

Our astronomers and space scientists

South African Astronomical Observatory (SAAO) and Southern African Large Telescope (SALT)



Cosmologist Professor Bruce Bassett studies the nature, composition and dynamics of the entire universe and its origin and destiny.

Dr David Buckley runs the astronomy operations for SALT. He develops instrumentation for polarimetry and high-time resolution astronomy, while his research focuses on compact objects, particularly magnetic white dwarfs.



Professor Phil Charles studies compact objects in our galaxy, principally neutron stars and black holes, which are accreting matter from an orbiting companion star. He uses both ground- and space-based observatories as the companion star is best observed in the optical, whereas the extremely high temperatures reached near the compact object produce X-rays that can only be seen from space.

Dr Alexei Kniazev investigates dwarf galaxies and galaxies with intense current bursts of star formation to help us understand very distant, and therefore very young, objects that we cannot study in detail, but which are crucial to our understanding of how galaxies evolve.



Dr Peter Martinez runs the Space Science and Technology Division at SAAO. His research area is astero-seismology – the study of starquakes – to understand the interior structure and evolution of stars.

In addition to searching for extrasolar planets in the direction of the Galactic bulge, **Dr John Menzies** also studies the infrared characteristics of evolved cool stars in a Local Group galaxies and is a data analyst for the SALT edge sensor project.



Dr Darragh O'Donoghue develops astronomical instrumentation and telescopes, including their optics. Scientifically, he is interested in single and binary stars in the late stages of their evolution.

The research done by **Dr Stephen Potter** concentrates on magnetic cataclysmic variables, including the inter-stellar medium and blazars (active galactic nuclei with jets pointing towards Earth).



The research interests of **Dr Ramotholo Sefako** include multi-wavelength studies of blazars and pulsar-driven nebulae to unravel how these objects produce high energies, up to gamma rays.



Dr Petri Vaisanen investigates star formation to understand how galaxies form and evolve. His special interest is in colliding and interacting galaxies.



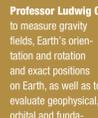
Astrophysicist Professor Patricia Whitelock studies the late stages of stellar evolution and Local Group galaxies. She uses infrared techniques, both from Sutherland and from telescopes in space, to study the material that enshrouds stars towards the ends of their lives.

Hartebeesthoek Radio Astronomy Observatory (HartRAO), Karoo Array Telescope (MeerKAT) and the Square Kilometre Array (SKA)

Using molecular spectroscopy to study interstellar molecules and cosmic masses, **Professor Roy Booth** is working towards understanding how stars are formed. He also works on high-resolution very long baseline interferometry (VLBI) of quasars and active galactic nuclei, and the science of the MeerKAT and the SKA.



Professor Ludwig Combrinck works on supernovae, gamma-ray bursts, supernova remnants as well as active galactic nuclei, using VLBI and radio telescopes around the globe.



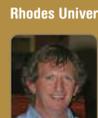
Professor Erwin de Blok uses space geodesy to measure gravity fields. Earth's orientation and rotation and exact positions on Earth, as well as to evaluate geophysical, orbital and fundamental physics parameters.



By investigating the radio and infrared emissions from the gas surrounding high-mass stars in the Milky Way, **Dr Michael Gaylard** studies how they are formed. He uses data from HartRAO and telescopes in space.



The galaxies that lie behind the obscuring layers of our Milky Way are what **Dr Anja Schröder** focuses on. She studies how they form filaments and clusters, the biggest and most important of which is the so-called Great Attractor. She is also a support scientist for the MeerKAT project.



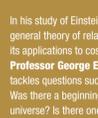
As South Africa's MeerKAT project scientist, **Professor Justin Jones** is involved with the design, construction and operation of this new radio telescope, as well as Africa's bid to host the SKA. His astrophysics research interests include supernova remnants, pulsars and the cosmic microwave background radiation.



Professor Erwin de Blok studies dark matter in galaxies, as well as how galaxies form stars. He also works on the MeerKAT project.



Professor Peter Dunstby is attempting to find alternatives to the standard "concordance" model of the universe based on modifications of Einstein's theory of general relativity or by retaining general relativity but ditching the Friedmann description of the large-scale properties of the universe.



In his study of Einstein's general theory of relativity and its applications to cosmology, **Professor George Ellis** tackles questions such as: Was there a beginning to the universe? Is there one universe or many? Does the universe have a centre, or not? Why is there life in the universe?



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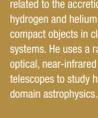
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An awesome new universe unfolds as spiral galaxies become "dust-penetrated" at infrared wavelengths, says **Professor David Block**. He devotes his research to penetrate masks of cold cosmic dust grains in galaxies, many of these at temperatures of minus 250 °C, or approximately 20 °C above absolute zero.

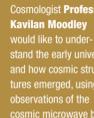


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University of KwaZulu-Natal



Professor Manfred Hellberg and colleagues model electromagnetic and acoustic-like waves, including large solitary waves, that may occur in the different forms of ionised gas (plasma) found in Earth's and planetary magnetospheres, cometary regions and solar-terrestrial space. Their mathematical-computational studies assist in understanding satellite- and ground-based measurements, and predicting possible new observations.



Cosmologist Professor Kavilan Moodley would like to understand the early universe and how cosmic structures emerged, using observations of the cosmic microwave background (CMB) radiation, the remnant heat from the big bang.



Professor Derek Smith studies the properties of astronomical masses in star-forming regions. He also models the atomic processes occurring in gaseous nebulae and uses online databases to study binary stars that are in contact with each other.



Professor Pieter Meintjes focuses on multi-wavelength astrophysics of accretion-driven Galactic and extra-galactic sources, especially the production of non-thermal radiation from radio frequencies to TeV gamma rays in cataclysmic variables, X-ray binaries and active galactic nuclei.



Professor Okkie de Jager's focus on gamma-ray work is on observations of energetic sources in the Galactic plane with the High-Energy Stereoscopic System (HESS) that consists of four 12-metre telescopes in Namibia. He also works on radio, infrared, optical and X-ray astronomy.



In addition to his interest in the culture and history of Astronomy in Africa, **Professor Thebe Medupe** focuses on numerical modelling of stellar oscillations to gain new knowledge about the interiors of stars. He leads a research project to study the contents of ancient astronomical manuscripts found in Timbuktu, Mali.



Professor Harm Moraal records the intensity of cosmic rays with instruments called neutron monitors. He combines measurements from Southern Africa and Antarctica with data gathered by NASA's Voyager spacecraft in the outer regions of the heliosphere.



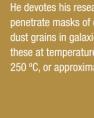
Professor Marius Potgieter uses cosmic rays as probes to study the physics of the heliosphere, the region of the inter-stellar medium that surrounds the Sun. He also develops numerical models using high-performance computing.



Professor Johan van der Walt studies how massive stars are formed, specifically focusing on how we can use the masses associated with high-mass star-forming regions to understand the environment of very young massive stars.



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University of the Western Cape
To help focus the search for life on Mars and other planetary bodies, microbial ecologist **Professor Don Cowan** explores extreme life forms in some of the harshest conditions on Earth, such as the cold deserts of Antarctica.



Professor Chris Koen is an expert on statistical questions in astronomy.



Professor Catherine Cross studies galaxies and cosmology. Her group uses supercomputer simulations to understand galaxy evolution. They are also involved in science for SALT, MeerKAT and the SKA.



Professor Herman Steyn applies most of his satellite engineering research in the specialist field of satellite attitude and orbit determination and control systems. The attitude control system of both SUNSAT-1 and SumbandiraSAT (Africa's only locally designed Earth-orbiting satellite) was developed and implemented under his guidance.



Hermanus Magnetic Observatory
Dr Lee-Anne McKinnell specialises in modelling the variability of the ionosphere for the purpose of high-frequency radio communications. She uses South African ionosonde data, works on space weather products and participates in global ionospheric modelling under quiet and disturbed conditions.



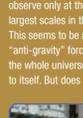
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Dr Sandile Malinga specialises in gravity, tidal and planetary waves, their associated transport mechanisms and the resultant interconnections between the various regions of the space environment, using instruments such as radars, lidars and satellites to study regions in South Africa and in Antarctica.



Rising stars – a few of the many young astronomy and space science researchers building their careers in South Africa
Dr Chris Clarkson at UCT studies the strange phenomena of dark energy, which we observe only at the very largest scales in the universe. This seems to be a weak "anti-gravity" force, making the whole universe repulsive to itself. But does it really exist?



Dr Sharmila Goedhart studies how the largest stars in the galaxy are born. The types of stars she studies are not visible to the naked eye but can be examined indirectly using radio telescopes. Based at the MeerKAT project office in Cape Town, she is also part of the team building this new radio telescope.



Dr Amanda Gulbis, an astronomer at SALT, works towards characterising the dynamical and physical properties of small bodies in the outer solar system, such as Pluto and other trans-Neptunian objects to help understand how our solar system evolved. She also searches for the tenuous atmospheres of these objects via stellar occultation observations.



Dr Enrico Olivier is involved in observational cosmology and the study of vibrations in stars. He is also responsible for science outreach and media liaison at the SAAO.



Dr Kurt van der Heyden does multi-wavelength studies of galaxy clusters and explores the observational constraints on dark energy models. Based at UCT, he is also interested in radio interferometry and is leading a large continuum survey with MeerKAT.



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science & technology

Department: Science and Technology REPUBLIC OF SOUTH AFRICA

South Africa's Cosmic Explorers

With the entire universe as their laboratory and South Africa's unique position for exploring it, our astronomers and space scientists are among the best in the world. Meet some of our scientists fascinated by astronomy and space science questions ranging from black holes and blazars to supernovae and starquakes.

HESS

The High-Energy Stereoscopic System (HESS) is situated near the Gamsberg Mountain in Namibia. Scientists use the instrument to investigate cosmic gamma rays – the highest energy radiation detected by astronomers. The name HESS also pays homage to Victor Hess, who received the Nobel Prize in Physics in 1936 for his discovery of the very energetic particles, known as cosmic rays. The Unit for Space Physics at the North-West University is an active partner in HESS.

SAAO AND SALT – SUTHERLAND

The South African Astronomical Observatory (SAAO) is the premier optical/infrared astronomy facility in Africa. Among the high-tech facilities on this site are 11 telescopes (more are under construction). Some of these are South African, others are operated jointly with, or on behalf of institutions from Germany, Japan, Korea, UK and the USA. The most important of these is the Southern African Large Telescope – the largest single optical telescope in the southern hemisphere. SALT's primary mirror is made up of 91 hexagonal segments. SALT is operated by SAAO on behalf of an international consortium of which South Africa is the largest shareholder.

SAAO – CAPE TOWN

The history of the South African Astronomical Observatory dates back to the founding of the Royal Observatory at the Cape of Good Hope in 1820. Its historical McClean telescope was for some while the largest refractor in the southern hemisphere. The SAAO library houses a collection of approximately 13 000 items, including over 800 journal titles from around the world. The library has a unique richness of pre-twentieth century journals, with the core astronomical journals starting at Volume 1. The oldest book in the collection dates back to 1515.

WINDHOEK



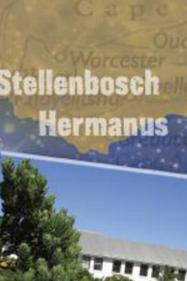
NAMIBIA



Carnarvon



Sutherland



Stellenbosch



Hermanus



PORT ELIZABETH



HERMANUS MAGNETIC OBSERVATORY

The Hermanus Magnetic Observatory (HMO) is South Africa's cutting edge Earth and space science research facility, situated at Hermanus in the Western Cape. It is part of a worldwide network of magnetic observatories which monitor and model variations of the Earth's magnetic field. The Hermanus Magnetic Observatory is also one of thirteen space weather regional warning centres globally that form part of the space weather information and warning network for the International Space Environment Service (ISES).

HARTRAO

The Hartebeesthoek Radio Astronomy Observatory (HartRAO) is located in a valley in the Magaliesberg hills, 50 km west of Johannesburg. In addition to its 26-metre radio dish, HartRAO researchers also work with a prototype dish that was built for the Karoo Array Telescope (MeerKAT) on the same site. HartRAO is also a key node in a global network of observatories doing very long baseline interferometry (VLBI).

PRETORIA



BOYDEN

The Boyden Observatory, 25 km from Bloemfontein, belongs to the University of the Free State. The Observatory was established in Peru in 1889 as the southern station of Harvard University Observatory, and moved by them to South Africa in 1927.

DURBAN

ASTRONOMY ONLINE

• Astronomy Month: www.saasta.ac.za/astronomy/



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