European Astronomical Society
2023 Prizes

Tycho Brahe Medal

The 2023 Tycho Brahe Medal is awarded to **Prof. J. Anton Zensus (Max Planck Institute for Radio Astronomy and University of Cologne, Germany)** *for major advances in Very Long Baseline Interferometry that led to the first images of the shadow of the black holes in the galaxy M87 and in our own Galactic centre.*

Lodewijk Woltjer Lecture

The 2023 Lodewijk Woltjer Lecture is awarded to **Prof. Isabelle Baraffe (University of Exeter, United Kingdom and CRAL/CNRS/ENS de Lyon/Claude Bernard Lyon 1 University, France)** *for fundamental contributions to the understanding of low mass stars, brown dwarfs and exoplanets.*

Jocelyn Bell Burnell Inspiration Medal

The 2023 Jocelyn Bell Burnell Inspiration Medal is awarded to **Prof. Mariano Méndez (Kapteyn Astronomical Institute, the Netherlands)** *for his work over decades to set up a programme of education in space science in developing countries around the world.*

MERAC Prizes

The 2023 MERAC Prizes for the Best Early Career Researcher are awarded in

Theoretical Astrophysics

to **Prof. Manuel Arca Sedda (Gran Sasso Science Institute and University of Padova, Italy)** *for pioneering research in the dynamics of binary compact objects as gravitational wave sources in galactic nuclei and dense star clusters.*

Observational Astrophysics

to **Dr Dominika Wylezalek (Heidelberg University, Germany)** *for her pioneering work using state-of-the-art IFU instruments, in particular for her work demonstrating the impact of supermassive black holes on their host galaxies and the large-scale environment.*

New Technologies (Computational)

to **Dr Dylan Nelson (Heidelberg University, Germany)** *for his leading role in computational astrophysics, in particular for the IllustrisTNG series of cosmological simulations and his work to enable their widespread use.*

All six awardees will give a plenary lecture at the European Astronomical Society Annual Meeting 2023 to be held in Krakow, Poland, from 10 to 14 July 2023.

The European Astronomical Society (EAS) promotes and advances astronomy in Europe. As an independent body, the EAS can act on matters that need to be handled at a European level on behalf of the European astronomical community.

Visit the EAS website: https://eas.unige.ch/ and contact the EAS President: Prof. Roger Davies, eas@unige.ch

The Tycho Brahe Medal is awarded in recognition of the development or exploitation of European instruments or major discoveries based largely on such instruments.

Tycho Brahe Medal

The 2023 Tycho Brahe Medal is awarded to **Prof. J. Anton Zensus (Max Planck Institute for Radio Astronomy and University of Cologne, Germany)** *for major advances in Very Long Baseline Interferometry that led to the first images of the shadow of the black holes in the galaxy M87 and in our own Galactic centre.*

Prof. J. Anton Zensus obtained his PhD from the University of Münster, and worked as a postdoc and staff scientist at the California Institute of Technology and the National Radio Observatory, before becoming Director at the Max Planck Institute for Radio Astronomy in 1997 and honorary professor at the University of Cologne in 2005. Zensus is recognized for a cutting-edge research and technology program, especially for his leading contributions to the research of Active Galactic Nuclei (AGN) and their radio cores and jets through intercontinental Very Long Baseline Interferometry (VLBI). Zensus has led pioneering technological and methodological breakthroughs: among these are critical improvements of VLBI polarisation performance, accurate positional measurements from VLBI data, and detailed analysis of the two-dimensional structure of radio emission. Zensus and his team developed several generations of digital recording equipment, developed and operate a massive VLBI correlation facility adapted for space and mm-VLBI processing, and delivered critical components of the ALMA phasing system. As Chair of the Board of the EHT Collaboration, Prof. Zensus has made important contributions to all aspects of the research program.

Anton Zensus is recognized for his leadership over decades in advancing radio astronomical observations with extreme angular resolution and sensitivity. By the early 1980s, the astronomical technique of Very Long Baseline Interferometry (VLBI) had been pioneered as the most powerful means of studying and ultimately imaging the structure in the central regions of Active Galactic Nuclei. At that time, VLBI was optimized for centimetre radio waves, and achieved imaging details on the scale of light years, enough to study details in the jets but not to resolve the central core thought to harbour the central engines.

Much higher resolutions were needed to confirm the prediction that the central engines consist of supermassive Black Holes, requiring the extension of VLBI to shorter millimetre wavelengths or even beyond the size of the Earth with orbiting radio telescopes. As the Director for VLBI at the Max Planck Institute for Radio Astronomy (MPIfR), Anton Zensus and his team tackled the challenge and used the IRAM 30m telescope and the Plateau de Bure interferometer to observe first fringes at 1.3mm. Transatlantic fringe detections followed, and they created with international partner organisations the Global millimetre VLBI Network, which produced reliable output of research data at 3mm. The next technically feasible step was to select telescopes capable of observing at 1.3mm, among those the two IRAM telescopes, APEX, and also ALMA, and equip them with the necessary hardware and software. Again, first experimental fringes were obtained from both sides of the Atlantic.

Since the late 1970s, computations of the vicinities of black holes showed that the event horizon of a supermassive black hole should be observable as a dark “shadow” with an angular size that relates in a simple way to the distance of the object, and its mass against the distorted background of its surrounding gas emission. The small size of the expected shadow, even for the most promising candidates, M87 and our Galactic Centre, confirmed the long-standing expectation that such observations would require a significant improvement of existing observing systems, and an efficient collaboration on a global scale. This became the Event Horizon Telescope (EHT) Collaboration. The EHT made short wavelength (1.3mm) observations with an array of telescopes distributed across Europe, the Americas, Oceania, and Antarctica that achieved an angular resolution of 20 micro-arcseconds, necessary to image the black holes in Messier 87 and Sgr A*.

As well as confirming the masses derived from other methods, these measurements have allowed the shadow of the black hole to be imaged against the relativistic matter orbiting it within a few Schwarzschild radii. This is significantly closer than other methods permit, and thus enters the realm where the effects of General Relativity are most significant. Anton Zensus played a key and foundational role from the outset, most visibly in his critical central role as the Founding Chair of the EHT board. He succeeded in brokering and maintaining the necessary but complex synergies between different and initially competing groups in Europe, the USA and Asia, which ultimately paved the way for the EHT’s success.

All these achievements make Prof. J. Anton Zensus an outstanding awardee of the Tycho Brahe Medal.

The Lodewijk Woltjer Lecture honours astronomers of outstanding scientific distinction.

Lodewijk Woltjer Lecture

The 2023 Lodewijk Woltjer Lecture is awarded to **Prof. Isabelle Baraffe (University of Exeter, United Kingdom and CRAL/CNRS/ENS de Lyon/Claude Bernard Lyon 1 University, France)** *for fundamental contributions to the understanding of low mass stars, brown dwarfs and exoplanets.*

Prof. Isabelle Baraffe obtained her PhD in astrophysics from the University of Paris VII and the University of Göttingen. She moved to postdoc position at the Max-Planck Institute for Astrophysics and then University of Göttingen, before becoming getting a CNRS position at the Centre de Recherche Astrophysique (CRAL) of the Ecole Normale Supérieure (ENS) in Lyon. She joined the University of Exeter in 2010. Her field of research has focussed on stellar and planetary physics. She has been awarded several international prizes and distinctions, among which the Viktor Ambartsumian International Science Prize in 2020 and the Bronze medal from the Centre National de la Recherche Scientifique in 1999. She has been recipient of two Advanced European Research Council (ERC) grants in 2013 and 2018.

Prof. Isabelle Baraffe has produced important work in the fields of stellar and planetary astrophysics, encompassing a wide range of physical domains, from Earth-like planets to very massive stars and compact binaries. Her work aims at understanding and properly describing the physical processes characteristic of the formation, structure and evolution of substellar (planets, brown dwarfs) and stellar objects.

With her collaborators Gilles Chabrier and France Allard, Prof. Baraffe made fundamental contributions to the domain of brown dwarfs and low-mass stars (the dominant stellar population in galaxies). Brown dwarfs are not massive enough to sustain or even ignite hydrogen fusion in their core and provide the missing link between stars and planets. They were discovered only in 1995. Isabelle Baraffe developed along the years a coherent theory for describing the internal and atmospheric structures of low-mass stars and brown dwarfs based on state-of-the-art description of all the micro-physics characteristic of these objects.

The Baraffe et al. models explain and even predict all the peculiar observational properties of the aforementioned astrophysical bodies. These models revolutionised the field and established a new paradigm that has sustained for more than 20 years**.** Her models are widely used by the community to interpret observations and to develop new observational strategies.

Recently, Baraffe demonstrated that early phases of accretion during the birth of the object have a crucial impact on the evolution of young low mass stars and brown dwarfs, even long after accretion has ended. This idea completely changed the standard picture of the early evolution of nascent stars and brown dwarfs, and explained various puzzling properties of young objects, leading to a revision of the standard concept of early phases of evolution.

With Chabrier and Travis Barman, Baraffe developed a general theory that described the inner structure, atmospheric properties and evolution of planets over the entire mass range from Earth-mass to Jupiter-mass bodies. Their models include not only the essential planetary input physics, but also peculiar processes, such as atmospheric evaporation due to the intense parent star incident flux for the short-period transiting planets, double-diffusive layered convection and energy dissipation in the interior due to tidal effects. These models are used widely by the community and provide a theoretical foundation for the analysis of observational data obtained with the largest telescopes worldwide.

While in Exeter, she initiated a major interdisciplinary project, gathering several institutes in the UK and France, in the field of exoplanet atmospheric dynamics. She led the development of the most advanced, three-dimensional radiative hydrodynamics models of exoplanet atmospheres, which are necessary to analyse the wealth of data expected from new generations of telescopes, and to obtain key information such as planet atmospheric chemical composition, the necessary path to better understand planet formation and to detect biosignatures on Earth-like planets.

Prof. Baraffe was awarded an advanced European Research Council (ERC) grant in 2013, which allowed the development of a highly novel numerical tool, specifically the fully compressible, time implicit, three-dimensional (3D) code MUSIC (MUlti-dimensional Stellar Implicit Code). The significant potential for this new tool was recognized by the award of a second advanced ERC grant in 2018.

Prof. Isabelle Baraffe's personal ambition is to advance the very frontiers of astronomy, taking stellar and planetary physics to a new era and to make it one of the major domains of 21st century astronomy. To achieve this, Professor Baraffe has led highly innovative projects such as the development of complex numerical tools that combine state-of-the-art physics and computational methods.

All these achievements make Prof. Isabelle Baraffe an outstanding awardee of the Lodewijk Woltjer Lecture.

The Jocelyn Bell Burnell Inspiration Medal is awarded in recognition of astronomers of all career stages whose contribution beyond scientific research.

The 2023 Jocelyn Bell Burnell Inspiration Medal is awarded to **Prof. Mariano Méndez (Kapteyn Astronomical Institute, the Netherlands)** *for his work over decades to set up a programme of education in space science in developing countries around the world.*

Jocelyn Bell Burnell Inspiration Medal

Prof. Mariano Méndez studied in Argentina, where he obtained his PhD in Astronomy cum-laude in 1989. He is full professor at the Faculty of Science and Engineering at the University of Groningen where he established a new, and successful, line of research at the Kapteyn Institute. Prof. Méndez has organised or co-organised tens of international conferences and gave many invited talks at international conferences and colloquia. Prof. Méndez developed a programme of education on space science for the benefit of a large community of young scientists in developing countries He has raised funds from several international organisations, among others COSPAR, IAU, NASA, ESA, and JAXA, to carry out a programme of capacity-building workshops on space science in developing countries. In 2018 he received a medal from COSPAR for this endeavour.

The programme led by Prof. Méndez consists of a series of 2-week long, hands-on, Capacity-Building Workshops, with participants ranging from master students to young staff members. The workshops, held at a rate of about 3 per year, have so far trained more than 1500 participants from over 50 different countries all over the world (e.g., Argentina, Brazil, Chile, China, Cyprus, Ecuador, Ethiopia, Ghana, India, Indonesia, Israel, Mexico, Russia, South Africa, South Korea, Thailand, Vietnam), and covered a full range of topics related to space sciences: astrophysics, Earth surface and Earth atmosphere, Earth ionosphere, small solar-system bodies, space weather, solar physics, crystallography from space and science with small satellites.

To carry out this programme, Prof. Méndez secured funds from COSPAR, IAU, NASA, ESA, JAXA, national funding agencies and private foundations for a total of about 1.5 M€ in the last 10 years. The participants are selected on the basis of their scientific merit, measured in the context of their countries of origin; after being selected, the organization covers all

accommodation and meals expenses for the participants throughout the workshop. Additionally, in several instances, the organization partly covers the participants' travel expenses to enable them to attend the workshop.

Besides the programme of workshops, Prof. Méndez manages a fellowship programme for those young scientists who participated in one of these workshops. Within this programme, about a dozen candidates were selected each year to carry out an 8-week visit to the laboratory of one of the lecturers to finish the project that they had started at the workshop. The costs of these fellowships were supported by funds provided by different organisations, including COSPAR, NASA, ESA, ISRO and local funding agencies in the country of the fellows and of the hosting institution. In total, about 60 fellowships were supported by this programme.

The success of Prof. Méndez's initiative, and the impact of the workshops and fellowships on the scientific career of young scientists in developing countries, have been enormous, with many of the participants of these workshops now being high-level officials of national space programmes in their own countries or established scientists all over the world.

Prof. Méndez has dedicated this effort voluntarily, while simultaneously pursuing a very productive scientific career.

In the past decades, Professor Mariano Méndez has devoted a large share of his time and energy to reaching out to young people in developing countries. He has been extremely successful in this, inspiring an entire generation of young and aspiring scientists.

MERAC Prizes

FONDATION MERAC (Mobilising European Research in Astrophysics and Cosmology) is a non-profit foundation started in 2012 with headquarters in Switzerland to recognise and support young European astronomers.

There are yearly three MERAC Prizes awarded by the European Astronomical Society. The prizes of 25'000 € are for each of the three categories:

- ★ Theoretical Astrophysics
- ★ Observational Astrophysics
- ★ New Technologies (Instrumental/Computational/Multi-Messenger)

The prizes alternate by year for:

- ★ Best Early Career Researcher Prizes (on odd years)
- ★ Best Doctoral Thesis Prizes (on even years)

The awardees are also eligible for further support from the FONDATION MERAC.

Best Early Career Researcher in Theoretical Astrophysics

The 2023 MERAC Prize for the Best Early Career Researcher in Theoretical Astrophysics is awarded to **Prof. Manuel Arca Sedda (Gran Sasso Science Institute and University of Padova, Italy)** *for pioneering research in the dynamics of binary compact objects as gravitational wave sources in galactic nuclei and dense star clusters.*

Prof. Manuel Arca Sedda obtained his PhD in 2014 at the University La Sapienza. He then became a postdoctoral fellow at the University of Tor Vergata and moved, two years later, to the Heidelberg University at the Astronomisches Rechen Institut, where he started pursuing research on the formation and evolution of black holes of all sizes. He was awarded in 2018 an Alexander von Humboldt Fellowship and has recently obtained a Marie Skłodowska-Curie Individual Fellowship at the University of Padova. In May 2023, he will join the Gran Sasso Science Institute as an assistant professor. He is a member of several international collaborations, such as the Laser Interferometer Space Antenna, the Einstein Telescope Consortium, and the Lunar Gravitational Wave Antenna. His main research focuses on the formation of stellar and intermediate-mass black holes in dense star clusters and close to supermassive black holes in galactic nuclei.

Since the first detection of gravitational waves emitted during the merger of two black holes, understanding the formation channels of such systems has become one of the most pressing questions in theoretical astrophysics. Prof. Arca Sedda has delivered key results to shed light on the formation of binary black holes. He demonstrated that the dynamical evolution of stellar-born black holes in dense star clusters and galactic nuclei can result in a great variety of black hole masses and spins. Studying the interactions that occur in star clusters with and without a central black hole sub-system, he developed one of the first systematic studies of black hole-neutron star mergers forming in young, globular, and nuclear clusters, and suggested that one of the mergers, GW190814, could have had originated in a massive star cluster. Moreover, Manuel Arca Sedda studied the possible seeding and growth of intermediate-mass black holes in massive star clusters, pinning down both the astrophysical properties of these objects and their possible observation as gravitational-wave sources. Using state-of-the-art numerical simulations at unprecedented resolution, he developed a systematic study of nuclear cluster formation via in-spiral and merger of star clusters formed close to the central regions of galaxies, leading a unique series of papers focused on the dynamics of stellar- and intermediate-mass black holes delivered close to a supermassive black hole by spiralling star clusters.

The work of Prof. Manuel Arca Sedda was conducted at the University La Sapienza, Heidelberg University, and the University of Padova.

Best Early Career Researcher in Observational Astrophysics

The 2023 MERAC Prize for the Best Early Career Researcher in Observational Astrophysics is awarded to **Dr Dominika Wylezalek (Heidelberg University, Germany)** *for her pioneering work using state-of-the-art IFU instruments, in particular for her work demonstrating the impact of supermassive black holes on their host galaxies and the large-scale environment.*

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Dr Dominika Wylezalek studied physics at Heidelberg University, Germany (BSc, 2010), and the University of Cambridge, UK (MASt, Part III Physics, 2011). In 2014, she received her PhD from Munich University (LMU) with a fellowship from the International Max Planck Research School on Astrophysics which she had spent at the European Southern Observatory (ESO) in Garching/Munich. She then worked as a postdoctoral researcher at the Johns Hopkins University, Baltimore, USA, where she held an Akbari-Mack and Provost Postdoctoral Fellowship. She then moved to ESO in Munich as an ESO Fellow. Since 2020, she has been leading her Emmy Noether Group at the Centre for Astronomy of Heidelberg University. Her research focuses on the exploration of the role of AGN and quasars in galaxy evolution, one of the most important and pressing questions in extragalactic astronomy today.

Dominika Wylezalek is a world expert on the evolution of galaxies with intense AGN-driven activity and their impact on the intergalactic, circumgalactic and even galaxy cluster-scale environment. She uses a multi-wavelength, multi-technique, multi-scale and multi-era approach. During her PhD, Dominika found that powerful radio-loud AGN appear to trace very dense and massive distant galaxy proto-clusters, in which galaxy evolution seems to occur at an accelerated pace. As a junior postdoc, Dominika Wylezalek focused on the relation between AGN and galaxy evolution. Using large galaxy and AGN samples at low redshift, and smaller unique AGN samples at high redshift, she has developed new ideas and approaches on how to investigate AGN feedback processes. She has developed new spatially resolved techniques for identifying signatures of AGN, uncovering a much more nuanced picture of AGN activity. She has been and is leading several cutting-edge research projects on AGN feedback using ESO, ALMA, and JWST. She is PI of a JWST Early Release Science project (Q3D) and has become one of the leading experts for AGN science with the JWST. The initial Q3D data already resulted in an impressive and unanticipated result, namely identifying one of the densest knots of galaxy formation around a high-redshift quasar. The work received worldwide recognition, including media attention through several press releases. Under Wylezalek's lead, the Q3D team is actively working on several upcoming publications with their unique JWST data.

The work was conducted at Johns Hopkins University, the European Southern Observatory, and at Heidelberg University.

Best Early Career Researcher in New Technologies (Computational)

The 2023 MERAC Prize for the Best Early Career Researcher in New Technologies (Computational) is awarded to **Dr Dylan Nelson (Heidelberg University, Germany)** *for his leading role in computational astrophysics, in particular for the IllustrisTNG series of cosmological simulations and his work to enable their widespread use.*

Dr Dylan Nelson triple-majored in physics, mathematics, and astrophysics at the University of California, Berkeley. He completed his PhD at Harvard University in 2015. Dylan became one of the earliest active developers of the AREPO moving-mesh code for galaxy formation simulations, making key contributions to the original Illustris cosmological simulation. He was the recipient of the National Science Foundation Graduate Research Fellowship, as well as the Institute for Applied Computational Science Fellowship. In addition to his PhD, he obtained a secondary degree in Computational Science and Engineering at Harvard. He then moved to the Max Planck Institute for Astrophysics as a postdoctoral fellow (2015-2020). He became a key figure and leader of the IllustrisTNG simulations. He is the Co-PI of the TNG50 simulation, completed in 2019, a cosmological galaxy formation simulation of unprecedented scope and resolution. In 2020 he was awarded an Emmy Noether Research Group Leader position at Heidelberg University. He received the Research Career Development Award of the Hector Fellow Academy in 2022.

Dylan Nelson develops, carries out, and studies large numerical calculations of structure formation across cosmic time. He has played a unique role in making publicly accessible some of the largest and most sophisticated cosmological simulations, namely, IllustrisTNG. The simulation has (i) re-shaped our theoretical understanding of galaxy feedback and the impact of AGN-driven outflows, (ii) predicted how galactic disks and morphological structure emerge at early epochs, as now being probed with JWST, and (iii) provided foundational theoretical predictions for space telescope mission proposals. Based in part on the IllustrisTNG simulations, Dylan Nelson has studied the dynamics of the diffuse gas outside of galaxies, in the intergalactic medium and circumgalactic medium (CGM). His results have changed our understanding of cold, filamentary accretion flows, and their ability to feed high-redshift galaxies. One of the most scientifically exciting and novel results is that the CGM encodes a non-trivial “historical record” of past galactic feedback activity. The release of the simulations to the community is a high-impact example of Open Science in astronomy. Dylan Nelson has designed and developed the entire infrastructure to enable researchers to remotely explore, search, analyse, and download these petabyte-scale datasets (www.tng-project.org/data). Since its launch, more than 5,200 registered users have downloaded tens of thousands of simulation snapshots and catalogues, and tens of millions of individual galaxy datasets.

The work was conducted at Max Planck Institute for Astrophysics and at the Institute of Theoretical Astrophysics, which is part of the Centre for Astronomy of Heidelberg University.