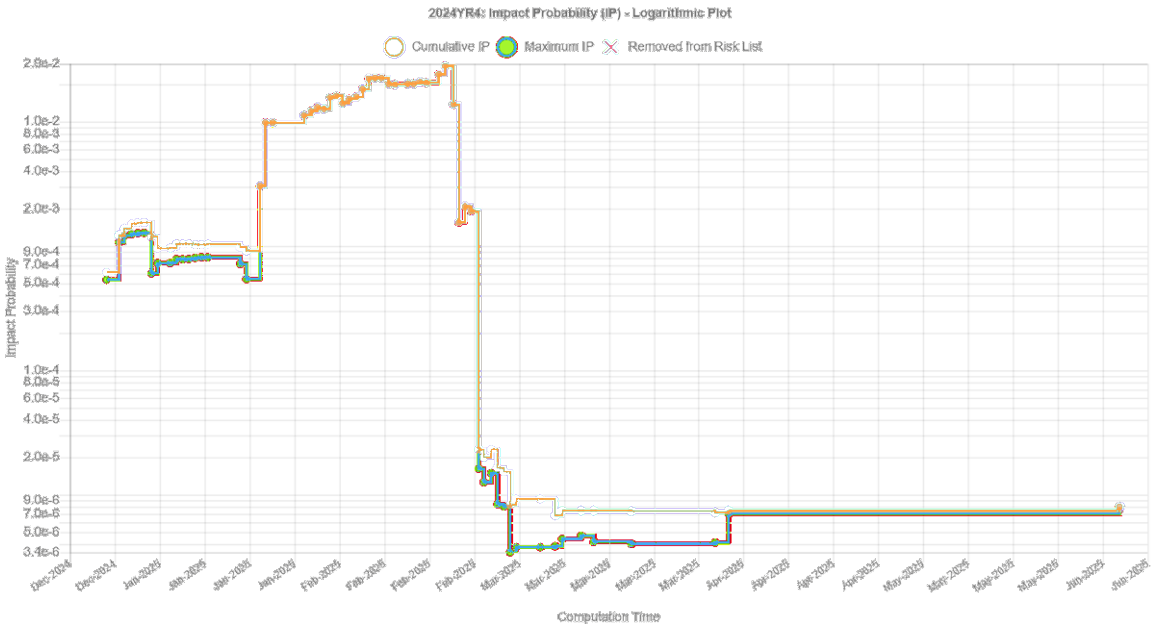


Figure 3.1: The evolution of the impact probability of asteroid 2024 YR4 as a function of time. The NOT observations were performed in late January - February, which was the most critical period for determining the impact probability. Image courtesy of ESA NEOCC

NOT ha been amended with the possibility of immediate updates of asteroid orbits. This is a major step on the pathway of enabling rapid-response observations at the NOT also for small Solar System bodies.

Observing high-priority targets: Earth's near miss and an interstellar visitor

During 2025, **Fedorets** was involved in observation campaigns of two high-profile Solar System objects. In January-February, the recently discovered asteroid 2024 YR4 triggered a global planetary defense alert, reaching the impact probability of 3.1% for December 2032 (Fig. 3.1. This surpassed asteroid Apophis as the previous city-killer level asteroid that had reached the highest probability of Earth impact of 2.7% in 2004. Members of the Planetary-System Research group participated in the global effort by performing astrometric and photometric observations of 2024 YR4 with the Nordic Optical Telescope. As a result of the global effort, the impact with the Earth was ruled out in mid-February. Another high priority target was the interstellar comet 3I/ATLAS. Members of the Planetary-System Research group contributed to the global characterisation effort of Solar System's third interstellar visitor by observing its polarimetric phase curve with several telescopes, including the Nordic Optical Telescope. The polarimetric phase curve of 3I turned out to be unique compared to all other known comets, with deep negative polarisation and small inversion angle.

3.1.2 Stellar and Galactic Astrophysics

New Year's Burst GRB 220101A

Tuomas Kangas modeled and analyzed the afterglow of a highly energetic gamma-ray burst, GRB 220101A. This GRB kicked off the year 2022 with a bang, as it was one of the bursts with both the highest redshift ($z = 4.618$) and the largest isotropic-equivalent energy released in gamma rays

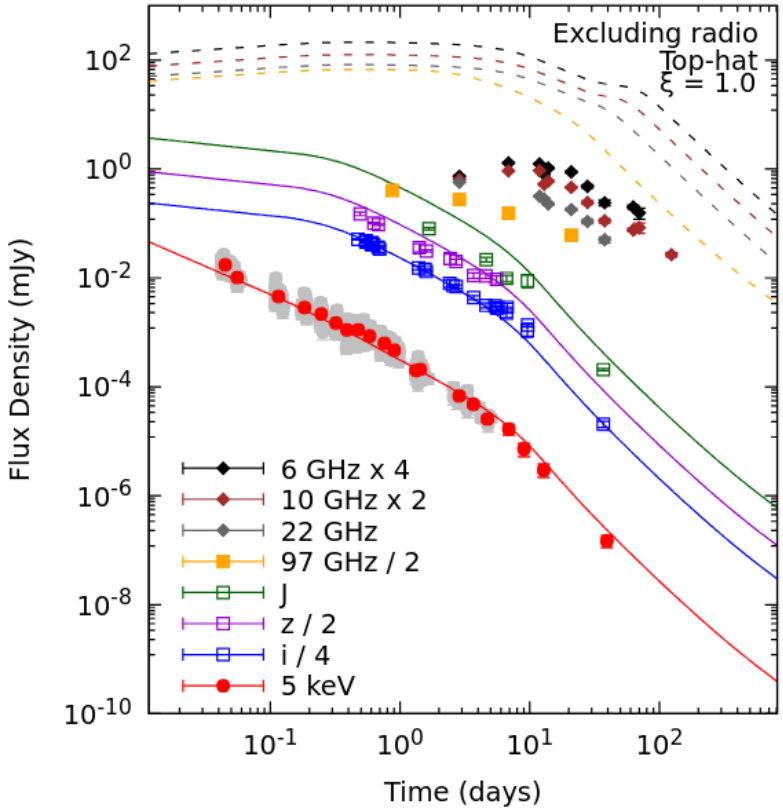


Figure 3.2: Numerical model fit to the afterglow of GRB 220101A. Dashed lines correspond to radio flux predictions based on the optical and X-rays, with a reasonable circumburst density, which overpredict the radio observations by an order of magnitude or even more. Only extremely low densities can reproduce these observations.

($E_{\rm iso} \approx 3.6 \times 10^{54}$ erg). The afterglow of GRB 220101A was observed from X-rays to radio. This multi-wavelength follow-up revealed some abnormalities. Because of the nature of the GRB as a relativistic jet, each afterglow has a so-called jet break, at which point the decline of the afterglow steepens: the post-jet-break decline rate depends on the lateral expansion of the jet. GRB 220101A exhibited the steepest late-time decline rate ever measured ($t^{-2.99\pm0.10}$), making lateral expansion not only necessary, but possibly even inadequate by itself – more complex hydrodynamical effects can be needed, as no analytical model predicts a decline this steep. Additionally, both numerical and analytical modeling of the afterglow results in an extremely low circumburst particle density that is difficult to explain ($n \sim 10^{-5}$ cm^{-3}) – but ignoring the radio data removes this problem. This GRB thus joins a growing group of afterglows exhibiting behavior contrary to standard model predictions specifically in the radio, implying the need for additional physics in that wavelength range. Kangas is the second author, heavily involved in data analysis, modeling and interpretation, in a paper submitted to ApJ.

Superluminous supernovae (SLSNe)

Superluminous supernovae (SLSNe) are rare and extremely powerful stellar explosions. Less than half of them are hydrogen-rich (SLSNe II), and they typically exhibit strong, narrow hydrogen lines that indicate circumstellar interaction (CSI). However, roughly 20% of SLSNe II do not show apparent narrow lines. Only about 20 such events have been discovered so far, so their powering mechanism requires further study.

Uliana Pylypenko started the analysis of one such broad-lined SLSN II - SN 2024adtg. This is the second brightest event in this class ($M_{peak} \sim$ -22.25 mag). Additionally, it is the first broad-lined SLSN II with medium-resolution spectra from X-shooter obtained during the photospheric phase. These data reveal weak narrow components superimposed on the broad hydrogen lines, which were not detected in low-resolution spectra. They suggest some level of CSI, although this event may also require a central engine.

Circumstellar interaction of SNe

Hanindyo Kuncarayakti with students and a postdoc studied signatures of circumstellar interaction in supernovae using observational data primarily from the NOT and ESO VLT. The circumstellar material surrounding the supernovae are thought to be formed from extensive mass loss of the supernova progenitor star, prior to the explosion. There are variations as some supernovae were found to have nearby and dense circumstellar material, while some others have this material detached from the supernova progenitor star which required very late-time observations at few hundred days. With VLT/MUSE integral field spectroscopy and a novel detection technique (led by **Timo Kravtsov**), old supernovae (decades to centuries old) that are transitioning into supernova remnants were discovered in nearby galaxies.

Interacting binaries

Pasi Hakala has continued actively exploiting the resources provided by both ESO (VLT+NTT) and the NOT. His research has mainly concentrated on studying cataclysmic variables of various kind and related objects. **Hakala** published two major first author papers.

In particular **Hakala**, together with an international team of scientists (from Universities of Warwick(UK), Cambridge(UK) and Dartmouth (USA) as well as IAC(Spain) and ESO), discovered that the source ASASSN-14dx, a cataclysmic variable consisting of a white dwarf and a normal donor star, contains a massive white dwarf, that shows various pulsations modes (Hakala et al. 2025, MNRAS, 540, 838). The white dwarf is amongst the most massive detected in cataclysmic variables. These results were based on a large observing campaign involving data from VLT/XSHOOTER, NTT/ULTRACAM, SAAO 1.9m, Kitt Peak 1.3m, as well as NOT photometry + polarimetry. Hakala has also been involved in discovering two new extremely old magnetic cataclysmic variables (Cunningham et al. 2025) that represent rare end stage systems of binary evolution.

The main result during 2025 was the discovery of a bright circumbinary ring around a so called supersoft source V Sge. This was based on ESO VLT/XSHOOTER P.I. data set. (**Hakala**, Charles & Rodríguez, 2025, MNRAS, 543, 2058). The team, that also included researchers from Oxford/Southampton Universities (UK) and IAC (Spain) discovered that this extraordinary and extremely rare system contains a circumbinary disc/ring of matter and that the accretion disc in the system exhibits chaotic behavior due to Eddington limited very high accretion rate, which leads to rapid changes in the structure/geometry of the inner accretion disc. This confirms that the normal star in the V Sge system must be losing matter at huge rate, likely exceeding the so called Eddington limit, which then forces matter out of the binary system, forming a circumbinary ring around it (Fig

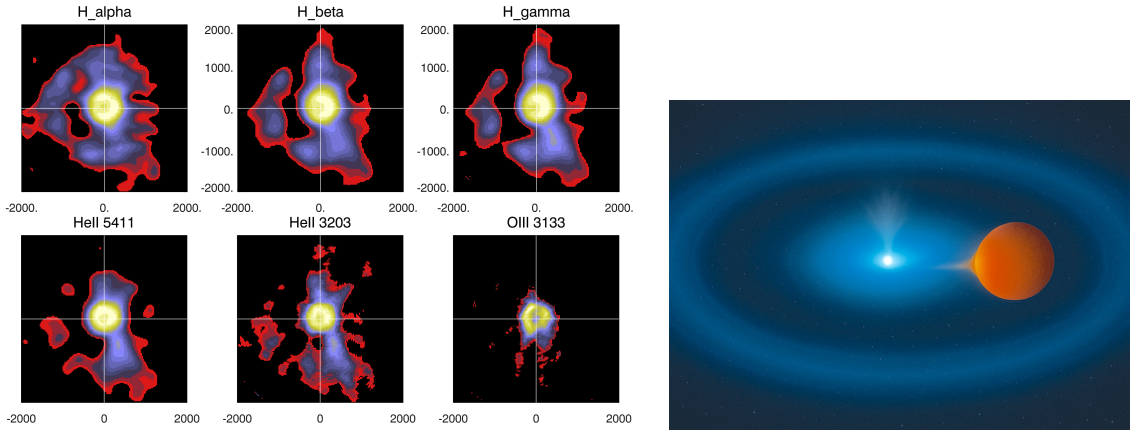


Figure 3.3: The Doppler maps based on VLT/XSHOOTER spectra showing the circumbinary ring as the central bright ring-like feature (left plot). AI generated schematic view of V Sge, showing the implied circumbinary ring around the binary discovered by Hakala, Charles & Rodríguez in 2025 (not to scale, right plot).

3.3, right). Such high mass transfer rate implies that the system is in unstable evolutionary state towards a likely merger event. This ring was detected in the so called Doppler maps (Fig 3.3, left), created from spectral emission lines. The circumbinary ring shows as a non-moving bright central ring in the Doppler maps.

These findings resulted in a press release, that was published by more than 100 news agencies across the world, from Bolivia and Chile to Azerbaidjan, India, Korea and Vietnam, to name a few.

Hakala also opened new international collaborations with University of Northumbria, taking part in research applying AI models to the population studies of cataclysmic variables. He is also involved in theoretical studies of magnetic accretion and binary evolution with the same group.

Finally, in collaboration with people from Caltech and Warwick, **Hakala** analysed linear polarimetry from NOT to set stringent limits on the nature of a newly found peculiar cataclysmic variable Gaia22ayj, which appears to be a sought after missing link in between different types of magnetic cataclysmic variables (Rodriguez et al. 2025).

3.1.3 Cosmology and Extragalactic Astrophysics

Spectro-polarimetric Measurements of AGN Using ALMA

In December 2024, **Mikael Turkki** started to work as a doctoral student in the Research Council of Finland project JetOrigin which partly includes analysis of full-Stokes data of AGN (Active Galactic Nuclei) with ALMA. Mikael's supervisors are **Talvikki Hovatta** and Tuomas Savolainen (Aalto University). During 2025, data analysis of the target 3C120 was completed. The interesting quantity that we derived from the data is Faraday rotation measure (RM) which depends on electron density n_e and magnetic field strength **B** in the system. It can be quantified by observing the polarisation angle in multiple wavelengths, as shown in Figure 3.4. The work continues with the aim to submit the paper for publication in 2026.

CAZ: The largest blazar catalog and optical light curves to date

In 2025, FINCAns **Pouya M. Kouch, Elina Lindfors, Talvikki Hovatta, Kari Nilsson, Jenni Jormanainen, Vandad Fallah Ramzani**, and **Folkert Wierda** as well as former FINCAn Ioannis

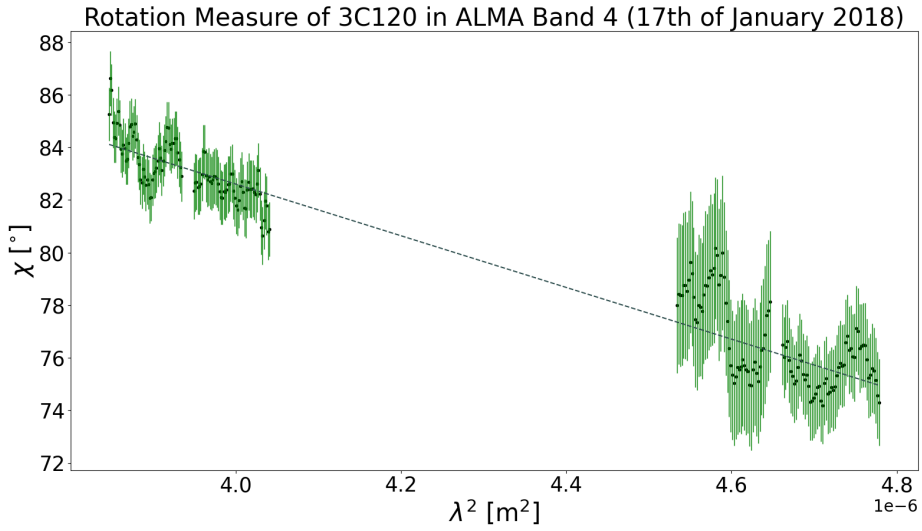


Figure 3.4: We detect a rotation measure (RM) of 1.9x10^5 rad m^{-2} within frequencies 137-153 GHz, and a RM of 3.8x10^6 rad m^{-2} within frequencies 223-243 GHz.

Liodakis compiled the largest-ever blazar catalog consisting of 7918 sources (Fig 3.5) and collected physical parameters, such as redshift, synchrotron peak frequency, radio variability Doppler factor, and X-ray flux density, for as many of them as possible. They then extracted optical light curves for as many source as attainable via three all-sky surveys, CRTS, ATLAS, and ZTF (hence the acronym CAZ), and combined them on a source-by-source basis. On average, the CAZ light curves span more than 15 years and have a daily-to-weekly cadence (e.g., Fig 3.6). They performed a thorough variability analysis on the CAZ light curves and identified tens of thousands of flaring periods in them using a Bayesian technique. This allowed them to study how blazar variability and flaring are connected to different blazar classes and physical parameters on a scale never done before. They found that: (1) flares tend to be faster when brightening and slower when dimming; (2) synchrotron peak frequency dictates how bright and variable blazars are at different observing frequencies; (3) the main blazar classes behave similarly at the same synchrotron peak frequency; and (4) optical flare parameters correlate with radio variability Doppler factor. They made the catalog, its light curves, Bayesian values, and flaring parameters available to the public. As such, the CAZ catalog and its light curves provide the community with an unprecedented tool to study jetted-AGN variability and prepare to handle jetted-AGN data in the era of Vera Rubin (LSST). The catalog paper is accepted for publication in A&A.

CAZ-versus-IceCube: The most extensive blazar-neutrino correlation study to date

The FINCA blazar group also continued their research on the mystery of the blazar-neutrino connection. Ever since the high significance spatio-temporal correlation of a high-energy ($\sim$100 TeV) neutrino event with the flaring blazar TXS 0506+056, researchers have been trying to establish a systematic correlation between blazars and high-energy neutrinos. The results have so far remained inconclusive but suggestive, which motivates further population-based studies. In 2025, FINCAns **Pouya M. Kouch, Talvikki Hovatta, and Elina Lindfors** as well as former FINCAn Ioannis Liodakis took their search for the mysterious sources of astrophysical high-energy neutrinos to the next level. Following up on their unique spatio-temporal approach to the blazar-neutrino mystery

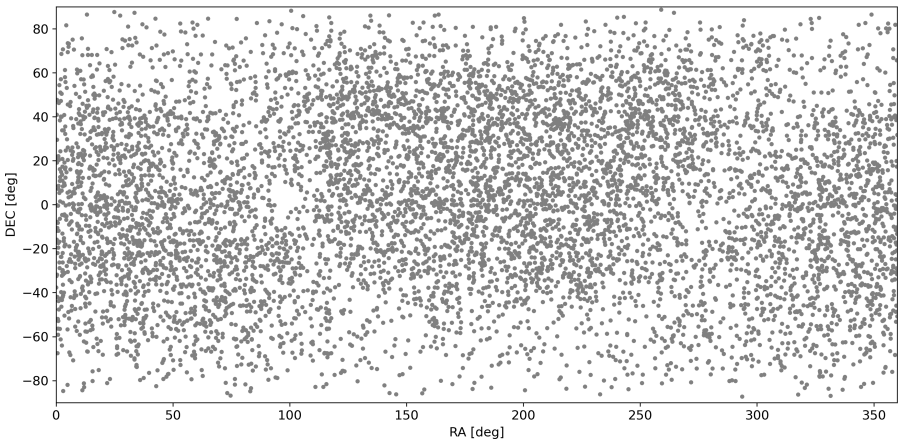


Figure 3.5: All-sky map of 7918 sources in the CAZ blazar catalog.

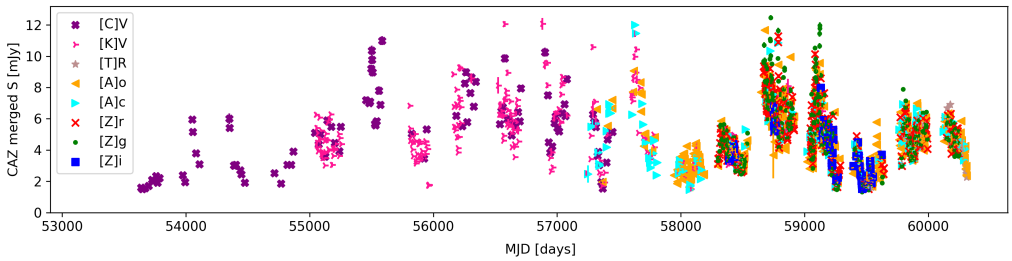


Figure 3.6: CAZ optical light curve for the blazar CAZ J0211+1051. The light curves were constructed by combining data from the CRTS, ATLAS, and ZTF all-sky surveys as well as from the long-running Tuorla blazar monitoring program and the KAIT monitoring program.

(see Hovatta et al., 2021, A&A 650, A83; Liodakis et al., 2022, A&A 666, A36; and Kouch et al., 2024, A&A, 690, A111), they leveraged the most optimal test strategy identified in Kouch et al. (2025; A&A, 696, A73) and the unprecedently large CAZ catalog and light curves (see above) to investigate whether high-energy neutrinos preferentially arrive during prominent blazar optical flares. They found that the spatio-temporal blazar-neutrino correlation (Fig 3.7) is still rather weak ($>2\sigma$), enabling them to put an upper limit of 8% on the fraction of astrophysical neutrinos coming from blazar optical flares. This adds to the mounting evidence that blazars are a subdominant source for $\sim$100 TeV neutrinos. Their work has helped build the necessary foundation for exploiting the next-generation neutrino facilities like KM3NeT to definitively pinpoint cosmic multimessengers. This work is also accepted for publication in A&A.

MAGIC Blazars

The international MAGIC Collaboration operates two Imaging Air Cherenkov Telescopes at La Palma, Canary Islands, Spain. During 2025, FINCAns **Jenni Jormanainen, Elina Lindfors, Pouya M. Kouch, Vandad Fallah Ramazani, Kari Nilsson**, and **Talvikki Hovatta** were involved in many blazar studies in utilising the very high-energy (VHE, E $>$ 100 GeV) gamma-ray data of MAGIC. In particular, we continued to study the significance of two-component emission models and long-term behaviour at radio-optical wavelengths to gamma-ray flaring of blazars. In 2025, a paper on “Very

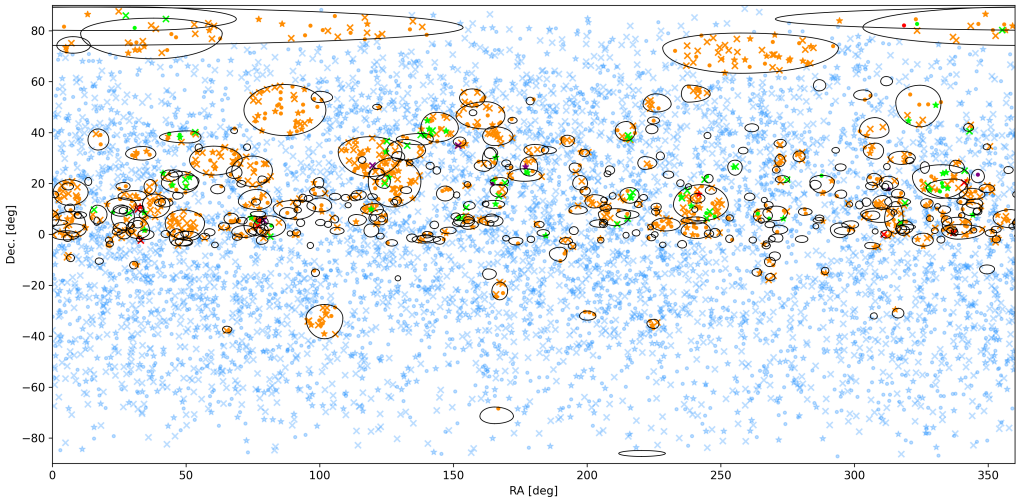


Figure 3.7: Spatio-temporal correlation of 7918 CAZ blazars with 356 IceCube high-energy neutrino events from the IceCat-1 catalog.

high-energy gamma-ray detection and long-term multiwavelength view of the flaring blazar B2 1811+31" led by Davide Cerasole (PhD student at the University of Bari, who visited FINCA in 2023 for this project) was published (MAGIC Collaboration et al. 2025, A&A, 697A, 172). We also submitted "A long-term multiwavelength study of the flat spectrum radio quasar OP313," that was led by Chiara Bartolini (PhD student at the University of Bari, who visited FINCA for 3 months in 2024 for this project).OP313 underwent extreme gamma-ray flaring in 2023-2024 (Fig. 3.8) and during that period was also detected at VHE gamma-rays by LST-1 and MAGIC. It has a redshift of z= 0.997 and is the most distant VHE gamma-ray emitting blazar to date.

Blazar redshift program

Blazars constitute the most numerous source class in the known extragalactic population of VHE gamma-ray sources. However, determining their redshifts is often challenging due to the presence of weak or non-existent emission lines in their spectra. Therefore, we have organised a task force within the CTAO consortium to conduct large redshift surveys of blazars, utilizing ESO telescopes as well. Within the task force, already three papers using direct spectroscopy with high S/N to determine the distance have been published with FINCA co-authors (Goldoni et al. 2021, Kasai et al. 2022, D'Ammando et al. 2024). In 2025, we published the fourth paper of the series. In this fourth paper, we report the results of detailed spectroscopic observations of 29 blazars using the ESO/VLT, Keck II, and SALT telescopes. We successfully determined firm redshifts for 12 blazars, ranging from 0.1636 to 1.1427, and identified two redshifts lower limits at $z > 1.0196$ and $z > 1.4454$. The remaining 15 BL Lac objects exhibited featureless spectra under the observed S/N (Rajbut et al. 2025, A&A, 704, 190, 17).

Multiwavelength polarisation of blazars with the IXPE satellite

FINCAns **Pouya M. Kouch, Jenni Jormanainen, Vandad Fallah Ramazani, Elina Lindfors, Kari Nilsson**, and **Mikael Turkki** participated in several photo-polarimetric campaigns of blazars across the electromagnetic spectrum, from the radio band all the way to X-rays. Polarimetry in such high-energy bands as X-rays is made possible by the Imaging X-ray Polarimetry Explorer (IXPE)

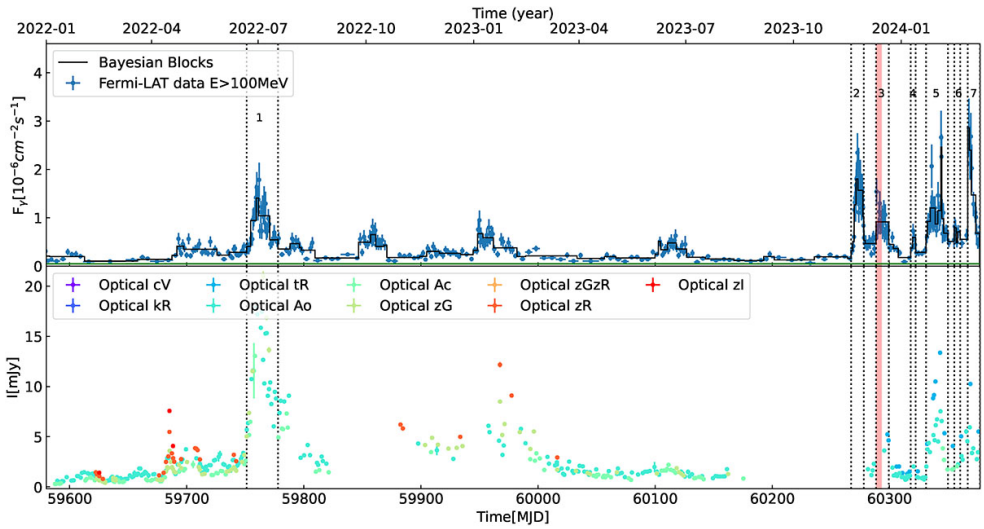


Figure 3.8: Fermi-LAT (top) and optical (bottom) light curves from 1 January 2022 to 9 March 2024. The dashed black lines indicate the brightest γ-ray flaring periods. The optical light curve was obtained from the CAZ catalogue (Kouch et al. 2026). The red vertical bands indicate the period when LST-1 detected OP 313.

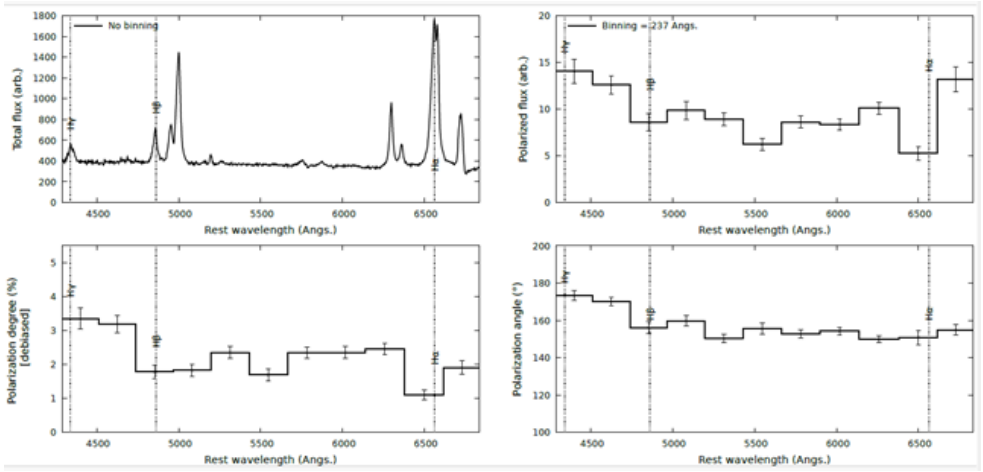


Figure 3.9: NGC 1275 as observed with NOT/ALFOSC on March 21, 2025. Top left: Total flux spectrum (corrected for instrumental response, in arbitrary units). Top right: Polarised flux (total flux multiplied by the polarisation degree). Bottom left: Linear polarisation degree. Bottom right: Polarisation position angle. All but the total flux spectrum were re-binned to 137 consecutive pixels ($\sim$237Å), with observational errors indicated per spectral bin.

satellite. They directly contributed to the studies by performing photo-polarimetric (PI: P.Kouch) and spectropolarimetric (co-Is: E. Lindfors and M.Turkki) observations using the Nordic Optical Telescope (NOT). In 2025, one of the highlight targets was NGC1275, the central galaxy of the Perseus Cluster. We performed spectropolarimetry of the source during the IXPE campaign (Fig 3.9), and while the total-light spectrum confirms its edge-on, core obscured (type-2) classification, the polarised spectrum shows a polarisation angle aligned with the arcsecond radio jet axis, an exceptional behavior for type-2 objects (Marin et al. *including E. Lindfors and M. Turkki* 2025, A&A, 702, 16). IXPE performed the longest observation for a radio-loud active galaxy on NGC1275, which allowed it to reach unprecedented sensitivity, leading to the detection of an X-ray polarisation degree of $P_X = 4.2 \pm 1.3\%$ (3.2σ confidence) at an X-ray electric vector polarisation angle of $PA_X = 163 \pm 9^\circ$, which is aligned with the radio jet direction on the sky. The results strongly favour models in which X-rays are produced by Compton scattering from relativistic electrons, specifically, synchrotron self-Compton, that takes place downstream, away from the supermassive black hole. Paper is led by former FINCAn Ioannis Liodakis and it included data from our NOT polarisation monitoring program (Liodakis. et al. 2025, ApJL, 994, 1, L9).

Optical Polarisation of Tidal Disruption Events

Supermassive black holes are known to disrupt passing stars, triggering tidal disruption events (TDEs). TDEs have recently attracted significant attention due to their unique dynamics and emission processes, which remain not fully understood. Optical TDEs, in particular, are intriguing because they often exhibit delayed or obscured X-ray emission from the accretion disk, leaving the origin of the prompt emission unclear. Our team, including **Elina Lindfors** and **Kari Nilsson** from FINCA, worked on two population studies of TDEs in 2025 (Floris et al. 2025 A&A, 703, A81, 11 and Floris et al. 2026, A&A, 707, 378). Alberto Floris is PhD student of former FINCAn Ioannis Liodakis (now at FORTH, Crete) and Alberto Floris visited FINCA for two weeks in 2025 to work on the data analysis of these papers. In Floris et al. 2025, the population study of optical TDEs reveals that AT2020mot (that we studied in Liodakis et al. 2023, Science) aligns with the broader TDE sample in terms of most physical properties, including blackbody temperature, luminosity, and rise timescales. However, its optical polarisation degree is exceptionally high compared to the low or undetected polarisation observed in other events. In Floris et al. 2026, we concentrated on variability of the polarisation angle. Our final sample comprised 12 transients, including three Bowen fluorescence flares (BFFs). The majority of the sources show significant polarisation angle variability.

New M87 Images from the Event Horizon Telescope

Global millimetre very long baseline interferometry, leveraging the incredible sensitivity of ALMA, has opened a new window into the immediate environments around supermassive black holes. Responsible for producing the highest resolution observations in astronomy, the Event Horizon Telescope in December published new results from multi-year observations of M87, the first black hole ever imaged.

We have analyzed the observations of M87 across three epochs (2017, 2018, and 2021), and for the first time presents resolved polarisation maps of the black hole shadow from 2018 and 2021. As expected from a stochastic, turbulent accretion flow around a black hole, both the total intensity and polarised images vary significantly from year to year. While the total intensity images seem relatively similar between 2018 and 2021 (despite a significant gamma ray flare detected within days of the 2018 observations), both the magnitude and pattern of the linear polarisation changes

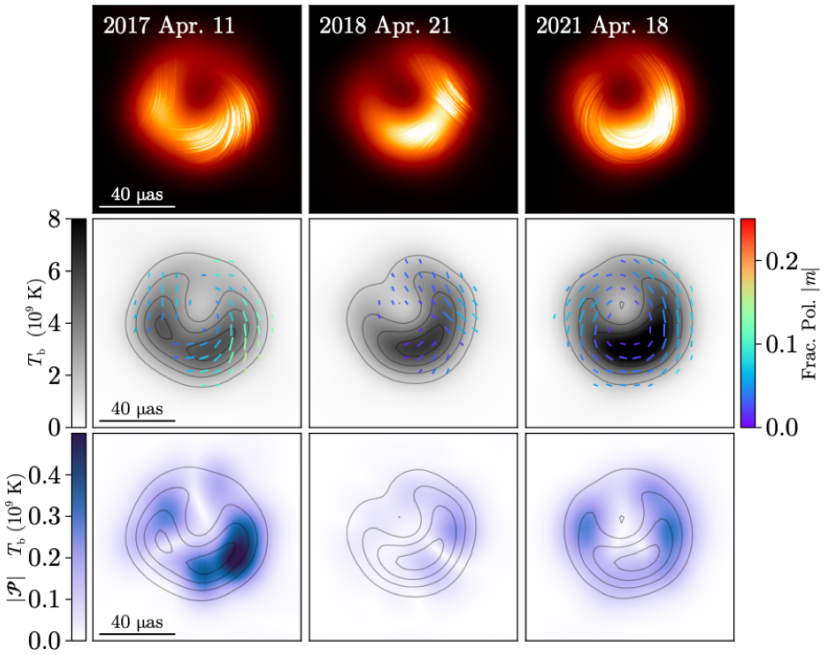


Figure 3.10: Fiducial images for 2017 (band 3), 2018 (bands 3 and 4), and 2021 (bands 3 and 4). The images were produced by averaging across reconstruction methods. Each method's image reconstruction has been blurred to match the resolution of the representative CLEAN image. Top row: Polarisation 'field lines' overlaid on the total intensity image. Second row: Total intensity image in grey scale with the contours showing the 22.5%, 45%, 67.5%, and 90% peak brightness levels, overlaid with polarisation ticks. Bottom row: Total linear polarised brightness |P|.

significantly in each epoch (Fig 3.10). 2018 features very low polarisation fractions, especially relative to 2017, and the electron vector position angle pattern in 2021 changes helicity, strongly challenging our expectations from general relativistic magnetohydrodynamic simulations.

FINCA recently welcomed **George Paraschos** and **Britton Jeter** as new postdoctoral researchers, both of whom are active members of the EHT and have significant experience in global millimetre VLBI. Working closely with **Elina Lindfors, Talvikki Hovatta, Kaj Wiik** and the rest of the Blazar and high frequency radio group, we hope to combine expertise at the highest resolutions and highest energies to better understand the nature of supermassive black holes, relativistic jets, and the rich zoo of active galactic nuclei.

Ultra-diffuse galaxies in the Hydra I cluster

Ultra-diffuse galaxies (UDGs) are extremely low-surface brightness galaxies with a size of several kpc, i.e. comparable to that of the Milky Way, but with at least 100 times smaller stellar masses. Their spectroscopic study is incredibly timely in the context of steadily increasing UDG discoveries from imaging data, since their observational properties cannot be reconciled with a single formation scenario. In 2025, the LEWIS collaboration (PI: Enrica Iodice, INAF) published the first data release of the Looking into the faintEst With Muse ESO Large Programme. LEWIS is the first homogeneous integral-field spectroscopic survey of UDGs in a galaxy cluster. The data reduction workflow was developed and tested at the Finnish CSC (IT Center for Science) by FINCA

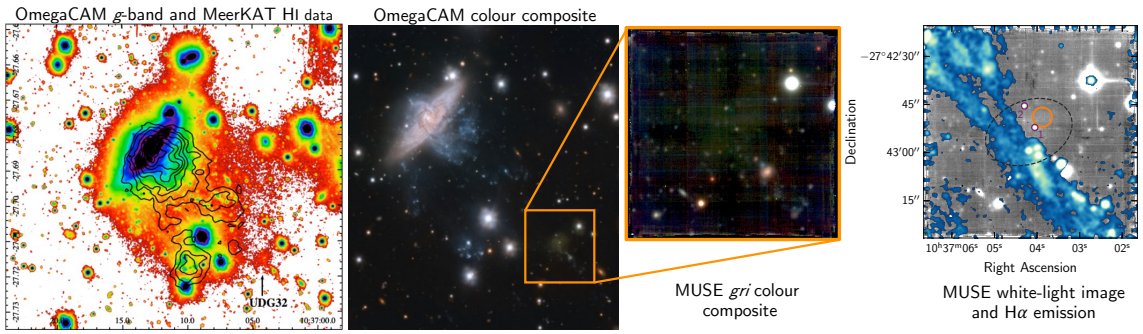


Figure 3.11: Multi-wavelength view of UDG 32 and its environment. From left to right: VST OmegaCAM g-band image (Iodice et al. 2021) of UDG 32 and NGC 3314A/B with black contours tracing the HI emission detected by the MeerKAT survey (Hess et al. 2022), VST OmegaCAM colour-composite image (Iodice et al. 2021) with the location of UDG 32 highlighted by the orange box, colour-composite derived from the MUSE data presented in this paper, and MUSE white-light image with the H? emission overplotted by the blue colour map. The dashed ellipse denotes the 1 Reff isophote of UDG 32 derived by Iodice et al. (2021) and the purple circles the two intracluster GCs that were spectroscopically confirmed by Hartke et al. (2025). Credit: Hartke et al. (2025, A&A, 695, A91)

researcher **Johanna Hartke** and then handed over to the LEWIS core team at INAF Capodimonte (Naples, Italy) funded by the FINCA visitor and mobility programme. Besides the ESO data release (https://doi.eso.org/10.18727/archive/104), the LEWIS team published the stellar kinematics and dynamical masses of the sample (Buttitta et al. 2025, including JH). **Johanna Hartke** led a paper titled "Untangling UDG 32 from the stripped filaments of NGC 3314A with multi-wavelength data", focusing on the special case of UDG 32, which was discovered in projection with the stellar filaments of the jellyfish galaxy NGC 3314A (Iodice et al., 2021). The new MUSE data allowed the authors to reveal that the stripped material from NGC 3314A extends much further from its parent galaxy than previously known, covering the UDG in projection (see Fig 3.11). While a direct link to the material stripped from NGC 3314A could not be established, the metal-rich and intermediate-age nature of UDG 32 points to its formation from material that was pre-enriched in a more massive galaxy and then liberated via tidal or ram-pressure stripping in the Hydra I cluster.

VLTI-GRAVITY observations blazars

Milliarcsecond-scale jets of blazars have so far been spatially resolved only in millimeter- and submillimeter wavelengths. **Talvikki Hovatta** has been leading a program with the ESO VLTI-GRAVITY instrument where the aim has been to observe blazars with near-infrared interferometry to resolve them on shorter wavelengths for the first time. We obtained observations with the VLTI-GRAVITY instrument for five blazars, one of which was observed during a flaring state triggered by the Tuorla blazar monitoring program optical observations. The squared visibilities of the flaring source Ton 599 are shown in Fig 3.12 (right) and they can be modeled with either an unresolved point source or a partially resolved Gaussian component. In nearby AGN the near-infrared emission often originates from the dusty torus, but we can rule this out as the sole origin of the near-infrared emission in Ton 599 due to the brightness of the target (Fig 3.12, left). Instead, we suggest that we are seeing the compact, synchrotron-radiation emitting, jet base. Our observations demonstrate the

feasibility to observe blazars with near-infrared interferometry and with the upgraded GRAVITY+ instrument one should be able to spatially resolve their near-infrared-emitting regions. The article presenting these results was submitted to Astronomy and Astrophysics in December 2025.

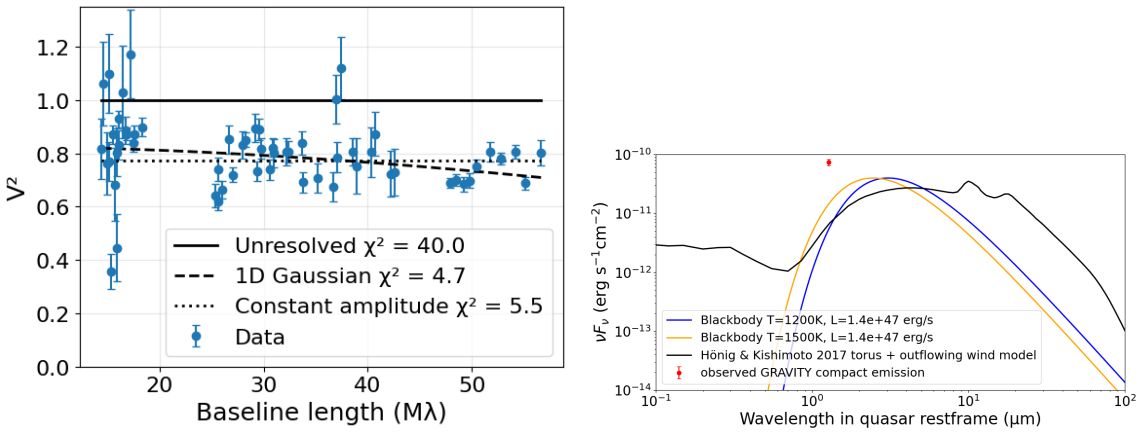


Figure 3.12: Left: Squared visibilities as a function of baseline length along with three different models used to fit them. We cannot statistically discriminate between the unresolved point source and the Gaussian models. Right: Spectral energy distribution of a single blackbody component with a luminosity corresponding to the disk luminosity of Ton 599 and temperatures of 1200 K (blue) and 1500 K (orange) along with a model for a torus including an outflowing wind (black). The observed value for the compact emission in our GRAVITY data is shown by the red symbol.

Hidden dust in blazars

Very-high-energy gamma-ray emission of blazars is thought to be due to Inverse Compton scattering where synchrotron electrons from the relativistic jet scatter photons to higher energies. The origin of these seed photons is not always clear, and some studies have suggested that circumnuclear dust visible in the millimeter wavelenghts could act as the seed photon field in some objects. Motivated by preliminary analysis of ALMA archival data **Talvikki Hovatta** applied for ALMA observing time to study this in the blazar Ton 599. As part of his master's thesis and partially funded by the FINCA incentive funding, **Leo Tamminen** imaged high-resolution archival ALMA observations of two blazar targets, Ton 599 and TXS 0506+056, in search for such a circumnuclear dust disc. Although preliminary image of Ton 599 had suggested that there could be such a disc, after proper calibration, no strong evidence for a substantial disc was found in either target. The thesis of Leo included several suggestions on how to improve the search for such dust disc using dedicated observations of samples of objects.

An updated view on the molecular clouds in the northern filaments of Centaurus A

Evidence of recent star formation is observed in the halo of few radio galaxies, where the radio jet encounters a gas reservoir. This suggests that star formation is triggered by the interaction (jet-induced star formation). The northern filaments of Centaurus A are a testbed to study the influence of the radio jet on gas in the halo. Located at about 15 kpc from the galaxy, where the jet encounters a large HI shell, the filaments host a large reservoir of molecular gas associated with very inefficient star formation. In 2017, a study based on ALMA data identified 140 molecular clouds in the filaments with similar properties that observed in the inner Milky Way. However, the high virial

parameter indicates that gravity is not dominant in the clouds. This suggests that, while the energy injected by the jet is able to trigger the formation of molecular gas, it is too high to let the gas cool efficiently, therefore quenching the star formation. **Quentin Salomé** obtained complementary ACA short- and TP zero-spacing observations to recover the diffuse CO(1-0) emission. The new data analysis yields a more complete catalogue with higher total mass, but otherwise properties consistent with the previous study. A comparative analysis with clouds in nearby star-forming disc galaxies shows that the molecular clouds in the northern filaments are much more turbulent and pressurised. Moreover, the low star formation efficiency in the clouds is consistent with the suppression of star formation by mechanical AGN feedback.

Multi-phase AGN-driven outflow in the NLSy1 IRAS 17020+4544

The narrow-line Seyfert 1 (NLSy1) galaxy, IRAS 17020+4544, is one of the few known sources exhibiting a multi-phase outflow in the highly ionised and molecular phases consistent with AGN feedback operating in the 'energy-conserving' regime. **Quentin Salomé** and his collaborators analysed new optical integral-field spectroscopic observations from MEGARA at the GTC to characterise the properties of the warm ionised gas in IRAS 17020+4544, and assess the presence of outflowing ionised gas and its connection with the other gas phases. A fast ionised outflow traced by both H_α and OIII emission lines, with velocities $\sim$ 1460 and 1240 km/s, follows an 'energy-conserving' regime. A slower ionised outflow ($\sim$ 450 km/s) is also detected in the secondary component of the OIII line, following a 'momentum-driven' regime. The ionised outflows are enclosed within the molecular outflows detected with NOEMA, and the large momentum boosts derived in both phases suggest efficient AGN feedback, likely dominated by radiatively driven winds (quasar-mode) rather than kinetic (jet-driven) processes. These results support a scenario where the multi-phase outflow in IRAS17020+4544 is AGN-driven and 'energy-conserving' in the different phases, efficiently coupling the AGN energy to the host galaxy's interstellar medium.



4. Instrument Development

Son of X-Shooter (SOXS): In commissioning

SOXS has arrived at the NTT telescope in ESO La Silla, Chile. Following the installation, it has been undergoing commissioning activities to verify the instrument functionalities. Real on-sky data have been obtained during these activities, confirming that the instrument is performing as designed. SOXS is now waiting for green light from ESO to be offered to the community for normal use. The calibration unit of the instrument was constructed at the University of Turku as Finland's contribution funded through a FINCA FIRI grant. The work was led by **Hanindyo Kuncarayakti**.

ELT-MICADO & MOSAIC

MICADO PSF-Reconstruction work progressed with the development of the ELT pupil software which simulates the 798 segments of the ELT primary mirror. The work led by **Hanindyo Kuncarayakti** and involving also **Johanna Hartke** has been carried out in collaboration with *Incident Angle Oy*, a local optical design company based in Turku. The pupil software will eventually be integrated with the MICADO software for users.

During the year, FINCA started active participation in the MOSAIC instrument project for the ELT. MOSAIC is a multi-object spectrograph operating in both visual and near-infrared wavelengths, currently in the design phase. The Finnish contribution on MOSAIC is also managed by Kuncarayakti, and is currently assigned within the near-infrared channel of MOSAIC, with detailed tasks still to be defined.

Black Silicon detectors: Nano-Astro

A *Proof of Concept* Research Council of Finland application by the "Nano-Astro Consortium" was accepted in 2025. This is a collaboration between FINCA and Aalto University (in particular their nano-electronics group), as well as the Nordic Optical Telescope (NOT) and the well-known CCD-chip provider STA from California. The project Co-PIs are **Hanindyo Kuncarayakti** from FINCA, and prof. **Hele Savin** from Aalto. The project aims to apply an Aalto-developed Black Silicon technology for the first time into astronomy, to large-format detectors used in astronomical instrumentation. If demonstrated successfully, this could be attractive for multiple uses and for a range of customers.

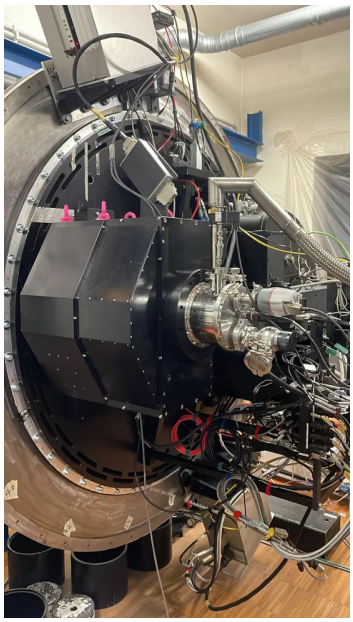


Figure 4.1: .Fully integrated SOXS instrument in Padova. Picture: INAF

In June 2025, FINCA and the University of Turku hosted the 22nd MICADO consortium meeting on the UTU campus. It was the first significant ELT-related meeting in Finland and was organised by FINCA researchers Dr **Johanna Hartke** and Dr **Hanindyo Kuncarayakti**. 60 consortium members attended the meeting in person in Turku and the total attendance amounted to more than 90 people, as remote participation was also possible. In addition to the meeting activities, a public lecture titled "Euroopan eteläisen observatorion jättiteleskooppi" was held by doc. Heidi Korhonen (MPIA Heidelberg) and a visit of Tuorla Observatory was organised for the participants. The picture shows the on-site participants in the Calonia building.

Africa Millimeter Telescope (AMT)

Talvikki Hovatta and former FINCAn **Elina Lindfors** are actively participating in the Africa Millimeter Telescope (AMT) project where a new radio telescope will be built in Namibia. The project is partially funded through an ERC Synergy grant "Blackholistic" where University of Turku and FINCA participates as a non-PI partner. In June 2025, with support from FINCA, we organised the Blackholistic collaboration meeting at the Aalto-University campus in Otaniemi, where nearly 40 members of the synergy grant groups attended.

The CTAO array at ESO

CTAO, the first VHE gamma-ray observatory, will consist of two telescope arrays: the CTAO Northern array, on Instituto de Astrofisica de Canarias (IAC) Roque de los Muchachos Observatory on the Canary island of La Palma (Spain), and the CTAO Southern array, at the European Southern Observatory (ESO) Paranal Observatory in the Atacama Desert. In 2025, the construction of the three more LST telescopes of the Northern array continued and the construction of the Southern Array started. The preparation of the Active Galactic Nuclei Key Science Program continued with active participation from FINCAns **Kari Nilsson** and **Talvikki Hovatta** and former FINCAn **Elina Lindfors**.



Figure 4.2: In June 2025, FINCA and the University of Turku hosted the 22nd MICADO consortium meeting on the UTU campus. It was the first significant ELT-related meeting in Finland and was organised by FINCA researchers Dr **Johanna Hartke** and Dr **Hanindyo Kuncarayakti**. 60 consortium members attended the meeting in person in Turku and the total attendance amounted to more than 90 people, as remote participation was also possible. In addition to the meeting activities, a public lecture titled "Euroopan eteläisen observatorion jättiteleskooppi" was held by doc. Heidi Korhonen (MPIA Heidelberg) and a visit of Tuorla Observatory was organised for the participants. The picture shows the on-site participants in the Calonia building.



Figure 4.3: FINCA staff at the Nordic-Baltic meeting in June 2026. Picture: Vadim Kravtsov.



5. Teaching

5.1 Lectured courses

Basic level - in Finnish

Teacher	Course	Credits	Location
P. Väisänen (lecturer)	Johdatus Maailmankaikkeuteen	5	Turku

Advanced level - in English

Teacher	Course	Credits	Location
G. Fedorets (co-lecturer)	Observational Techniques Using the Nordic Optical Telescope	7	Turku
J. Hartke (co-lecturer)	Spectroscopic diagnostics: Spectroscopic diagnostics with Integral Field Units		Turku
J. Hartke (co-lecturer)	Observational Techniques Using the Nordic Optical Telescope	7	Turku
T. Hovatta (lecturer)	Radio astronomy and interferometry	5	Turku
T. Hovatta (co-lecturer)	Radio astronomy	5	Aalto
T. Hovatta (co-lecturer)	Space Instrumentation	5	Aalto
T. Kangas (co-lecturer)	Observational Techniques Using the Nordic Optical Telescope	7	Turku

5.2 Completed theses

MSc theses

Kristen Gardner, Turku, *Using Scopesim to Plan Research With the Extremely Large Telescope*, supervisors: J. Hartke (FINCA), H.Kuncarayakti (FINCA/Dept. of Physics and Astronomy), S. Mattila (Dept. of Physics and Astronomy).

Leo Tamminen, Université de Toulouse / Luleå University of Technology, *Hidden dust in blazars*, supervisor: Talvikki Hovatta (FINCA)

Chantal Babooram, Turku, *Decomposition of Supermassive Black Hole host galaxies in near-infrared*, supervisor: Kari Nilsson (FINCA)

Simon Flesch, Observatoire de Paris, PSL University, France, *Regulating star formation in massive galaxies: From jet-driven AGN feedback to quenching resistance*, supervisors: Philippe Salomé (Observatoire de Paris, France), Quentin Salomé (FINCA), Pierre Guillard (IAP, Paris)

PhD theses

Jenni Jormanainen, University of Turku, *Particle acceleration and magnetic fields of relativistic jets through multi-wavelength analyses*, supervisors: Talvikki Hovatta (FINCA) and Elina Lindfors (Dept. of Physics and Astronomy.

Petronella Janse van Rensburg, University of Cape Town, *Studying Gas Flows in the SUNBIRD Starburst Galaxies and LIRGs*, supervisors: Moses Mogotsi (SAAO) and Petri Väisänen (FINCA).



6. Other research activities

FINCA Visitor and Mobility Program

Twice a year, FINCA publishes a Call for Applications for its “Visitor and Mobility Program" to promote the scientific interaction of FINCA, and Finnish astronomers, with research institutions worldwide. During 2025, the following trips were approved to be funded, in full or in part. Note that some of the trips approved would actually happen in 2026.

Mobility grants – the awardee, their institute, and the research visit destination, are indicated:

Alexis Finoguenov	Helsinki	ESO, Chile
Johanna Hartke	Turku	ESO, Chile
Elina Lindfors	Turku	La Palma, Spain
Anagha Nitindala	Turku	INAF, Brera, Italy
Vitaly Neustroev	Oulu	Charles Univ., Czech Rep.
Irene Varglund	Aalto	ESO, Chile

Visitor grants – the visitor with their home institute, and their Finnish destination and host, are indicated:

Maria Cristina Baglio	INAF, Brera, Italy	Turku	Anagha Nitindala, Alexandra Veledina
Rasha Eldaly	NRIAG Cairo, Egypt	Helsinki	Ghassem Gozaliasl
Duncan Galloway	Monash Univ., Australia	Turku	Rubina Kotak
Karri Koljonen	NTNU, Trondheim, Norway	Turku	Kari Nilsson, Elina Lindfors
Yannis Liodakis	FORTH, Crete, Greece	Turku	Kari Nilsson, Elina Lindfors
James Robinson	Edinburgh, UK	Helsinki	Grigori Fedorets

ESO Incentive program

To support new ESO-related research and the timely analysis and publication of such results, FINCA awards grants to Finland-based Principal Investigators who have been successful in their ESO or ALMA observing proposals. The grant can be used for, e.g., travel expenses to visit/invite relevant collaborators, to participate in conferences presenting results, and/or to hire a student or postdoc to enhance the project. In 2025, there were numerous Finnish applications that were successful - the PIs of these are listed below along with the broad topic of the project, and the ESO instrument used.

ESO period 115

Z. Gray	Helsinki	Near-Sun asteroids with VLT/FORS2.
J. Hartke	FINCA/Turku	Relic galaxies with VLT/MUSE.
T.Killestein	Turku	Supernova environment and progenitor with VLT/X-Shooter.
T.Killestein	Turku	Donor star of an x-ray binary with VLT/CRIRES.
R. Kotak	Turku	Nearby supernovae with VLT/X-Shooter.
T. Kravtsov	FINCA/Turku	Young supernova remnants with VLT/X-Shooter.
P. Kvist	Oulu	Dwarf Novae with VLT/X-Shooter.

ESO period 116

R. Kotak	Turku	Core-collapse Supernovae in a joint VLT/X-Shooter and ALMA program.

ALMA Cycle 12

R. Kotak	Turku	Core-collapse Supernovae in a joint VLT/X-Shooter and ALMA program.

NOT observations support program

FINCA supports PIs based at FINCA-affiliated universities, who are successful in obtaining observing time from the NOT. This support comes in the form of reimbursing all trip costs to the observatory at La Palma, Canary Islands, in case of Visitor mode observations, and/or the payment of Service Observing fees.

During the calendar year 2025 there were numerous Finnish observing programs related to NOT Semesters P70, P71, and P72, supported from FINCA funds, for a total of approximately 55keur.

Visitor mode programs supported:

A. Berdyugin	Turku	February 2025.
Z. Gray and G. Fedorets	Helsinki	April 2025.
R. Rautio	Oulu	May 2025.
M. A. Diaz Teodori	Turku	June, December 2025.
A. Nitindala	Turku	June, December 2025.
A. Haris-Kiss and N. Routamo	Helsinki	July, December 2025.

The names of PIs of accepted NOT programs in Service mode during the 2025 calendar year are also listed below. FINCA paid the relevant NOT service fees. The names are in an alphabetical order, and only once, even if they had multiple accepted programs during the year (as several did):

P. Charalampopoulos	Turku
G. Fedorets	FINCA/Helsinki
M. Granvik	Helsinki
Z. Gray	Helsinki
E. Kankare	Turku
T. Killestein	Turku
E. Kool	FINCA/Turku
R. Kotak	Turku
P. Kouch	FINCA/Turku
H. Kuncarayakti	FINCA/Turku
E. MacLennan	Helsinki
T. Nagao	Turku
A. Penttilä	Helsinki
P. Väisänen	FINCA/Turku

Finally, FINCA supports educational use of NOT for the benefit of the Finnish astronomical community. Support to utilise NOT was hence awarded to the following programs, in the form of covering all the relevant service observing fees, and also the travel and accommodation costs to/in Turku for the university students of the National NOT school:

National NOT School (university level, done remotely from UT in October)	PI: Erkki Kankare (Turku)
NOT school for high-school students (twice per year, both visits to La Palma, and remote)	PI: Pasi Nurmi (LUMA Centre, Turku)

There were 23 students, from three universities, enrolled in the former, and a total of 60 students and 14 teachers from 14 high schools involved in the latter two hands-on courses aimed at secondary schools in Finland.

Memberships in conference SOC/LOC and other committees

G. Fedorets	LOC member for the joint Europlanet Science Congress/Division for Planetary Science meeting, 7.-12.9.2025, Helsinki, Finland. Board of the Finnish Astronomical Society (treasurer) Secretary of the Finnish National Committee for Astronomy
P. Hakala	Referee for A&A and MNRAS Reviewer for the global QS University ranking
J. Hartke	Panel member, ESO Observing Programmes Committee SOC member IAU 396 Massive Galaxies across the Universe (Naples, Italy 2025) LOC co-chair, MICADO consortium meeting #22 FINCA Board staff representative Referee for PASA
T. Hovatta	Finnish representative in the ESO Scientific Technical Committee Chair of the European Science Advisory Committee for ALMA Member of the Africa Millimeter Telescope Board
T. Kangas	ESO Observing Programmes Committee participation for Period 114 SOC and LOC co-chair of IAU Symposium #406 NOT Observing Programs Committee membership for Periods 72 and 73
P. Kouch	Chair of the Scientific Organizing Committee of the Nordic-Baltic Astronomy Days 2026 (Turku) Chair of the Local Organizing Committee of the Nordic-Baltic Astronomy Days 2026 (Turku) Board of the Finnish Astronomical Society (President))
H. Kuncarayakti	ESO Users Committee member SOC and LOC co-chair of IAU Symposium #406
P. Väisänen	Member of the Finnish ESO National Committee Member of the Finnish National Committee for Astronomy Member of the ELT/MICADO Consortium Board Member of the ELT/MOSAIC Consortium Board Member of the UTU EXACTUS Steering Committee / Board NOT representative in the International Scientific Committee of the Canary Islands (CCI) *ex-officio* Member of the NOT Council *ex-officio* Member of the FINCA Board

Conference presentations

G. Fedorets	Winter Satellite Workshop 2025, Espoo, Finland, “Characterising very small asteroids with the Nordic Optical Telescope.”
	Workshop on LSST follow-up observations. Edinburgh, UK, “Earth’s temporary moons (and some other types of NEOs) as targets of interest for LSST follow-up”
	Joint European Planetary Science Congress - Division of Planetary Science meeting, Helsinki, Finland, “Detecting minimoons with LSST - building a dedicated approach”
	Joint hybrid workshop of University of Helsinki, and University of Kunming, People’s Republic of China. “Predictions of Solar System discoveries with the Vera C. Rubin observatory”
J. Hartke	Benasque, Spain, August 2025, “10 Years of Ultra-Diffuse Galaxies: Past Perspectives and Future Prospects”
	Tartu-Tuorla 2025, May 2025, Viinistu, Estonia, ”The fate of ultra-diffuse galaxies in the Hydra I cluster”
T. Hovatta	Extragalactic jets at all scales: a Cretan view, Heraklion, Greece, 25-29 Aug 2025,”Resolving the supermassive black hole jet of a blazar in near-infrared wavelengths” (talk)
	5xERC on Jets, Ringberg, Germany, 22-24 Oct, 2025, "PARTICLES" (talk)
T. Kangas	European Astronomical Society Annual Meeting, Cork, Ireland, June 2025, “Power sources of hydrogen-rich superluminous supernovae”, (poster)
	3rd Finland-Japan bilateral meeting on extragalactic transients, Kyoto, Japan, May 2025. “The origins of Type II SLSNe”.
P. Kouch	Tartu-Tuorla 2025, May 2025, Viinistu, Estonia), “The Wild Hunt for Cosmic High-Energy Neutrino Counterparts”
	BlackHolistic 2025 (Espoo, Finland),“Solving the Mystery of High-Energy Neutrinos via Blazar Radio Monitoring”
	Extragalactic Jets at All Scales" (Heraklion, Greece), “The Hunt for Cosmic High-Energy Neutrino Counterparts”
K. Nilsson	Tartu-Tuorla 2025, May 2025, Viinistu, Estonia, “Host galaxy studies of Blazars and kindred phenomena” (talk)

M. Turkki	BlackHolistic 2025, (Espoo, Finland), "3C120: Faraday Rotation in Millimetre Waveband"
	Extragalactic jets at all scales: a Cretan view (Heraklion, Greece), "AGN Jets: Faraday Rotation in Millimetre Wavebands"
	5xERC on Jets (workshop), (Ringberg, Germany), "Magnetic Field Structure of AGN Jet with ALMA Polarimetry"
P. Väisänen	Tartu-Tuorla 2025, May 2025, Viinistu, Estonia, "Young massive star clusters in strongly star forming galaxies"

Other talks

G. Fedorets	"Asteroidi 2024 YR4:n uhan lyhyt historia", Asteroid Day, Observatory, University of Helsinki, June 2025
J. Hartke	"Ring-a-scientist" talk to students at Rudolf-Hildebrand-Schule, Markkleeberg, Germany, June 2025
K. Nilsson	"Sata vuotta tähtitiedettä Turun yliopistossa", at the '100 Years of Astronomy at the Turku University' celebration, Tuorla, January 2025
P. Väisänen	"European Southern Observatory and the ELT" talks at the '100 Years of Astronomy at the Turku University' celebration, Tuorla, January 2025

Research Visits

J. Hartke	Visit to Chalmers, April 2025 ESO-incentive grant funded visit to University of Oxford, October 2025 ESO SSDF invited visit, Garching, September 2025
P. Kouch	Observing shift at the MAGIC telescopes in Roque de los Muchachos, Spain (3 weeks in April 2025) Research visit to the group of Ioannis Liodakis at the FORTH Institute of Astrophysics in Heraklion, Greece (1 week in September 2025)
M. Turkki	Universitat de València, Spain, March 24 - April 4, 2025 Universidad Complutense de Madrid, April 7 - 11, 2025 JIVE VLBI School, Dwingeloo, the Netherlands, September 15-19, 2025

Other Activities and Trips

G. Fedorets	Planetary Science Journal Club (organiser), Helsinki
	FINCA seminar organiser, online
T. Kangas	SOXS Consortium Meeting, Milan, Italy, September 2025
H. Kuncarayakti	ESO Users' Committee Meeting, Garching, April 2025
	Finland-Japan bilateral collaboration meeting, Kyoto University, May 2025
	Research visit to University of Tokyo and Kyoto, July 2025
	Research visit to National Observatory of Indonesia, July 2025
	CSC seminar on international collaboration in data-intensive research, Helsinki, September 2025
	SOXS Consortium Meeting, Milan, Italy, September 2025
	MOSAIC Consortium Meeting, Amsterdam, October 2025
	MOSAIC NIR Channel Meeting, Madrid, November 2025
	Licenciate defense committee member, Stockholm University, December 2025
	Department seminar, Stockholm University, December 2025
M. Turkki	Outreach video on Ursa's YouTube channel about MAGIC telescopes in La Palma
M. Turkki	Outreach video on Ursa's YouTube channel about William Herschel Telescope's WEAVE instrument
P. Väisänen	NOT External Review & UTU Rectorate Visit, La Palma, Spain, April 2025
	CCI Meeting, Toulouse, France, May 2025
	SALT 20 year Anniversary, Sutherland & Cape Town, South Africa, November 2025
	NOT & CCI Meeting, La Palma, Spain, November 2025

Hosted visitors

Visitor	Time	Host(s)
Anjasha Gangopadhyay (Stockholm U.)	June 2025	H. Kuncarayakti
Keiichi Maeda (Kyoto U.), Akihiro Suzuki (U. Tokyo) &Takashi Moriya (NAOJ)	August 2025	H. Kuncarayakti
Dr. Zara Randriamanakoto (SAAO, Cape Town)	September 1–12, 2025	P. Väisänen



Figure 6.1: FINCA 2025 christmas dinner in Helsinki.

7. Publications

FINCA Refereed publications 2025:

1. Aamer, Aysha, Nicholl, Matt, Gomez, Sebastian et al. (2025) **including H. Kuncarayakti**. The Type I superluminous supernova catalogue – II. Spectroscopic evolution in the photospheric phase, velocity measurements, and constraints on diversity. MNRAS, 541, 2674-2706.
2. Abe, K., Abe, S., Abhir, J. et al. (2025). **including including J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Insights from the first flaring activity of a high synchrotron peaked blazar with X-ray polarization and VHE gamma rays. A&A, 695.
3. Abe, K., Abe, S., Abhir, J. et al. (2025). **including including J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Very high energy observations of the Seyfert galaxy NGC 4151 with MAGIC: Indication of another gamma-ray obscured candidate neutrino source. A&A,
4. Abe, K., Abe, S., Abhir, J. et al. (2025). **including including J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Characterization of Markarian 421 during its most violent year: Multiwavelength variability and correlations. A&A, 694.
5. Abe, K., Abe, S., Abhir, J. et al. (2025). **including T. Hovatta, J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Very high-energy gamma-ray detection and long-term multiwavelength view of the flaring blazar B2 1811+31. A&A, 697.
6. Abe, K., Abe, S., Abhir, J. et al. (2025). **including including J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Prospects for dark matter observations in dwarf spheroidal galaxies with the Cherenkov Telescope Array Observatory. MNRAS, 544, 2946.
7. Abe, K., Abe, S., Abhir, J. et al. (2025).**including T. Hovatta, J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Galactic transient sources with the Cherenkov Telescope Array Observatory. MNRAS, 540, 205.
8. Abe, K., Abe, S., Abhishek, A. et al. (2025). **including including J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Detection of RS Oph with LST-1 and modelling of its HE/VHE gamma-ray emission. A&A, 695.
9. Abe, K., Abe, S., Abhishek, A. et al. (2025). **including including J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Detection of the Geminga pulsar at energies down to 20 GeV with the LST-1 of CTAO. A&A, 698.

10. Abe, K., Abe, S., Abhishek, A. et al. (2025). **including including J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** VHE γ-ray observations of bright BL Lacs with the Large-Sized Telescope prototype (LST-1) of the CTAO. MNRAS, 544, 669-686.
11. Abe, K., Abe, S., Abhishek, A. et al. (2025). **including including J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Constraining the TeV gamma-ray emission of SN 2024bch, a possible type IIn-L from a red supergiant progenitor. A&A, 702.
12. Abe, K., Abe, S., Abhishek, A. et al. (2025). **including including J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** GRB 221009A: Observations with LST-1 of CTAO and Implications for Structured Jets in Long Gamma-Ray Bursts. ApJL, 988.
13. Abe, S., Abhir, J., Abhishek, A. et al. (2025). **including including J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Testing the ubiquitous presence of very high energy emission in gamma-ray bursts with the MAGIC telescopes. A&A, 700.
14. Abe, S., Abhir, J., Abhishek, A. et al. (2025).**including T. Hovatta, J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Time-dependent modelling of short-term variability in the TeV-blazar VER J0521+211 during the major flare in 2020. A&A, 694, A308-.
15. Abe, S., Abhir, J., Abhishek, A. et al. (2025). **including including J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Cosmic-ray acceleration and escape from supernova remnant W44 as probed by Fermi-LAT and MAGIC. A&A, 693.
16. Abe, S., Abhir, J., Abhishek, A. et al. (2025). **including including J. Jormanainen, P. Kouch, E. Lindfors and K. Nilsson** Combined search in dwarf spheroidal galaxies for branon dark matter annihilation signatures with the MAGIC telescopes. *Journal of Cosmology and Astroparticle Physics*, 2025.
17. Agudo, Ivan, Liodakis, Ioannis, Otero-Santos, Jorge et al. (2025). **including P. Kouch, J. Jormanainen, E. Lindfors** High Optical-to-X-Ray Polarization Ratio Reveals Compton Scattering in BL Lacertae Jet. ApJL, 985.
18. Akiyama, K., Albentosa-Ruíz, E., Alberdi, A. et al. (2025) **including B. Jeter**. The persistent shadow of the supermassive black hole of M87: II. Model comparisons and theoretical interpretations. A&A, 693.
19. Akiyama, Kazunori, Albentosa-Ruíz, Ezequiel, Alberdi, Antxon et al. (2025).**including B. Jeter** Horizon-scale variability of M87* from 2017–2021 EHT observations. A&A, 704.
20. Bevacqua, Davide, Saracco, Paolo, La Barbera, Francesco et al. (2025). TP-AGB stars and stellar population properties of a post-starburst galaxy at z$\sim$2 through optical and near-infrared spectroscopy with JWST. A&A, 699.
21. Buttitta, Chiara, Iodice, Enrichetta, Doll, Goran et al. (2025). **including J. Hartke** Looking into the faintEst WIth MUSE (LEWIS): Exploring the nature of ultra-diffuse galaxies in the Hydra-I cluster. II. Stellar kinematics and dynamical masses. A&A, 694.
22. Capecchiacci, Sara, Liodakis, Ioannis, Middei, Riccardo et al. (2025). **including P. Kouch, E. Lindfors** Unveiling blazar synchrotron emission: a multiwavelength polarimetric study of HSP and LSP populations. A&A, 703.
23. Charalampopoulos, P., Kotak, R., Sollerman, J. et al. (2025) **including T. Kangas, H. Kuncarayakti**. Luminous, rapidly declining supernovae as stripped transitional objects in low-metallicity environments: The case of SN 2022lxg. A&A, 700.
24. Chitan, A., Mylläri, A., **Valtonen, M.** (2025). The influence of spin in black hole triplets. *Astronomy and Computing*, 51.
25. Congiu, E., Scheuermann, F., Kreckel, K. et al. (2025). **including J. Hartke, T. Kravtsov** The MUSE view of the Sculptor galaxy: Survey overview and the luminosity function of planetary nebulae. A&A, 700.

26. Cunningham, Tim, Caiazzo, Ilaria, Sienkiewicz, Gracjan et al. (2025).**including P. Hakala** Discovery of two new polars evolved past the period bounce. MNRAS, 540, 633-649.
27. Dahale, R., Cho, I., Moriyama, K. et al. (2025) **including B. Jeter**. Origin of the ring ellipticity in the black hole images of M87. A&A, 699.
28. Dall'Agnol de Oliveira, Bruno, Storchi-Bergmann, Thaisa, Nagar, Neil et al. (2025). NGC 6860, Mrk 915, and MCG -01-24-012. A&A, 701.
29. Deb, Debabrata, Gopakumar, Achamveedu, **Valtonen, Mauri J.** (2025). On the Evidence of a Dark Matter Density Spike around the Primary Black Hole in OJ 287. ApJL, 984.
30. **Dixit, Bela, Wiik, Kaj, Hovatta, Talvikki** (2025). A Digital Single-0Dish Backend for the New Triple-Band Receiver at the Metsähovi Radio Observatory, URSI Radio Science Letter, Vol. 6, 27.
31. Ennis, Ana Inés, **Hartke, Johanna**, Bian, Fuyan et al. (2025). Planetary nebulae as tracers of stellar population properties: a pilot study with MUSE. MNRAS, 545.
32. Fang, Qiliang, Moriya, Takashi J., Ferrari, Lucía et al. (2025). Diversity in Hydrogen-rich Envelope Mass of Type II Supernovae. II. SN 2023ixf as Explosion of Partially Stripped Intermediate Massive Star. ApJ, 978.
33. Ferrari, Lucía, Folatelli, Gaston, Ertini, Keila et al. (2025) **including H. Kuncarayakti**. The nebular phase of SN 2024ggi: A low-mass progenitor with no signs of interaction. A&A, 703.
34. Floris, Alberto, Liodakis, Ioannis, Koljonen, Karri I. I. et al. (2025). **including E. Lindfors, K. Nilsson** Polarimetric diversity in tidal disruption events: Comparative study of low-polarised sources with AT2020mot. A&A, 703.
35. Folatelli, Gastón, Ferrari, Lucía, Ertini, Keila et al. (2025). SN 2023ixf: Interaction signatures in the spectrum at 445 days. A&A, 698.
36. Ford, Nicole M., Nowak, Michael, **Ramakrishnan, Venkatessh** et al. (2025). Tracking X-Ray Variability in Next-generation EHT Low-luminosity Active Galactic Nucleus Targets. ApJ, 981.
37. Gannon, Jonah S., Di Cintio, Arianna, Forbes, Duncan A. et al. (2025) **including J. Hartke**. Ultra-diffuse, ultra-different: observed versus simulated ultra-diffuse galaxies live in fundamentally different haloes. MNRAS, 544, 3094.
38. Goddi, Ciriaco, Carlos, Douglas F., Crew, Geoffrey B. et al. (2025) **including B. Jeter**. First polarization study of the M87 jet and active galactic nuclei at submillimeter wavelengths with ALMA. A&A, 699.
39. Gray, Zuri, Bagnulo, Stefano, Borisov, Galin et al. (2025). **including G. Fedorets** Extreme Negative Polarization of New Interstellar Comet 3I/ATLAS. ApJL, 992.
40. Griffith, Olivia, Showerman, Grace, Sarbadhicary, Sumit K. et al. (2025). A Late-time Radio Survey of Type Ia-CSM Supernovae with the Very Large Array. ApJ, 995.
41. **Hakala, Pasi**, Charles, Phil, Rodríguez-Gil, Pablo (2025). V Sge: supersoft source or exotic hot binary? - I. An X-Shooter campaign in the high state. MNRAS, 543, 2058.
42. **Hakala, Pasi**, Pelisoli, Ingrid, Gänsicke, Boris T. et al. (2025). ASASSN-14dx: a cataclysmic variable harbouring a massive pulsating white dwarf. MNRAS, 540, 838.
43. **Hartke, Johanna** (2025). Planetary nebulae as tracers of accreted stellar populations in massive galaxies in groups and clusters. *Frontiers in Astronomy and Space Sciences*, 12.
44. **Hartke, Johanna**, Iodice, Enrichetta, Gullieuszik, Marco et al. (2025). Looking into the faintEst WIth MUSE (LEWIS): Exploring the nature of ultra-diffuse galaxies in the Hydra I cluster III. Untangling UDG 32 from the stripped filaments of NGC 3314A with multi-wavelength data. A&A, 695.
45. Holman, Matthew J., Bernardinelli, Pedro H., Schwamb, Megan E. et al. (2025).**including G. Fedorets** Sorcha: Optimized Solar System Ephemeris Generation. AJ, 170.

46. Inkenhaag, Anne, Jonker, Peter G., Levan, Andrew J. et al. (2025). Study of late-time ultraviolet emission in core collapse supernovae and its implications for the peculiar transient AT2018cow. A&A, 693.
47. **Jormanainen, J., Hovatta, T., Lindfors, E**. et al. (2025) **including K Nilsson**. The polarisation behaviour of OJ 287 viewed through radio, millimetre, and optical observations between 2015 and 2017. A&A, 694.
48. Kankare, E., **Kangas, T.**, Fraser, M. et al. (2025). Explosion sites of SN 1994W-like transients. A&A, 699.
49. Kankkunen, Sofia, Tornikoski, Merja, **Hovatta, Talvikki** et al. (2025). Long-term radio variability of active galactic nuclei at 37 GHz. A&A, 693.
50. Kankkunen. S., Tornikoski. M., **Hovatta. T.** (2025). Active galactic nucleus time-variability analysis and its caveats. A&A, 693.
51. Kennedy, Mark R., Callanan, P., Garnavich, P. M. et al. (2025). **including P. Hakala** Analysis of optical spectroscopy and photometry of the type I X-ray bursting system UW CrB. *Open journal of astrophysics*, 8.
52. Kiehlmann, S., de la Parra, P. V., Sullivan, A. G. et al. (2025). **including T. Hovatta** PKS 2131-021-Discovery of Strong Coherent Sinusoidal Variations from Radio to Optical Frequencies: Compelling Evidence for a Blazar Supermassive Black Hole Binary. ApJ, 985.
53. Kim, Sanghyun, Lee, Sang-Sung, Algaba, Juan Carlos et al. (2025). Gamma-ray flares from the jet of the blazar CTA 102 in 2016–2018. A&A, 694.
54. Koljonen, Karri I. I., **Nilsson, Kari**, Liodakis, Ioannis et al. (2025). Optical polarization properties of the closest tidal disruption event AT 2023clx indicate origin from tidal stream shocks. MNRAS, 542, 2238.
55. **Kouch, P.M.**, Liodakis, I., Fenu, F. et al. (2025). IXPE observation of the low-synchrotron peaked blazar S4 0954+65 during an optical-X-ray flare. A&A, 695.
56. **Kouch, Pouya M**., Lindfors, Elina, **Hovatta, Talvikki** et al. (2025). , **including J. Jormanainen, K. Nilsson** Optimizing the hunt for extraterrestrial high-energy neutrino counterparts. A&A, 696.
57. **Kravtsov, T.**, Anderson, J. P., **Kuncarayakti, H**. et al. (2025). Discovery of young, oxygen-rich supernova remnants in PHANGS-MUSE galaxies. A&A, 700.
58. Kurlander, Jacob A., Bernardinelli, Pedro H., Schwamb, Megan E. et al. (2025).**including G. Fedorets** Predictions of the LSST Solar System Yield: Near-Earth Objects, Main Belt Asteroids, Jupiter Trojans, and Trans-Neptunian Objects. AJ, 170.
59. Kwok, Lindsey A., Singh, Mridweeka, Jha, Saurabh W. et al. (2025) **including H. Kuncarayakti**. . JWST and Ground-based Observations of the Type Iax Supernovae SN 2024pxl and SN 2024vjm: Evidence for Weak Deflagration Explosions. ApJL, 989.
60. Li, L. H., Benetti, S., Cai, Y. -Z. et al. (2025). **including T. Kangas**. SN 2017ckj: A linearly declining type IIb supernova with a relatively massive hydrogen envelope. A&A, 704.
61. Liodakis, Ioannis, Chakraborty, Sudip, Marin, Frédéric et al. (2025). **including P. Kouch, J. Jormanainen, K. Nilsson** Detection of Compton Scattering in the Jet of 3C 84. ApJL, 994.
62. Liodakis, Ioannis, Zhang, Haocheng, Boula, Stella et al. (2025). **including P. Kouch, K. Nilsson** Determining the origin of the X-ray emission in blazars through multiwavelength polarization. A&A, 698.
63. MAGIC Collaboration: Abe, H., Abe, S., Acciari, V A et al. (2025). **including T. Hovatta, P. Kouch, J. Jormanainen** Multi-wavelength study of OT 081: broadband modelling of a transitional blazar. MNRAS, 540, 364-384.
64. Maksym, W. Peter, Liodakis, Ioannis, Saade, M. Lynne et al. (2025). **including P. Kouch** A Two-week IXPE Monitoring Campaign on Mrk 421. ApJ, 986.

65. Marin, Frédéric, Pursimo, Tapio, Liodakis, Ioannis et al. (2025). Spectropolarimetry of NGC 1275 reveals a narrow-line radio galaxy with polarization parallel to its radio jet axis. A&A, 702.
66. Mellier, Y., Abdurro'uf, Acevedo Barroso J., A. et al. (2025) **including K. Nilsson**. Euclid: I. Overview of the Euclid mission. A&A, 697.
67. Merritt Stephanie R., **Fedorets Grigori**, Schwamb Megan E. et al. (2025). Sorcha: A Solar System Survey Simulator for the Legacy Survey of Space and Time. *Journal of Open Source Software*, 10.
68. Merritt, Stephanie R., **Fedorets, Grigori**, Schwamb, Megan E. et al. (2025). Sorcha: A Solar System Survey Simulator for the Legacy Survey of Space and Time. AJ, 170.
69. Mills, John, Spiniello, Chiara, Sergeyev, Alexey et al. (2025) **including J. Hartke**. E-INSPIRE- I. Bridging the gap with the local Universe: stellar population of a statistical sample of ultra-compact massive galaxies at z < 0.3. MNRAS, 541, 2440-2458.
70. Murtagh, Joseph, Schwamb, Megan E., Merritt, Stephanie R. et al. (2025).**including G. Fedorets** Predictions of the LSST Solar System Yield: Discovery Rates and Characterizations of Centaurs. AJ, 170.
71. Mäntynen, I., Kankare, E., Mattila, S. et al. (2025). **including P. Väisänen** The undetectable fraction of core-collapse supernovae in luminous infrared galaxies. A&A, 700.
72. Nagao, T., Reynolds, T. M., **Kuncarayakti, H.** et al. (2025). Observational diversity of bright long-lived Type II supernovae. A&A, 699.
73. Omeliukh, A., Garrappa, S., **Fallah Ramazani, V.** et al. (2025) , **including J. Jormanainen, K. Nilsson**. Multi-epoch leptohadronic modeling of neutrino source candidate blazar PKS 0735+178. A&A, 695.
74. Osorno, Juan, Nagar, Neil, Richtler, Tom et al. (2025). Keplerian molecular gas disk and black hole mass of NGC 4751. A&A, 695.
75. Pacciani, L., Kim, D.E., Middei, R. et al. (2025). **including P. Kouch, E. Lindfors** X-Ray Polarization of the High-synchrotron-peak BL Lacertae Object 1ES 1959+650 during Intermediate and High X-Ray Flux States. ApJ, 983.
76. de la Parra, P. V., Kiehlmann, S., Mroz, P. et al. (2025). **including T. Hovatta, P. Kouch** PKS J0805-0111: A Second Owens Valley Radio Observatory Blazar Showing Highly Significant Sinusoidal Radio Variability—The Tip of the Iceberg. ApJ, 987.
77. Pastorello, A., Reguitti, A., Tartaglia, L. et al. (2025). **including T. Kangas**. A long-lasting eruption heralds SN 2023ldh, a clone of SN 2009ip. A&A, 701.
78. Pathak, D., Leroy, A. K., Barnes, A. T. et al. (2025) **including T. Kravtsov**.. Masses, Star Formation Efficiencies, and Dynamical Evolution of 18,000 H II Regions. AJL, 993.
79. Pessi, P Priscila J., Lunnan, Ragnhild, Sollerman Jesper et al. (2025). **including T. Kangas**. Sample of hydrogen-rich superluminous supernovae from the Zwicky Transient Facility. A&A, 695.
80. Pursiainen, M., Killestein, T. L., **Kuncarayakti, H.** et al. (2025) **including T. Kravtsov**. Optical evolution of AT 2024wpp: the high-velocity outflows in Cow-like transients are consistent with high spherical symmetry. MNRAS, 537, 3298.
81. Rajput B., Goldoni P., Max-Moerbeck W. et al. (2025). **including E. Lindfors**. Optical spectroscopy of blazars for the Cherenkov Telescope Array Observatory – IV. A&A, 704.
82. Reguitti, A., Pastorello, A., Smartt, S. J. et al. (2025) **including T. Kravtsov**. SN 2024abfo: A partially stripped type II supernova from a yellow supergiant. A&A, 698.
83. Reynolds, Thomas M., Nagao, Takashi, Gottumukkala, Rashmi et al. (2025). **including T. Kangas, T. Kravtsov, H. Kuncarayakti**. The bright long-lived Type II SN 2021irp powered by aspherical circumstellar material interaction I. Revealing the energy source with photometry and spectroscopy. A&A, 702.

84. Reynolds, Thomas M., Nagao, Takashi, Maeda, Keiichi et al. (2025). **including T. Kangas, H. Kuncarayakti**. The bright long-lived Type II SN 2021irp powered by aspherical circumstellar material interaction: II. Estimating the CSM mass and geometry with polarimetry and light curve modeling. A&A, 702.

85. Robinson, James E., Schwamb, Megan E., Jones, R. Lynne et al. (2025).**including G. Fedorets** Tuning the Legacy Survey of Space and Time Observing Strategy for Solar System Science: Incremental Templates in Year 1. ApJS,, 279.

86. Rodriguez, Antonio C., El-Badry, Kareem, **Hakala, Pasi** et al. (2025). A Link Between White Dwarf Pulsars and Polars: Multiwavelength Observations of the 9.36-minute Period Variable Gaia22ayj. PASP, 137.

87. Röder, J., Wielgus, M., Lobanov, A.P. et al. (2025) **including B. Jeter**. A multifrequency study of sub-parsec jets with the Event Horizon Telescope. A&A, 695.

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