European Astronomical Society
2022 Prizes

Tycho Brahe Medal

The 2022 Tycho Brahe Medal is awarded to **Dr Jean-Luc Starck (CEA Paris Saclay, France)** *for the development of novel astro-statistics methods and open source analysis tools which have enabled optimal scientific exploitation of astronomical data obtained from European space and ground based facilities leading to major discoveries in extragalactic astrophysics and cosmology.*

Lodewijk Woltjer Lecture

The 2022 Lodewijk Woltjer Lecture is awarded to **Prof. Bożena Czerny (Center for Theoretical Physics, Polish Academy of Sciences, Poland)** *for her contributions to our understanding of the physics of accretion disks and the broad line regions in active galactic nuclei, as well as for her application of quasars to constrain the cosmological model at high redshift and open a window on the role of dark energy.*

Fritz Zwicky Prize for Astrophysics & Cosmology

The 2022 Fritz Zwicky Prize for Astrophysics & Cosmology is awarded to **Prof. Ewine F. van Dishoeck (Leiden University, the Netherlands)** *for her groundbreaking, decades-spanning, work in observational astrochemistry and molecular spectroscopy, revealing the secrets of molecules from interstellar clouds to star and planet formation, and for her leadership within the astronomical community.*

MERAC Prizes

The 2022 MERAC Prizes for the Best PhD Thesis are awarded in

Theoretical Astrophysics

to **Dr Helmer Koppelman (the Netherlands)** *for his multi-faceted approach to the field of galactic archaeology that transformed our understanding of the history and dynamics of the Milky Way.*

Observational Astrophysics

to **Dr Núria Miret Roig (University of Vienna, Austria)** *for the discovery of many new free-floating planets, which illuminated the origin of these exotic nomad planets.*

New Technologies (Instrumental)

to **Dr Ewelina Obrzud (Centre Suisse d'Electronique et de Microtechnique, Switzerland)** *for the development of novel laser frequency combs for the accurate calibration and extreme radial velocity-precision of astronomical spectrographs.*

All six awardees will give a plenary lecture at the European Astronomical Society Annual Meeting 2022 to be held in Valencia, Spain, from 27 June to 1 July 2022.

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 2022 Tycho Brahe Medal is awarded to **Dr Jean-Luc Starck (CEA Paris Saclay, France)** *for the development of novel astro-statistics methods and open source analysis tools which have enabled optimal scientific exploitation of astronomical data obtained from European space and ground based facilities leading to major discoveries in extragalactic astrophysics and cosmology.*

Dr Jean-Luc Starck is Director of Research at CEA Saclay, France. He holds a Ph.D from Nice Observatory (1992) and a Habilitation from the University Paris XI. In 2010 he founded and has since been leading the CosmoStat lab at CEA, an interdisciplinary research group performing cutting edge research at the interface between astrophysics, cosmology and statistics. Dr. Starck served as the first vice-president of the International Astrostatistics Association (2012-2018) and received the IAA fellowship in 2016. He has received the EADS prize of the French Academy of Science in 2011, as well as the 2018 Gruber Prize in Cosmology (as a member of the ESA Planck team) and is member of Academia Europae (since 2021). Over the last 10 years, he has been awarded competitive research funding including an Advanced ERC. He has published over 250 refereed papers in astrophysics, cosmology, signal processing and applied mathematics, which have received more than 89,000 citations and he is also author of three books. He is heavily involved in the Euclid space mission of ESA, which will soon be launched.

Jean-Luc Starck is a pioneer in the field of astrostatistics: Modern telescope facilities produce large amounts of data and require advanced analysis techniques to achieve their scientific goals. Thus astrophysicists have been increasingly relying on statisticians to develop sophisticated and mathematically robust methods to reduce and interpret their data, leading to a new interdisciplinary field, astrostatistics. Dr. Starck is among a handful of scientists leading this dynamic new field. His CEA group has been at the forefront of advancing astrostatistics, providing sophisticated methods and software tools to tackle Big Data management and analysis.

Dr Starck has been a pioneer in the field of harmonic analysis developing new wavelet and curvelet decompositions, and showing how they could be used to solve very ill posed inverse problems, covering a broad range of fields such as sources detection, deconvolution, interferometric image reconstruction, component separation, inpainting and weak lensing mass map recovery. His group has been the first to investigate the concept of compressed sensing in the astrophysical field, leading to the striking results that interferometry radio-image resolution can be improved by 4 using compressed sensing.

His work had a direct impact on the science results of several space projects: the Infrared Space Observatory (ISO) relied on his calibration approach and galaxy detection methods to analyse the first deep infrared surveys opening a new window on dust obscured galaxy evolution at high-z. His work on wavelets and Poisson noise allowed him to propose a solution for deriving robustly both the XMM cluster catalog and the Fermi source catalog. His Morphological Component Analysis method further enabled the study of molecular cloud filaments in star formation. Dr Starck's work on weak lensing had success with HST and will bear strong impact in the future with the Euclid mission.

Dr Starck has put substantial effort for the advancement of astrostatistics via the training of the next generation of scientists. He has supervised more than 30 PhD students and postdocs and he organized 24 astrostatistics conferences and 3 summer schools. He has also published three books in the field of signal processing and astrophysical data analysis geared towards advanced undergraduate and graduate students as well as researchers entering the field.

All these achievements make Dr Jean-Luc Starck an outstanding awardee of the Tycho Brahe Medal.

The Lodewijk Woltjer Lecture honours astronomers of outstanding scientific distinction.

Lodewijk Woltjer Lecture

The 2022 Lodewijk Woltjer Lecture is awarded to **Prof. Bożena Czerny (Center for Theoretical Physics, Polish Academy of Sciences, Poland)** *for her contributions to our understanding of the physics of accretion disks and the broad line regions in active galactic nuclei, as well as for her application of quasars to constrain the cosmological model at high redshift and open a window on the role of dark energy.*

Prof. Bożena Czerny (born Muchotrzeb) studied theoretical physics at Warsaw University, where she obtained her MSc degree in 1974. In 1978 she started working as a research assistant at the Nicolaus Copernicus Astronomical Center of the Polish Academy of Sciences (CAMK), Warsaw, Poland in the field of accretion and obtained her PhD in 1984. Prof Czerny was gradually promoted at CAMK and eventually reached full professor position in 1996. In 2015 she moved to a full time professor position at the Center for Theoretical Physics, Polish Academy of Sciences, Warsaw, Poland, keeping a part-time employment at CAMK till the end of 2017. Prof. Czerny has seved in several committees, such as International Union of Pure and Applied Physics, Council of the National Science Center, and Polish Astronomical Society (President in 2011-2013). She served as a Scientific Editor of the American Astronomical Society journals from 2012 to 2020. She further was awarded in 2019 the Ernst Mach Honorary Medal for Merit in the Physical Sciences awarded by the Czech Academy of Sciences.

Prof. Czerny focuses on modelling the physical processes close to black holes in the centers of active galaxies and in stellar binary systems, and on comparison of the models to the observational data. Her early works started with the understanding of the matter inflow from the inner edge of the disk toward the black hole horizon, which culminated in the contribution to formulation of the slim disk theory. She was among the pioneers in studies of the X-ray variability of active galactic nuclei and of the vertical stratification of the accretion disks, including the idea of the disk warm corona, collaborating with Leicester, Cambridge and Harvard colleagues while working on the emission from accretion disks in AGN. She studied the accretion disk instabilities, comparing their consequences to the observational data. In 2011 she formulated a new model of the Broad Line Region structure in active galactic

nuclei, based on the radiation pressure acting on dust, called FRADO (Failed Radiatively Accelerated Dusty Outflow) model. Recently, she has focused her attention to the application of the light echo measurements of distant quasars to determine the distance to these sources and to derive constraints on the cosmological parameters.

Prof. Czerny was a long-time scientific editor of The Astrophysical Journal published by the American Astronomical Society. Her lecturing and publishing activities include the popularization of astronomy and science in general. Her expertise in research led her to win numerous grants. She is currently PI of a 5-year Maestro grant awarded by the Polish National Science Centre, and since Autumn 2021 she is one of the four PIs of an ERC Synergy Grant aimed to use multi-probe methods to establish the distance scale in the Universe with unprecedented accuracy, which includes also the quasar-based constraints.

The Fritz Zwicky Prize for Astrophysics & Cosmology honours scientists who have obtained fundamental and outstanding results related to astrophysics and/or cosmology. The Fritz Zwicky Prize is awarded biennially, for the first time in 2020, by the European Astronomical Society on behalf of the Fritz Zwicky Foundation, located in Glarus, Switzerland.

The 2022 Fritz Zwicky Prize for Astrophysics & Cosmology is awarded to **Prof. Ewine F. van Dishoeck (Leiden University, the Netherlands)** *for her groundbreaking, decades-spanning, work in observational astrochemistry and molecular spectroscopy, revealing the secrets of molecules from interstellar clouds to star and planet formation, and for her leadership within the astronomical community.*

Fritz Zwicky Prize for Astrophysics & Cosmology

Professor Ewine van Dishoeck is Professor of molecular astrophysics at Leiden University, the Netherlands and external scientific member of the Max Planck Institute for Extraterrestrial Physics. After a MSc in theoretical quantum chemistry; she obtained her PhD in astrochemistry in 1984 from the Leiden University, and held positions at Harvard, Princeton and Caltech before returning to Leiden in 1990. From 2007-2021, she was the scientific director of the Netherlands Research School for Astronomy (NOVA), and since 2009, she is co-Editor of Annual Reviews of Astronomy and Astrophysics. From 2018-2021, van Dishoeck served as the President of the International Astronomical Union (IAU). She has received several prestigious awards, including the 2000 Dutch Spinoza Prize, the 2015 Albert Einstein World Award of Science, the 2018 Kavli Prize for Astrophysics and two ERC Advanced grants. She is a Member or Foreign Associate of several academies, including that of the Netherlands, USA, Germany and Norway.

Prof. van Dishoeck has devoted her career to understanding how these molecules shape the Universe around us. With her unique and comprehensive approach encompassing quantum chemical calculations, laboratory studies, and astronomical modelling and observations, she has pioneered and led the field of astrochemistry and revolutionized our understanding of the physical processes leading to the formation of stars and planets by studying the trail of molecules from star-forming clouds to protoplanetary disks.

A big mystery in the early days of astrochemistry was how large molecular clouds could exist in space when the ultraviolet parts of stellar light can easily destroy them. Prof. van Dishoeck's famous and much-cited PhD thesis showed how abundant molecules like molecular hydrogen and carbon monoxide (CO) could protect the interior of a cloud through a process called "self-shielding". This research led to several seminal papers on the chemical structure of diffuse interstellar clouds.

Prof. van Dishoeck has frequently exploited cutting-edge observational facilities, especially in the infrared and (sub-)millimetre wavelength ranges. She pioneered mid-infrared spectroscopy in star-forming interstellar clouds and discovered the presence of key organic molecular species locked in ices on grains. Her research revealed that icy grains are effective factories of pre-biotic organic molecules, ensuring that these species are present in significant amounts when terrestrial planets are formed.

Prof. van Dishoeck and her teams have studied in detail the formation and evolution of protostellar disks with ground and space state-of-the-art observatories at submillimeter and infrared wavelengths, tracing in particular the path of water from interstellar clouds, via collapsing cores, to planet-forming disks. Her masterful application of spectroscopic tools across a broad range of wavelengths, with a superb exploitation of the most capable astronomical measurement techniques, and increasingly powerful theoretical modelling have brought the goal of understanding the formation of solar systems many steps closer.

She led the Leiden Laboratory for Astrophysics from 1992-2005, in which experiments are conducted to simulate the chemical processes in and on icy grain mantles. She now leads the development of sophisticated physical-chemical models of gas-phase and gas-grain chemistry from the small to large scales, linking the observations and basic processes.

In addition to her groundbreaking scientific work, Prof. van Dishoeck has been an active and vital member of the astronomical community. As president of the International Astronomical Union, she led the celebrations for its centenary in 2019; the more than 5000 public and scientific activities reached millions of people worldwide. She also co-curated that year an exhibition on Cosmos: Art & Knowledge. She has been a strong advocate for a number of large billion-Euro ground and space-based observational facilities that push the studies of the molecular universe to unprecedented levels. These include ALMA and the Herschel and MIRI/JWST satellites. Her science vision, leadership, and political skills enabled her to play key roles in all phases of these projects. The trust that the community has in her judgement is also apparent from her memberships of the deciding bodies of ESA and review committees of top astronomical research institutes.

Her unique and high impact research has made Ewine van Dishoeck the leading and most influential observational astrochemist in the world, as demonstrated her citation numbers: over 670 published papers, cited nearly 50,000 times, with an h-index of 115, one of the highest of the entire astronomical community.

Photo credit : Bram Belloni

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 PhD Thesis in Theoretical Astrophysics

The 2022 MERAC Prize for the Best PhD Thesis in Theoretical Astrophysics is awarded to **Dr Helmer Koppelman (the Netherlands)** *for his multi-faceted approach to the field of galactic archaeology that transformed our understanding of the history and dynamics of the Milky Way.*

Dr Helmer Koppelman studied astrophysics at the University of Groningen, obtaining his MSc in 2016 « cum laude » with a thesis on the evolution of gaps in cold stellar streams. Dr Koppelman defended his PhD thesis at the University of Groningen in 2020 with the judicium « cum laude ». In his remarkably extensive and broad thesis, Dr. Koppelman combined theory, simulations, and vast datasets to yield new light on the structure and dynamics of the Milky Way halo and revolutionary new insights on its formation history. He spent a postdoc at the Institute for Advanced Study in Princeton and moved back to the Netherlands to start a new career as data scientist in an international company.

Dr Koppelman has produced an outstanding thesis on the formation and dynamics of the Galactic halo. The thesis offers new insights on how the Milky Way formed based on the newest datasets available and presents new modelling efforts and provides also a new characterization on the properties of dark matter halo of the Milky Way. Using Gaia DR2 data he discovered of a blob of stars that make up the local Galactic halo, which has been interpreted in terms of a large merger event that took place about 10 Gyr ago.

He further pushed the boundaries by fully exploiting the whole Gaia DR2 dataset, using the 1.3 billion stars with proper motion information to construct the biggest sample of halo stars currently available. Using data-mining tools, Dr Koppelman obtained the most precise lower limit to the mass of the Milky Way. In his thesis he further investigated the use of orbital frequencies to understand the gaps in narrow stellar streams, with as goal to put limits on the presence and properties of (dark matter) clumps in the halo.

Dr Koppelman's thesis excelled in the rigor of the analysis and detailed attention to uncertainties while keeping the broad overview of the scientific results and implications. Whereas most of the techniques were known, they were applied in rigorous way to totally new data with careful inference supported in an innovative way by insights from numerical simulations.

The PhD thesis of Dr Helmer Koppelman was conducted at the Kapteyn Astronomical Institute (Univ. of Groningen), under the supervision of Profs. Amina Helmi and Eline Tolstoy.

Best PhD Thesis in Observational Astrophysics

The 2022 MERAC Prize for the Best PhD Thesis in Observational Astrophysics is awarded to **Dr Núria Miret Roig (University of Vienna, Austria)** *for the discovery of many new free-floating planets, which illuminated the origin of these exotic nomad planets.*

Dr Miret Roig received a BSc in Physics and a MSc in Astrophysics from the University of Barcelona and obtained her PhD in 2020 from the University of Bordeaux, France, who also rewarded it with the Science and Technology Thesis Prize. Dr. Miret Roig expertise includes acquiring and analyzing massive observational datasets of nearby, young stars to derive fundamental properties such as the initial mass function, the spatial distribution, and the kinematics and dynamics of these systems. She has been co-PI of several successful proposals at major telescopes such as the GTC, VLT and CTIO, and led several studies of different aspects of the star formation process. Dr Miret Roig moved recently to a postdoc position at the University of Vienna, where she investigates the formation and origin of young stars in the solar neighbourhood.

Dr Núria Miret Roig's thesis presents the discovery of about a hundred new free-floating planets (FFPs) in the region encompassed by the Upper Scorpius stellar OB association and the Ophiuchus star-forming region. This sample is the largest ever discovered and constitutes an important step in setting the FFPs class and uncovering the origins and characteristics of these mysterious galactic nomads. Dr. Miret Roig demonstrated, for the first time, that the gravitational collapse of small clouds alone cannot explain the large fraction of observed FFPs. Instead, Dr. Miret-Roig thesis showed that an important fraction formed like planets but were ejected due to dynamical interactions.

Dr Miret Roig led an international team to combine images in public astronomical archives with new deep wide-field observations obtained with the best infrared and optical telescopes in the world, to measure proper motions and photometry of tens of millions of sources in a large area of the sky (171 square degrees). Dr. Miret-Roig used modern statistical and data mining techniques to identify the few thousands of stars and planets belonging to the young stellar association against the millions of background stars and galaxies. She obtained the mass function across four orders of magnitude for two regions of different ages (<10 Myr and 30 Myr), which now serve as a benchmark for defining the FFPs class, comparing to other regions, and testing theoretical models. Additionally, she presented a new methodology to determine the ages of young stellar associations based on their kinematics, in particular stemming from Gaia data. Dr Miret Roig has finished her PhD in three years with five articles as first author in high impact reviews.

The PhD thesis of Núria Miret-Roig was conducted at the Laboratoire d'Astrophysique de Bordeaux, University of Bordeaux (France), under the supervision of Prof. Hervé Bouy and Dr Javier Olivares.

Best PhD Thesis in New Technologies (Instrumental)

The 2022 MERAC Prize for the Best PhD Thesis in New Technologies (Instrumental) is awarded to **Dr Ewelina Obrzud (Centre Suisse d'Electronique et de Microtechnique, Switzerland)** *for the development of novel laser frequency combs for the accurate calibration and extreme radial velocity-precision of astronomical spectrographs.*

Dr Ewelina Obrzud graduated from the University of Geneva, Switzerland with a Master degree in Physics (specialisation in Astrophysics), and obtained in 2019 an interdisciplinary doctoral thesis (extra-solar planets and instrumentation) from the same university in collaboration with the Centre Suisse d'Electronique et de Microtechnique (CSEM), focussing on building and demonstrating alternatives for the existing laser frequency comb systems for astronomy. The quality of her thesis led her to be granted the Edith Alice Müller Award in 2020 by the Swiss Society for Astrophysics and Astronomy. Dr Obrzud has recently been promoted research & development engineer at CSEM.

In her PhD, Dr Obrzud developed two novel laser frequency combs for a precise and accurate calibration of extreme-radial-velocity-precision astronomical spectrographs. Both solutions are based on technologies providing laser pulses at ultra-high repetition rate (>10 GHz), a major challenge from a laser physics perspective but essential for spectrograph calibration. The first system, the electro-optic frequency comb, is characterized by an all-optical fibre-based design and simple architecture. The second system is based on dissipative Kerr soliton generation in optical microresonators. Dr Obrzud tested both systems, the electro-optic and Kerr frequency combs on astronomical spectrographs, demonstrating « real-life » operability and performance. She extended the scope of her work to a technique for frequency comb generation in the visible wavelength range, with a novel technique relying on triple-sum frequency generation in a nonlinear optical waveguide.

Dr Obrzud's work resulted in several peer-reviewed publications, four of them as first author, two of which in a Nature sub-journal. She also participated to international topical conferences and presented her results through talks and posters in conferences and workshops related to precise radial-velocity measurements and high-fidelity spectroscopy. Dr Obrzud's thesis work offers interesting solutions and concrete perspectives for the improvement of existing and future extreme-precision spectrographs for astronomy. While guided by the astronomical application, Dr Obrzud's work also attracted the attention of a wider interdisciplinary community including in particular those concerned with optical precision spectroscopy and nonlinear microphotonics.

The PhD thesis of Ewelina Obrzud was conducted at the Centre Suisse d'Electronique et Microtechnique (CSEM) in Neuchâtel and at the Department of Astronomy of the University of Geneva, under the supervision of Prof. Francesco Pepe, Dr François Wildi, and Dr Tobias Herr. The doctor title of « Dr es sciences » was granted by the University of Geneva with the tag 'Interdisciplinaire'.