European Astronomical Society
2020 Prizes

Tycho Brahe Medal

The 2020 Tycho Brahe Medal is awarded to **Prof. Stefano Vitale (University of Trento, Italy)** *for leading the LISA Pathfinder mission which has demonstrated with extraordinary precision the technology required for the future Laser Interferometer Space Antenna whose fundamental aim is to observe low frequency gravitational waves from space*.

Lodewijk Woltjer Lecture

The 2020 Lodewijk Woltjer Lecture is awarded to **Prof. Alvio Renzini (National Institute of Astrophysics, at the Astronomical Observatory of Padova, Italy)** *for his key contributions to the understanding of stars, stellar populations and the evolution of galaxies and his essential contributions to the success of ESO in his role as VLT Programme Scientist.*

Fritz Zwicky Prize for Astrophysics & Cosmology

The Inaugural Fritz Zwicky Prize for Astrophysics & Cosmology is awarded to **Prof. Martin J. Rees (University of Cambridge, United Kingdom)** *for outstanding contributions to astrophysics and cosmology including seminal papers on active galaxies and black holes, the origin of gamma-ray bursts, the large-scale structure of the Universe, and the cosmic microwave background. This exceptionally broad oeuvre has been both prescient and enormously influential.*

MERAC Prizes

The 2020 MERAC Prizes for the Best PhD Thesis are awarded in

Theoretical Astrophysics

to **Dr Aris Tritsis (Australian National University, Australia)** *for fundamental contributions to the physics of the interstellar medium and the process of star formation.*

Observational Astrophysics

to **Dr Jorryt Matthee (ETH Zürich, Switzerland)** *for spectacular results that have transformed the way we see and understand distant galaxies across time*.

New Technologies (Instrumental)

to **Dr Concepción Cárdenas Vázquez (Max-Planck-Institut für Astronomie, Germany)** *for her leadership and creative work in instrumentation, from the conceptual design and the feasibility study to the final integration and verification, both in the laboratory and at the telescope, related to the instrument PANIC.*

All six awardees will give a plenary lecture at the European Astronomical Society Annual Meeting 2020 to be held in Leiden, the Netherlands, from 29 June to 3 July 2020.

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, president-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 2020 Tycho Brahe Medal is awarded to **Prof. Stefano Vitale (University of Trento, Italy)** *for leading the LISA Pathfinder mission which has demonstrated with extraordinary precision the technology required for the future Laser Interferometer Space Antenna whose fundamental aim is to observe low frequency gravitational waves from space*.

Prof. Stefano Vitale studied physics at the University of Rome. He then occupied various positions at the University of Trento. In 1985, he was promoted to associate professor at the University of Trento and in 1994 to full professor at the same university. He was also visiting scholar at the University of California in Berkeley and at the University of Stanford. He started working in condensed matter physics, but then turned to gravitational physics. Since 1995, Prof. Vitale has been involved in space activities devoted (i) to tests of General Relativity and (ii) to observe gravitational waves, the latter as a member of the ESA study team for LISA. Since 2003, Prof. Vitale is the Principal Investigator (PI) of the LISA Technology Package payload on board of the LISA Pathfinder mission of ESA. Since mid of 2017, he is chair of the Science Program Committee (SPC) committee of ESA. He served in numerous various committees and held also various university managements responsibilities.

Initially working in the field of condensed matter and biophysics, Prof. Stefano Vitale turned his attention to phenomena in superconductivity and around 1989 he started to work on the realization of a resonant-antenna observatory for gravitational-wave bursts. This activity, under the lead of Prof. Cerdonio, brought to the construction of the gravitational wave detector Auriga at the Laboratori Nazionali di Legnaro nearby Padova, which took data from 1997 till about 2015.

Prof. Vitale turned his attention to the detection of gravitational waves in space and started to work on the technology of free fall in space. This lead then later to the design of the LISA

Pathfinder mission. The operation of LISA is based on laser ranging of test-masses under pure geodesic motion. Indeed, gravitational-wave detection relies on monitoring with high accuracy two freely falling bodies. This technology for space was not available at the level of precision needed for LISA and had thus to be designed and built ab initio increasing the precision by at least two orders of magnitude. Stefano Vitale played a crucial role in its conception and subsequent design, then in its realization and, as far as possible, in its verification on Earth before launch. The latter was done in his laboratory at the University of Trento by means of the so-called torsion pendulum. These measurements were crucial to systematically improve the drag-free technology and bring it to required level, as well as for the understanding of the residual forces acting on the test masses. Only with their precise knowledge it is possible to use this technology in LISA for measuring gravitational waves. Stefano Vitale gave important contributions in the subsequent analysis of the data coming from the LISA Pathfinder drag-free technology package. Thanks to which there is now a clear understanding of all non gravitational forces acting on the test-masses, which is a crucial step for being able to go forward with the LISA mission. The now established drag-free technology opens the door to other uses in the space science beyond the gravitational wave detection, as for instance it could be used for satellite missions aiming at testing more precisely the general relativity.

Since 2003, Prof. Vitale was the Principal Investigator (PI) of the LISA Technology Package payload on board of the LISA Pathfinder mission of ESA. Prof. Stefano Vitale played an eminent role in the very successful LISA Pathfinder mission of the European Space Agency (ESA). LISA Pathfinder was a very successful mission that was launched in December 2015 and took data till July 2017. ESA awarded in October 2017 the ESA Corporate Team Achievement Award 2016 to the LISA Pathfinder team. The LISA Pathfinder has proven that its residual noise was well below the requirements and already at the level of what is needed for building LISA. This excellent performance of LISA Pathfinder together with the ground-based discovery in 2016 and 2017 of gravitational waves by LIGO and VIRGO interferometers made a significant impact and helped the selection on 20 June 2017 of LISA by ESA as one of its large missions (L3): LISA is now in Phase A. In addition, after these historical success and discoveries, NASA is now back again as a partner in LISA.

The Lodewijk Woltjer Lecture honours astronomers of outstanding scientific distinction.

Lodewijk Woltjer Lecture

The 2020 Lodewijk Woltjer Lecture is awarded to **Prof. Alvio Renzini (National Institute of Astrophysics, at the Astronomical Observatory of Padova, Italy)** for his key contributions to the understanding of stars, stellar populations and the evolution of galaxies and his essential contributions to the success of ESO in his role as VLT Programme Scientist.

Prof. Alvio Renzini studied in Pisa, where he received a Physics Diploma from the University of Pisa and the Scuola Normale Superiore in 1963. After holding a fellowship at the Scuola Normale for three years he obtained an Astronomer position at the Astronomical Observatory of Bologna in 1967. In 1970, he was appointed a professor at the University of Bologna, a position he held until 1995 when he moved to ESO as VLT Program Scientist. Since his retirement from ESO in 2005, he is Associate Scientist of INAF at the Astronomical Observatory of Padova. He also was a visiting scientist/professor at numerous institutions around the world and received several awards and honorary appointments.

Prof. Alvio Renzini's research and contributions to astronomy are characterised by unusual breadth and depth. During his early career, he wrote seminal papers on stars, in particular their advanced evolutionary stages and chemistry. Over time, his interests broadened and included the evolution of stellar populations and galaxies, nucleosynthesis, the intergalactic medium in galaxy clusters, and more. As a theoretician, he participated in several prominent galaxy surveys and provided inspiration and support for the interpretation of data. In doing so, he displayed an unwavering focus on the underlying physical processes in astrophysical phenomena which allowed him to cut through their complexity, resulting in arguments of beautiful clarity and deep insight.

Prof. Renzini has been much more than a brilliant scientist with wide-spread theoretical and observational experience. When he moved to ESO in 1995 and became VLT Program

Scientist, he took on a most important and influential role in shaping ESO's Very Large Telescope Project. He provided guidance for the optimal use of the VLT and its future instrumentation and suggested crucial upgrades to existing instruments. He fostered survey work at ESO, also in combination with other facilities, like the Hubble Space Telescope. As VLT program scientist he contributed in a major way to the success of ESO and, in turn, the scientific excellence of European Astronomy over the last decades.

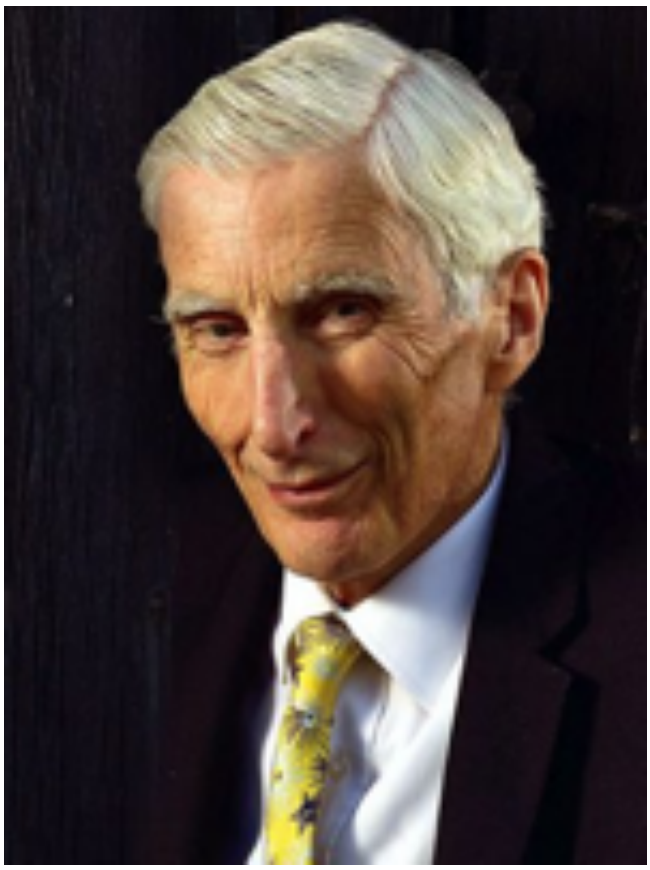
Prof. Renzini has been a mentor of many successful scientists who now hold prestigious positions around the world. He is a member of the 'Accademia Nazionale dei Lincei', Rome, the 'Instituto Veneto di Science, Lettere e Arti', and an Honorary Fellow of the Royal Astronomical Society.

Picture credit: Dr Robert A.E. Fosbury

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 Inaugural Fritz Zwicky Prize for Astrophysics & Cosmology is awarded to **Prof. Martin J. Rees (University of Cambridge, United Kingdom)** *for outstanding contributions to astrophysics and cosmology including seminal papers on active galaxies and black holes, the origin of gamma-ray bursts, the large-scale structure of the Universe, and the cosmic microwave background. This exceptionally broad oeuvre has been both prescient and enormously influential.*

Fritz Zwicky Prize for Astrophysics & Cosmology



Professor Sir Martin Rees (Lord Rees of Ludlow, Astronomer Royal of England, past President of the Royal Society and Master of Trinity College) studied in Cambridge University taking a BA in 1963 and PhD (1967), the latter for work with Dennis Sciama on physics of quasars and tests of steady state cosmology. After several research posts, and then a Chair at the University of Sussex, he was appointed Plumian Professor in Cambridge in 1973, post he held until 1991. He has held visiting and professorial positions in London, Princeton, Sussex, Harvard, and Caltech, where he interacted collegially with Zwicky in Fritz's home and office during his visit to Caltech in1971. Rees held, at last count 25 honorary doctorates from universities around the world and honorary fellowships and awards in 13 countries. He has been a member of the Order of Merit since 2007. The most recent of his 10 books 'On the Future' is being translated into 16 languages.

Prof. Martin Rees has maintained a consistent flow of important papers, over an amazingly wide range of topics in astronomy and cosmology-especially in high-energy processes, compact objects, relativistic astrophysics, galactic evolution, and the emergence of structure in the expanding universe. He is widely admired for his physical insight, and many of his ideas have proved prescient, being vindicated by later observations, forming the basis for

productive development by many others. He is primarily a theorist, but has always maintained close interactions with observers in all wavebands. He has achieved his pervasive influence not only through his papers, but also through his students, postdocs, the extended international 'network' of collaborators, the many lectures and reviews, both at conferences and to more general public audiences. He has also, especially in the last two decades, had an important role in science policy and international collaborations.

Prof. Rees has been the most influential single contributor to our understanding of the nuclei of galaxies. Even in the 1960s while still a student, he made predictions about 'superluminal expansion'; and other physical processes now recognised to be crucial to these phenomena. He originated key ideas about supermassive black holes - how the holes form, generate collimated jets, and energise active galaxies, their multiphase gaseous environment, and their use as probes of relativistic gravity.

With colleagues and students, he has maintained a flow of original contributions to the study of compact objects. Early in his career, he helped delineate the now-standard scenario for X-ray binaries in terms of accretion onto compact objects. More recently, his focus has been on gamma-ray bursts, where he and his associates have injected several key ideas that have clarified how these enigmatic objects arise.

He has focused not only on the cores of galaxies, but also on the galaxies themselves, and wrote classic papers that related the characteristic sizes of galaxies to basic physics. He authored some key papers on 'cold dark matter' (CDM) in the 1980s; later, he pioneered the exploration of CDM's implications for the 'first stars', high-redshift quasars, the ionisation and structure of the intergalactic medium. Over 40 years ago, he was already emphasising the importance of exploring 'how the cosmic dark age ended' and of 'Population III' stars.

In recent years there has been enormous growth in interest in the high-redshift universe. Prof. Rees has emphasized the role of molecules in early cooling, the role of successive mergers in the coordinated build-up of galaxies and massive black holes and the use of gamma-ray burst and supernovae to probe early epochs. He was the first to propose the possibility of 'cosmic tomography' using the 21 cm line, a subject now attracting wide interest in the context of future radio-astronomy projects. As a first-year postdoc in 1968, he wrote a prescient paper proposing that cosmic microwave background polarisation measurements could elucidate the origin of fluctuations and anisotropy in the microwave background. Polarisation of the CMB was first detected in 2002 and is now accepted as a key diagnostic for the physics of ultra-early eras. Another type of CMB fluctuation, the 'Rees-Sciama' effect due to large non-linear perturbations, was also proposed back in 1968, and is attracting renewed interest. He has been associated with many key developments in understanding gamma-ray bursts. His pioneering 1988 paper on the tidal disruption of stars by massive black holes (TDEs) led to this topic being intensively studied, at least 60 such events having been observed. In addition, Prof. Rees has written influential papers on large-scale clustering in the universe; cosmic magnetic fields and their origin; gravitational radiation; and cosmic strings, the idea of multiple Universes and the future of mankind itself.

Prof. Rees is one of the most highly cited researchers in his field. His influence on the contemporary development of astronomy and astrophysics - via informal discussions, correspondence, his wide travels, many lectures, and reviews is even greater than appears the formal publication record.

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.

The MERAC Prize Committee was pleased by the high quality of the nominated candidates for the three MERAC Prizes of 2020.

Best PhD Thesis in Theoretical Astrophysics

The 2020 MERAC Prize for the Best PhD Thesis in Theoretical Astrophysics is awarded to **Dr Aris Tritsis (Australian National University, Australia)** for fundamental contributions to the physics of the interstellar medium and the process of star formation.

Dr Aris Tritsis has been a post-doctoral fellow at the Research School of Astronomy & Astrophysics of the Australian National University since 2017. He studied Physics at the University of Ioannina and in 2013 he graduated with a master's degree in Astrophysics from the University College of London. He obtained his PhD at the University of Crete (2014 - 2017) where he worked on the physics of star formation, astrochemistry, and molecular line radiative transfer. He is a member of the SPICA collaboration aiming to launch the cryogenic infrared satellite for the ESA M5 slot.

Dr Tritsis studied a wide range of physical processes, from interstellar chemistry to cloud dynamics and radiative transfer. He made fundamental contributions to the understanding of the physical origin of striations (quasi-periodic, ordered structures in the low-density parts of otherwise chaotic-looking interstellar clouds). He demonstrated that striations are the result of magnetosonic waves, and he confirmed the predictions of this model by discovering normal modes that have been set up in an isolated cloud, the Musca molecular cloud, by these waves. In a highly surprising and impactful discovery, he used these normal modes to reconstruct the 3-dimensional shape of Musca. Tritsis showed that Musca is pancake-like, a sheet seen edge-on. This work received world-wide attention, both by scientists and the general public.

Using hydrodynamical numerical simulations coupled with the largest chemical network to date (300 species, 14,000 reactions, gas and grain species), Tritsis identified the best molecules to probe the true 3D shape of cloud cores. Tritsis is also the developer of the line radiative transfer code PyRaTE. He used it to post process the results of his MHD simulations of star forming regions to compare with observations.

Since his graduation, based on his PhD thesis results, Tritsis has developed a novel analytical method for measuring the magnetic field strength, taking advantage of the fact that striations are the imprint of hydromagnetic waves. He is currently using this method to create a 3D atlas of the magnetic field strength in the Milky Way.

The PhD thesis of Aris Tritsis was conducted at the University of Crete under the supervision of Prof. Konstantinos Tassis. He was also member of the Astrophysics Group at the Institute of Electronic Structure and Laser of the Foundation for Research and Technology - Hellas.

Best PhD Thesis in Observational Astrophysics

The 2020 MERAC Prize for the Best PhD Thesis in Observational Astrophysics is awarded to **Dr Jorryt Matthee (ETH Zürich, Switzerland)** for spectacular results that have transformed the way we see and understand distant galaxies across time.

Dr Jorryt Matthee obtained his BSc degree from Utrecht on the observability of multiple stellar generations in globular clusters. He continued his studies at Leiden, where he got his MSc Cum Laude in 2012. Jorryt was then awarded a prestigious Huygens PhD fellowship by Leiden University to work on his own research project at Sterrewacht Leiden, combining observational studies of distant galaxies and theoretical analysis. Dr Matthee's thesis in late 2018 received the prize for best PhD thesis in the Leiden Science Faculty, and was distinguished by the 2018 IAU PhD Prize for Division J: Galaxies and Cosmology. Jorryt Matthee currently holds a Zwicky fellowship on extragalactic astrophysics at ETH Zürich, using emission lines to study the early formation of distant galaxies with ground and space observatories. Dr Matthee, furthermore, make use of state-of-the-art cosmological hydrodynamical simulations to understand which physical mechanisms make galaxies different and cause the scatter in galaxy scaling relations.

Dr Jorryt Matthee's thesis presents spectacular results in 11 first-author papers that have transformed the way we see and understand distant galaxies across time. His own state-of-the-art observations with ALMA, Hubble and the VLT revealed that very distant galaxies are complex, actively assembling systems. Jorryt discovered some of the brightest distant galaxies and has also investigated the co-evolution of dark matter halos and galaxies in the state-of-the-art cosmological EAGLE simulation.

Dr Matthee discovered some of the brightest distant galaxies and showed that they are much more common than previously thought, with important consequences for future space missions like Euclid. Jorryt's PhD work also mapped, dissected and discussed how galaxies have evolved over the first few billion years of the Universe and how they have played a key role in dissipating the cosmic fog during the epoch of re-ionisation, including the first direct observation of a galaxy ionising the surrounding inter-galactic medium.

With numerical simulations, Dr Matthee found new interesting relations between the growth of galaxies and their alpha-enhancement, which future observations will test, and he was able to shed unique light in the so-called 'galaxy main-sequence'.

The PhD thesis of Jorryt Matthee was conducted at Leiden University, under the supervision of Profs. Huub Röttgering, Joop Schaye, and Dr David Sobral.

Best PhD Thesis in New Technologies (Instrumental)

The 2020 MERAC Prize for the Best PhD Thesis in New Technologies (Instrumental) is awarded to **Dr Concepción Cárdenas Vázquez (Max-Planck-Institut für Astronomie, Germany)** for her leadership and creative work in instrumentation, from the conceptual design and the feasibility study to the final integration and verification, both in the laboratory and at the telescope, related to the instrument PANIC.

Dr M. Concepción Cárdenas graduated in Physics at the University of Granada and began working in 1999 at the Institute of Astrophysics of Andalusia (IAA-CSIC, Spain) in the Instrumental and Technological Development Unit, as optical engineer until 2016. Always interested in getting a PhD, she conducted a master degree, simultaneously to her job between 2001 and 2003. As part of the IAA team for the development of new instrumentation for Calar Alto Observatory, she was appointed as the responsible of the optical package of PANIC in 2006 and of the infrared channel of the spectrograph CARMENES, in 2011. While developing PANIC, she restarted her PhD activities simultaneously to her job at IAA, and defended her thesis in December 2018. She was awarded the prize for the best Spanish PhD in Instrumentation, Computing and Technological Development in Astronomy and Astrophysics from the Spanish Astronomical Society. She moved in early 2016 to the Max-Plack Institut für Astronomie (Germany) as Senior Optical Engineer with responsibilities on several instruments for the European Extremely Large Telescope.

Dr Concepción Cárdenas described in her thesis the complete development of an astronomical instrument, PANIC (Panoramic Near-Infrared Camera), from the conceptual design and the feasibility study to the final integration and verification, either in the laboratory as well as at the telescopes, following all the standard processes and exhaustive design revisions. Her thesis can be considered as a very good text book for students in the instrumental fields due to the rigor in the methodology, the achievement of all specifications and goals, with a scrupulous verification.

Her thesis work on PANIC was carried out in parallel with all the activities required to the optical team at IAA, to the CARMENES project (Calar Alto high-Resolution search for M dwarfs with Exoearths with Near-infrared and optical Échelle Spectrographs), and with fulfilling her daily charges for an Optical Laboratory and the Observatory of Sierra Nevada.

The PhD thesis of M. Concepción Cárdenas Vázquez was conducted at IAA-CSIC under the supervision of Dr Julio F. Rodríguez Gómez and presented at the Univ. of Granada.