October 2011

UNIVERSITY OF JOHANNESBURG

Faculty of Science NEWSLETTER

Physics

The Faculty of Science is proud to report on the activities in the Department of Physics this month. Prof AM Strydom, Head of the Department of Physics, takes the leadership in this diverse Department. The Department is situated on both the Auckland Park and Doornfontein Campuses of the University of Johannesburg and offers courses that are central to both the Sciences and Engineering, indicating its important role in the University. Although the Department offers many lectured courses it also excels in research, proudly collaborating with many leading national and international institutes.

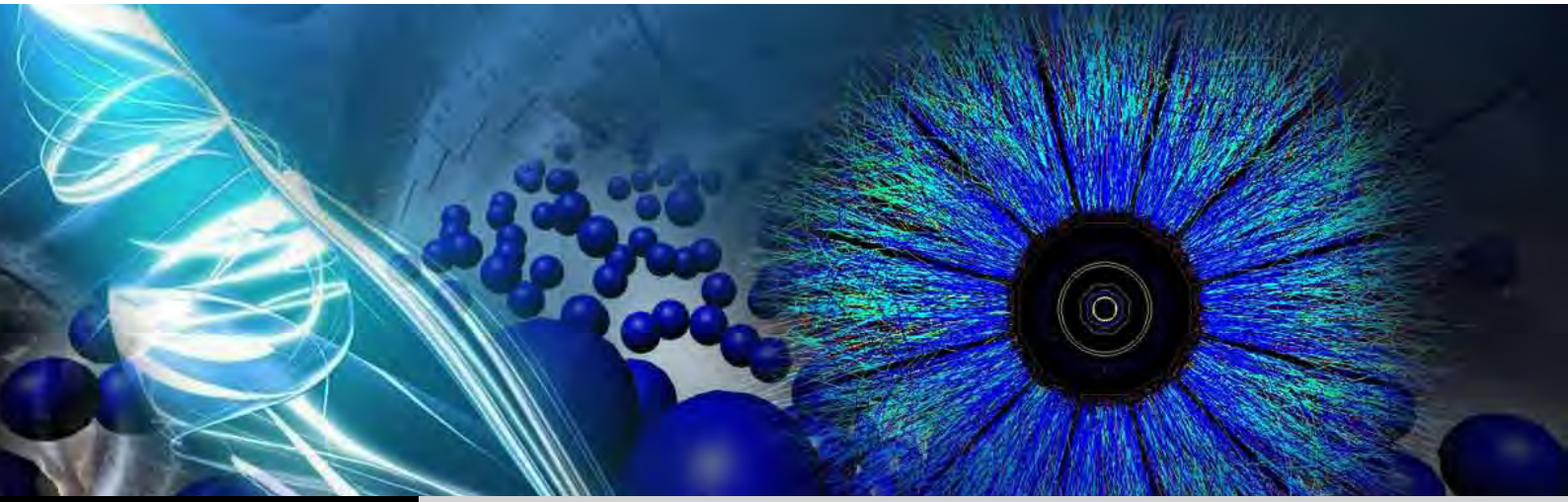
Staff and students have made the Department their home. Whether after hours or during holidays – the corridors of Physics are a constant hive of activity because physicists love their work and can often be found pursuing their research as a labor of love.

In the Department of Physics everyone is valued for their teamwork and for individual nature alike.

Prof André Strydom, Head of Department, chairing a scientific symposium at the Vienna Microkelvin Laboratoria.

THE STAFF OF THE PHYSICS DEPARTMENT

1st row (bottom): Prof Giovanni Hearne; Buyi Sondezi-Mhlungu; Prof Aletta Prinsloo; Dr Charles Sheppard and Jasper Snyman.
2nd row: Susan Jacobs; Rebecca Mokoena; Prof Azwinndini Muronga; Dr PAP Nair; Christa Botha; Dr Krish Reddy and Dr Bryan Doyle.
3rd row: Prof Paul de V du Plessis; Prof André Strydom (HOD); Martie Wallace; Reshika Moodley and Dr Emanuela Carleschi.
4th row: Dr Lerothodi Leeuw; Corrie Visagie; (Late) Agnes Mathebula and Kenny Vuma.
5th row: Théron Slattery; Jan Oelofse; Cecilia Jonker; Lianie Döman and Abdullah Kraft.
6th row: Themba Mathe; Christopher Middleton; Pieter Gouws; Paul Molefe and Sam Ramaila.
7th row (top): Dr Chris Engelbrecht; Prof Simon Connell; Claire Lee; Paulus Masiteng and Prof Steven Karataglidis.
(Absent): Prof HL Alberts and Prof H Winkler.



Introduction

The Department of Physics at the University of Johannesburg hosts a dynamic assembly of staff and students. The Department has expanded dramatically over the last few years and the Faculty is very proud of having grown this Department into a lively and diversified research-driven division. Research and lecturing staff are based on two satellites at the Auckland Park and Doornfontein campuses, offering a wide variety of courses to students interested in fundamental and applied Physics.

On the Doornfontein Campus of UJ the Department offers courses from first-year to Bachelor of Technology (BTech) level to the Faculties of Art, Design and Architecture; Engineering; Health and Science. The courses are service-oriented with emphasis on vocational training. Specialised Physics practicals are also offered to the Optometry, Industrial Engineering and Mechanical Engineering Departments. The Department of Physics on Doornfontein campus boasts excellent graduate laboratories used by learners from secondary schools, as well as by distance learning Universities in South Africa. This bears testimony to the high standard of training on this satellite campus of the Department. Research on this campus is currently geared towards Science Education, Nuclear Physics and Laser Optics.

Traditional Physics degree content leading to postgraduate research is the pillar of strength for this Department on the Auckland Park Campus of UJ. Here, groups and individuals practice research over a wide front of experimental and theoretical Physics. Areas of specialization include High-energy Physics (nuclear and particle – experimental, theoretical and phenomenology); condensed matter and Physics at extreme high pressure; Astrophysics including research into active galactic nuclei, extragalactic evolution, stellar structure, equation of state and transport properties of compact astrophysical objects, and astroseismology; atmospheric Physics of solar radiation; low temperature Physics and highly correlated electron systems; theoretical Physics including nuclear structure and reaction theory, high-energy nuclear collisions and quark-gluon plasma, and magnetism of chromium and its alloys.

The Department takes pride in its modern and leading-edge experimental research and characterization facilities across various platforms in solid state physics, as well as in the presentation of a broad portfolio of physics courses serving the scientific, technological, medical, education, and engineering communities of South Africa.

The Department strives towards national and international recognition – by training independently thinking and innovative physicists and scientists, by teaching relevant and modern Physics in our programs, by delivering multi-faceted and internationally competitive research, and by building leading-edge experimental facilities and computational networks.

The staff from the Department participate nationally and internationally in joint and collaborative research that involves postgraduate students in every step. They actively communicate research through publication in high-impact journals and subject-specific forums such as workshops and conferences. Staff aim to transfer knowledge of Physics, whether in pursuit of an understanding of nature or as an enrichment in the development of technology, through undergraduate service courses and core components of degree and diploma studies majoring in Physics.

The Department proactively seeks to interact with the community in order to put their knowledge in Science in general and in Physics in particular to the benefit of enquiring minds who seek an understanding of nature, and to introduce learners and students to the endless ways in which Physics empowers the mind.

Prof HL Alberts: Leader in his field

Prof Alberts

Prof Herman Alberts joined the Rand Afrikaans University in 1968 and retired from the Department of Physics in 2006. His field of research centered on physical properties and magnetism of chromium and its alloys. Prof Alberts retired with a B-rating from the NRF.

The South African Academy for Arts and Science awarded the prestigious MT Steyn Medal for Scientific and Technical Achievement in 2007 to Prof Alberts

The Medal is one of the most significant awards made by the Academy for leadership on the highest level in the area of science and technology.

Prof Alberts was the recipient of the UJ Alumni Dignitas Award during 2008. The Alumni Dignitas Awards is the highest award that a UJ alumnus can receive from fellow alumni.

It was with great sadness that the Department bid farewell to Prof Alberts in June 2011. We look back with fondness to the deep impact he has made on our Department and to the enduring influence of scholarly leadership that Prof Herman Alberts has had on Physics in the Scientific Community in South Africa throughout the formative years of Physics at the former RAU. His example pervades the careers of many current members of staff at Physics at UJ.

Opening and inaugural celebration of the Vienna Microkelvin Laboratory: Low temperatures hit high notes

On June 22, 2011, years of planning, deliberation, and project proposals came to fruition with the opening and inaugural celebration of the Vienna Microkelvin Laboratory at the Institute of Solid State Physics (IFP) of the Vienna University of Technology (TU-Vienna). The concept of establishing a laboratory with experimental facilities to explore quantum matter and related phenomena at ultra-low temperatures was discussed between Prof Andre Strydom and the Principal Investigator and Director of IFP at TU-Vienna, Prof Dr Silke Bühler-Paschen, as far back as 2006. Prof Strydom and Prof Bühler-Paschen had been colloborating on related topics of Physics since 2003, and research at ultra-low temperatures was a natural yet extremely challenging development demanded by the need to shift frontiers of knowledge and boundaries of extreme experimental conditions in research on this topic.

A scientific symposium was chaired by Prof Strydom and held in the Karlsplatz Festsaal of TU-Vienna in conjunction with the inaugural ceremony (photo front page). Dignitaries included the Vice Rector of TU-Vienna, Prof Sabine Seidler, the Dean of the Faculty of Physics Prof Gerald Badurek, as well as a representative of the Identification Committee of the European Research Council responsible for funding of the project, Dr Arnold Schmidt. A list of four prominent worldwide leaders in experimental and theoretical Condensed Matter Physics joined the Principal Grantholder, Prof Bühler-Paschen, in delivering keynote lectures to resonate the exciting new Physics and revealing insights expected to develop from the new Laboratory. Formalities then turned to the Laboratory itself where a technical and truly awe-inspiring overview was presented. Infrastructural difficulties such as the main cooling tank and magnet facility extending over multiple floors, as well as mechanical, cryogenic, and electronic complexity soon had everyone recognizing the extreme challenge and admiring the achievements by the group led by Prof Bühler-Paschen so far in already reaching into the microkelvin regime of low temperatures. Glasses were raised in anticipation of the success, in admiration of the high expectations, and in the team effort and joint work in years to come from the international team involved in the new Vienna Microkelvin Laboratory.

Onlookers at the technical overview session. Second from left is Prof Dr Silke Bühler-Paschen with Prof Strydom on her left.

Prof Strydom and Prof Qimiao Si during the opening formalities in Vienna.

Prof Arumugam (2nd from left), the University of Bharathidasan in Tiruchirapally, Vice Chancellor Dr K Meena (2nd from right) and Prof AM Strydom (far right).

Prof AM Strydom on a sightseeing trip to the Rock Fort Temple where religious idols greet visitors.

A group photo of some of the staff and students working at the Centre for High-Pressure Research (CHPR) of the Bharathidasan University at Tiruchirapally .

Prof Strydom and Prof Arumugam on a visit to a temple.

Senior research fellowship in India

During the 2010-2011 call for applications to the Indian CV Raman Fellowship, Prof Andre Strydom, HOD of the Department of Physics, was invited by the Director of the Centre for High-Pressure Research (CHPR), Prof S Arumugam of the Bharathidasan University at Tiruchirapally in the south-eastern state of Tamil Nadu to apply for a Senior Research Fellowship in India. The Fellowship is offered by the Federation of Indian Chambers of Commerce and Industry, under the auspices of the Indian Department of Science and Industry. Following a successful application of Prof Strydom jointly with Prof Arumugam, the Fellowship was awarded to Prof Strydom and during March CHPR was visited in order to initiate and work on bilateral research with scientists and students of CHPR. Several projects from the current research work of Prof Strydom were made available for bilateral studies in India. Joint research under this Fellowship offers the opportunity to extend the research of Prof Strydom in Physics at UJ to very high sample pressures as a valuable new experimental parameter. In correlated electron systems, physical properties are very amenable to external variables such as applied magnetic fields, sample temperature, and external or chemical pressure. This type of research is expected to open vast new experimental windows on typical research topics of Prof Strydom, such as quantum criticality and physical phenomena at the verge of magnetic ordering. A very devoted group of postgraduate students under the supervision of Prof Arumugam have joined in the research as part of their doctoral studies, and the first research results are expected soon.

Finding time between work to turn to spiritual matters, Prof Strydom benefitted from the location of Tiruchirapally to visit a number of religious sites and ancient temples.

Dining turned out to be a very spicy affair indeed and the unsuspected visitor from SA was given no gentle introduction to the culinary delights of India. The gastronomy was found to be delightfully varied with a seemingly endless assortment of dishes, spices and condiments, sweet treats, and exquisitely prepared bites to tempt the adventurous diner.

Prof Giovanni Hearne's visit to Japanese Research Institutions

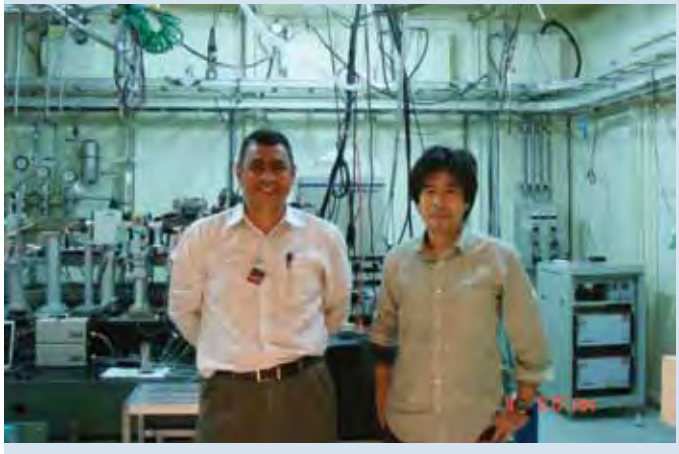
National Institute for Materials Science (NIMS) and the SPring-8 Synchrotron

In the first week of November 2010 Prof Hearne visited NIMS and the SPring-8 as part of an SA-Japanese initiative. This was funded by the DST to promote exchange and collaboration amongst researchers. Prof Hearne's interest is in the area of materials science at extreme conditions of high pressure and temperature (P-T). His interest includes the magnetic-electronic and structural-elastic response of various advanced materials at extreme P-T. To this end the visit to NIMS and SPring-8 was to establish contacts with eminent Japanese researchers in related fields.

The visit commenced at NIMS in the city of Tsukuba, otherwise known as *science city* because of the many scientific institutions in that region. At NIMS Prof Hearne made contact with Prof Kazuhiro Hono who leads the magnetic materials unit and Dr Takeshi Taniguchi who is head of the high pressure group.

In Prof Hono's magnetic materials unit, advanced magnetic and spintronics materials are developed primarily for later use as ultra-sensors and information storage technologies. These include magnetic, thin films, multi-layers and nanomaterials in which the micro-structure plays a key role in determining the magnetic response of the materials. Many of the materials are based on transition metal compounds, primarily Fe- and Co-based. Besides extensive facilities for materials synthesis and magnetic characterization (magnetometry), there were also state of the art techniques for investigating micro-structures. This included field or laser assisted atom probes involving time-of-flight measurements for 3D elemental analysis/imaging on the nanoscale.

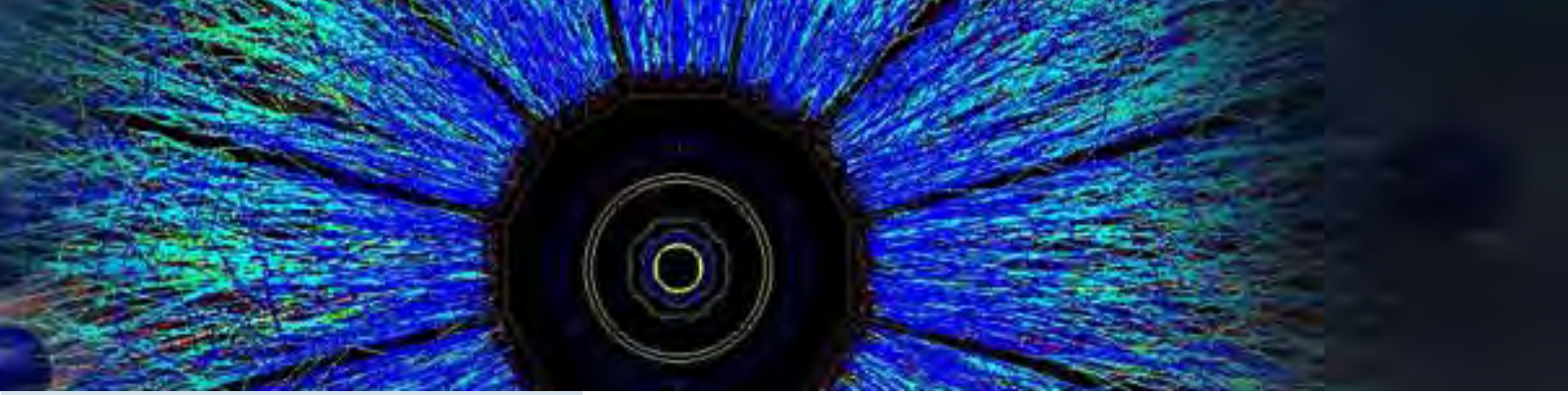
Prof Hearne then visited the high pressure group, which now falls under the Exploratory Nanomaterials Research Laboratory research unit at NIMS. The high pressure group is headed by Dr Takashi Taniguchi, renowned for his work on the synthesis of high quality single-crystal cubic boron nitride in large volume presses.



Prof Hearne with Dr Ohishi who is the beamline manager of the BL10XU high pressure beamline at the SPring-8 synchrotron.

Dr Taniguchi continues to be involved in the area of single-crystal boron nitride synthesis, more specifically for optoelectronic applications. Dr Kenichi Takemura then provided a tour of the diamond anvil cell (DAC) research laboratory and its capabilities. Dr Takemura is involved more in fundamental research of the high pressure structural phases of various elements extending to ultra-high pressures (megabar pressure regime). A number of these elements (Ca, K, etc) exhibit spectacular properties, eg. superconductivity at comparatively high temperatures. The structural characterization at these extreme conditions is normally done at synchrotron facilities in Japan, for example SPring-8, which Prof Hearne visited later in the week. Dr Takemura is well known in the high pressure research community for his technical expertise and the high quality data of his research work. This was exemplified by the outstanding DAC laboratory facilities, including the specialized helium and hydrogen gas loading station. These gases are considered ideal pressure transmitting media especially for ultra-high pressure work. About half a day was spent interacting with the high pressure group and touring their high pressure facilities.

Prof Hearne then traveled to the SPring-8 synchrotron X-ray facility in the south-west of Japan, 800 km west of Tokyo. He



was hosted at SPring-8 by Dr Takahiro Matsuoka, a young researcher working on hydrides at high pressure, as part of a research programme on hydrogen storage materials. Dr Matsuoka (now based in Osaka) works at the BL10XU high pressure beamline and uses XRD, Raman and electrical-resistance techniques for the investigation of his materials at pressure in DACs. Dr Yasuo Ohisi is head of the beamline, which is primarily involved in XRD structural studies at extreme P-T extending into the ultra-high pressure (megabar) regime, P > 100 GPa. A double-sided laser heating station is also installed at the beamline for the attainment of high temperatures up to 3000 K concurrent with high pressures. Much of the work is on geophysical related materials as a window into the behavior of minerals in planetary interiors. Raman spectroscopy and electrical-transport measurements can be performed concurrently with the XRD measurements to extreme P-T conditions. Dr Ohishi also has close linkages with colleagues at SPring-8 who use nuclear resonance spectroscopy (*synchrotron Mössbauer spectroscopy*) to probe magnetic-electronic behavior under extreme P-T conditions. Prof Hearne has a long-standing background in Mössbauer spectroscopy. In the near future he intends to access the BL10XU beamline and the nuclear resonance spectroscopy capabilities it will have, for energy-domain nuclear resonance studies of Fe-based materials under extreme conditions. Dr Ohishi was very supportive of this, indicating that researchers at SPring-8 were keen to have more foreign researchers accessing their beamlines. This would be possible through Japanese-SA collaborative programmes which are in place.

Dr Matsuoka conducted a tour of the 30 – 40 beamlines (of the 62 in total) at the synchrotron. This included a short excursion to the X-ray free electron laser (XFEL) facility which was in the final stages of construction. The XFEL will permit unprecedented X-ray intensities to be attained with a femtosecond time structure, indispensable for studying dynamical processes in time resolved XRD work. A full day was spent at the SPring-8 synchrotron in touring facilities and interacting with researchers.

Prof Giovanni Hearne's Research visit to Europe: June 2011

Prof Giovanni Hearne visited the Centre for Science at Extreme Conditions (CSEC) at the University of Edinburgh to assess a new miniature diamond anvil cell (DAC) for magnetisation studies at high pressure. The University of Edinburgh ranks within the top fifty universities worldwide. The Department of Physics at the University of Edinburgh boasts famous past members like James Clerk Maxwell (electromagnetism), Max Born (lattice dynamics) and Peter Higgs (Higgs boson in high energy physics).

The new turnbuckle magnetic diamond anvil cell (TM-DAC) is an innovation, developed at CSEC, that permits magnetic studies to extreme pressure conditions of 100 kbar (100000 atmospheres) in the ultra-sensitive MPMS-SQUID system. Such a state-of-the-art SQUID magnetometer is also operational in the laboratory of Prof Andre Strydom at UJ Physics, and there is an interest to extend the capabilities to high pressures. This is to investigate pressure tuned magnetic-electronic properties of advanced materials. Prof Hearne spent a few days with Dr Konstantin Kamenev (instrumentation scientist) and Dr Anna Kusmartseva (postdoctoral associate) at CSEC assessing and testing the new DAC. A sample of CeCuSi from Buyi Sondezi-Mhlungu, doctoral student in the group of Prof Strydom was used for the tests. The performance of the DAC and initial outcomes have been so impressive that Physics at UJ is now in process of acquiring the accessory for the SQUID in Prof Strydom's laboratory. This leading-edge technology is expected to be operational in Physics at UJ towards the end of 2011.

Following on the visit to Edinburgh, Prof Hearne proceeded to synchrotron SOLEIL (south of Paris) for several days of X-ray Magnetic Dichroism (XMCD) experiments at the ODE beamline. This is a unique X-ray spectroscopy that probes the magnetic signature specific to a wide variety of elements (Fe, Ti, Mn, etc). It may thus provide information on the origin of magnetism on the atomic scale in various compounds. Prof Hearne has been investigating the magnetic signatures of the dopant in the case of a topical alloy system where Co doping switches on the magnetism in a host FeSi semiconducting system. SOLEIL is a new forefront X-ray light source comprising about 30 beamlines (workstations), all using various X-ray techniques for investigations in a number of disciplines (bio-, geo- and physical sciences). In particular it has premier beamlines and researchers involved in the technique of element specific X-ray absorption spectroscopy (XAS), of which XMCD is a derivative.

Prof Hearne recently testing the TM-DAC with Dr Anna Kusmartseva of the Centre for Science at Extreme Conditions (CSEC) at the University of Edinburgh.

Prof Hearne recently at synchrotron SOLEIL in Paris with, from left to right, colleagues Dr's Jean-Paul Itié , Francois Baudelet and Anne-Marie Flank who are each responsible for different XAS beamlines.

Prof Hartmut Winkler's sojourn in Germany in May-July 2011

Prof Hartmut Winkler received a DAAD visiting research fellowship and visited several institutions in Germany during May and July 2011, including IER (Stuttgart), Fraunhofer-Institut für Bauphysik (Stuttgart), TÜV-Rheinland Gmbh (Köln), Institut für Energie und Umweltforschung (Heidelberg), Fraunhofer-Institut für Solare Energiesysteme (Freiburg), Institut für Zukunftstudien und Technologiebewertung (Berlin), and Wuppertal Institut (Berlin offices). The focus of the visit was on four research projects, namely: Enerkey and its partners, a UJ key science project, Gauteng solar potential, Solarwaters and Irradiation in Xinjiang province of China.

The Enerkey project is a component of the Megacities programme (to which the present scientific exchange programme was linked), and investigates the energy requirements for the South African urban province of Gauteng. There is strong German representation in Enerkey, especially at the Institute of Energy Economics and the Rational Use of Energy (IER), where the project leader, Ludger Eltrop, is based. Two Enerkey coordinating meetings were held there during his stay. The effectiveness of the Enerkey project is enhanced by personal networking with the project participants and first-hand knowledge of the inner workings of the institutions involved. Prof Winkler interacted closely with a series of investigators working for IER.

His particular focus in the Enerkey programme is the evaluation and quantification of the solar energy potential in Gauteng province. He therefore cooperated closely with Thomas Telsnig, who is assessing the technical requirements, restrictions, yields and costs of concentrated solar power (CSP) stations in the South African environment. They obtained extensive South African Weather Bureau solar irradiation data for the Pretoria and Upington measuring stations, covering the period 1957-1997. The data includes hourly global and diffuse irradiation readings, which in turn allowed them to determine the direct solar irradiation. Through analysis of the data they obtained turbidity, cloud cover and sunshine hour averages and timelines. Through the timelines they were also able to estimate solar power station down-times and energy storage requirements.

The group was furthermore able to compare the Gauteng site of Pretoria with the Upington site, which is in the vicinity of the first CSP stations planned for South Africa. Finally, they are also attempting to estimate solar irradiation in other parts of Gauteng from altitude, aerosol loading and other parameters through application of GIS techniques.

Prof Winkler has been part of the planning of a future large project to study the nexus between solar power generation and associated water requirements, as well as the use of solar power for desalination. He is assisting Ludger Eltrop in drawing together the South African research team that is to partner a German team in a large multi-institutional collaboration (named Solarwaters). As a part of these discussions Prof Winkler visited Werner Platzer of the Fraunhofer Institute for Solar Energy Systems, who are set to become key participants in the initiative.

Two meetings were held by Prof Winkler with Bernd Franke and Keke Wei from the Institute for Energy and Environmental Research (IFEU) regarding irradiation in Xinjiang province of China. Dr Franke is the co-leader of the Megacities project studying energy availability in the city of Ürümqi in Xinjiang, western China. In a joint discussion it became evident that solar irradiation maps for that area are extremely uncertain, and that hence another approach was required to enable their team to make more reliable solar energy generation forecasts. They have as a result commenced an analysis of ground-based insolation data.

Several scientific outputs were completed during his visit and two scientific papers are in preparation.

Prof Hartmut Winkler

Beamtime for UJ Physicists at Cassiopee, Soleil Synchrotron Radiation Facility

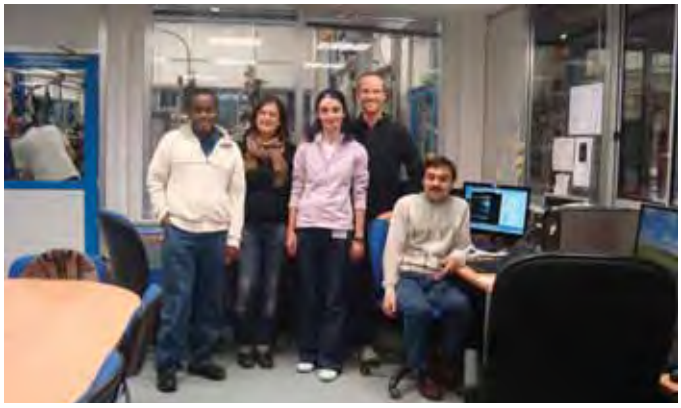
A variety of research topics are conducted in the electronic structure group of the Department of Physics at the University of Johannesburg. One of these topics focuses on the investigation of electronic and magnetic properties of the ruthenium oxides of the Ruddlesden-Popper series, $Sr_{n+1}Ru_nO_{3n+1}$. These compounds are particularly attractive materials in the realm of transition metal oxides and they exhibits distinct collective phenomena in the ground state, such as spin-triplet superconductivity, quantum critical metamagnetism and nematic fluid, anisotropic ferromagnetism and a proposed orbital-dependent metamagnetism.

The study of the electronic structure investigation of these compounds is conducted by use of Synchrotron radiation-based Angle Resolved Photoemission Spectroscopy (ARPES) experiments, which are performed at different synchrotron radiation facilities in Europe.

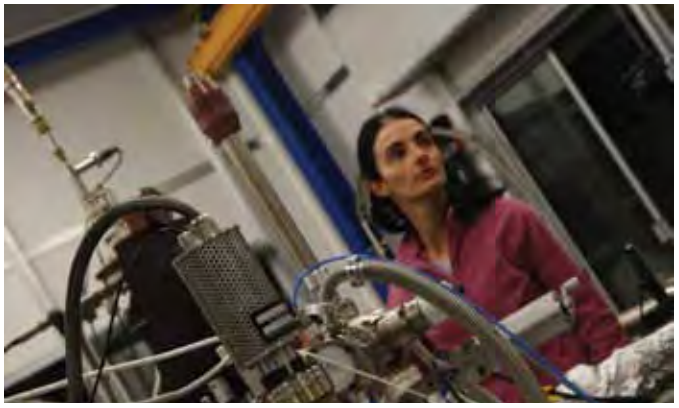
At the end of November, 2010, the research group of Drs Carleschi and Doyle performed a synchrotron radiation based ARPES experiment at Soleil synchrotron radiation in Paris, France.

The aim of the experiment was to investigate the electronic structure of $Sr_4Ru_3O_{10}$, especially the determination of electronic origin of the expected quantum critical metamagnetic transition in this compound, which is crucial to understand the electronic and magnetic ground state of this material.

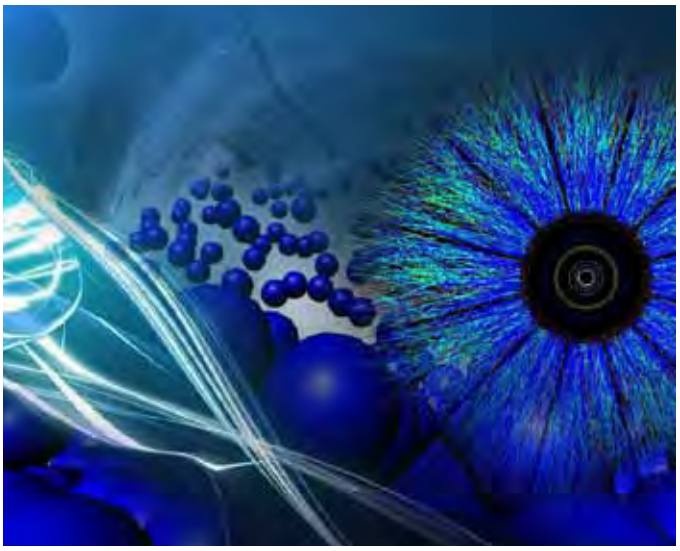
This ARPES experiment was conducted during six days, from 23rd to 28th of November, 2010. During this period they measured high-resolution Fermi surface maps at different incoming photon energies, ranging from 60 eV to 110 eV (UV), with both linear horizontal and vertical polarization of incoming light. The sample was cooled down to 5 K by means of a liquid-He cryostat. The Cassiopee electron energy analyzer allows measurements to be performed with excellent energy and angular resolutions (7 meV and 0.1°, respectively). These measurements were done on three different samples of $Sr_4Ru_3O_{10}$.



From left to right: Prosper Ngabonziza, MSc student at UJ; Dr Amina Taleb, beamline scientist at Soleil, Dr Emanuela Carleschi, lecturer at UJ; Dr Bryan Doyle, Senior Lecturer at UJ and Dr Volodymyr Zabolotnyy, a collaborator of the ARPES group from the IFW Institute in Dresden, Germany.



Dr Carleschi while optimizing the sample position for data acquisition at the beamline Cassiopee.



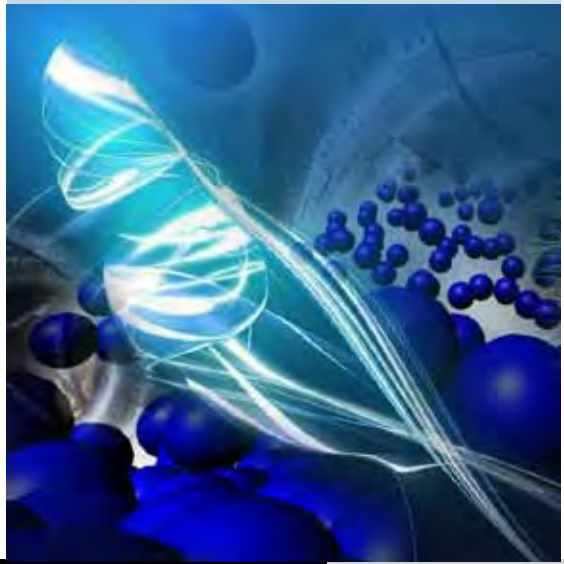
Prosper Ngabonziza moving the sample inside the ARPES experimental chamber of the beamline Cassiopee.

Experimental visit to the University of Modena

In June and July Dr Bryan Doyle and Mubarak Yagoub spent 3 weeks carrying out experiments in the laboratory of Dr Luca Pasquali at the University of Modena and Reggio Emilia, in Italy. The purpose of the visit was to carry out measurements on the effect of doping on the growth of molecules on surfaces, the subject of the MSc thesis of Mubarak. This is the latest step in a longstanding collaboration between Dr Doyle and Dr Pasquali, which has already yielded a number of research articles over the years.

The experiment was by all accounts a success. Apart from the results that we brought home it was also valuable experimental training for Mubarak, and a chance for the South African and Italian groups to have a number of fruitful discussions. The experiment is now being continued by the Modena group. A UJ Physics laboratory is presently being set up and will be operational shortly.

Mubarak Yagoub (centre) in the Surface Science Laboratory with Dr Monica Montecchi and Dr Luca Pasquali during his recent visit to Modena, Italy.



POSTGRADUATE STUDENTS VISIT KOšICE

At the end of December 2010 two postgraduate students of Prof Andre Strydom, Jasper Snyman and Douglas Britz, visited the Institute of Experimental Physics (IEP) in Košice. The institute forms part of the Slovak Academy of Sciences and the visit of Jasper and Douglas to Košice was funded under a bilateral research agreement between Prof Strydom and Prof Mariam Reiffers of IEP Košice.

The purpose of the visit was to determine the low temperature magnetocaloric properties of ErB_{12}.

The magnetocaloric effect is a physical phenomenon which allows suitable magnetic materials to be used as a refrigerant. Material exhibiting this effect are of great interest due to novel phenomena (such as quantum phase transitions) having associated magnetocaloric signatures. Commercial interest in such systems are also growing, as it is hoped that magnetic refrigeration may offer an energy efficient alternative to gas compression refrigeration.

The experiments conducted during the visit to Košice involved measuring the specific heat of ErB_{12} to temperatures as low as 0.3 K (-272.7°C) and in magnetic fields as high as 9 tesla (a magnetic field more than one million times greater than the magnetic field ot the Earth). The specific heat of a system is a measure of how much energy the system can absorb (or emit) by changing its temperature. Measuring how this quantity changes in various applied magnetic fields allows the determination of the magnetocaloric effect.

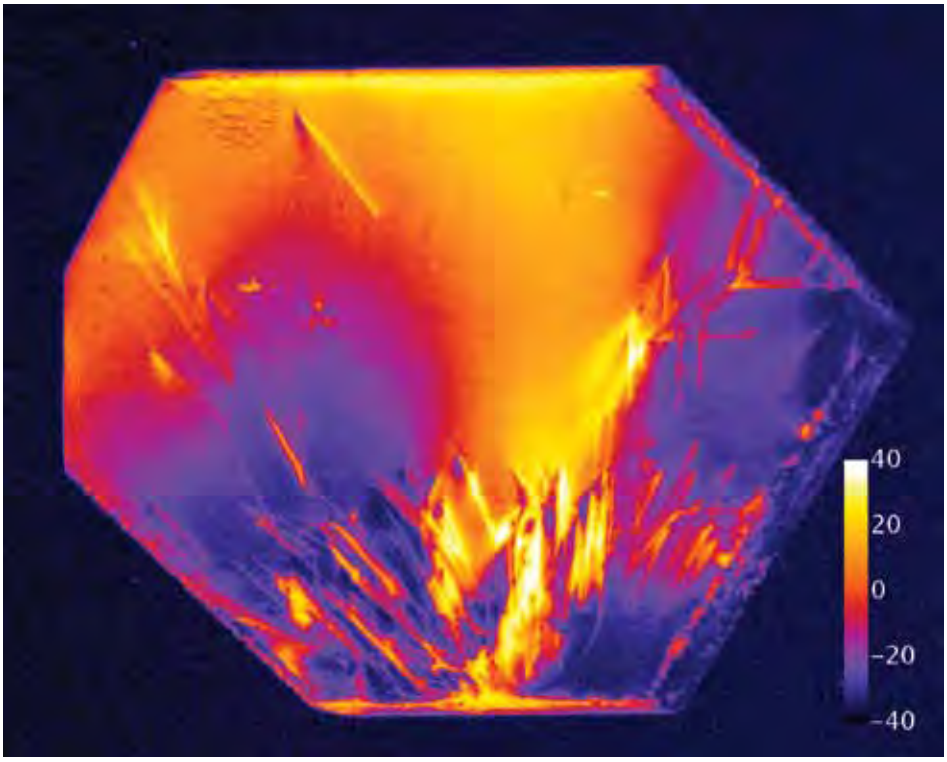
The experiment was successfully completed and shed light on the promising (and hereto unexplored) magnetocaloric properties of ErB_{12}. Further research on this topic is in progress.

In between cooling down the equipment and setting up the measurement, the students had time to explore Košice, which has one of the most well preserved historical town centres in Slovakia. The historical town centre is built around an elongated square, the latter containing the Cathedral of St Elizabeth (the easternmost Gothic Cathedral in Europe, dating from the 12'th century) and the National Theatre. During the time of the visit, the town square was alive with the annual Christmas market, which meant that busy physics students needing a respite from working in a laboratory would always find warm company despite the extremely cold weather.

One of the hallmarks of Košice is its wonderfully preserved historical architecture with the institute itself housed in an old monastery. After the necessary preparations on the equipment was done, the experiment could finally be executed. Both the Institute of Experimental Physics and the Department of Physics at UJ have extensive expertise and infrastructure allowing the investigation of the physical properties of condensed matter systems at extremely low temperatures, and in high magnetic fields. These expertise and equipment turned out to be very useful as the experiment was executed without any serious problems or delays. The experiment illuminated the interesting low temperature behaviour of ErB_{12} to the great satisfaction of both teams of scientists.

Jasper Snyman and Douglas Britz.

ON THE ROAD TO NEAR PERFECT DIAMONDS



False colour map of the effective misorientation within the diamond lattice (internal strain). The scale on the left is at the 10-8 level. The size of the sample is almost 10mm at the longest breadth.

Prof Simon Connell visited the European Synchrotron Radiation Facility (ESRF) in Grenoble in July, France to work on a project which studies very pure synthetic diamonds with very low internal strain.

Diamonds are currently seen as the only material for X-ray optical elements which can withstand the intense beams from modern and future synchrotrons. The lattice quality of the diamond plate shown below has an extended region where the residual strain is of the order of 1 part in 100 million. A single threading dislocation intersecting the surface is clearly visible. Most of the strain originates from the seeding face and the surface processing.

In this project, several international partners seek to understand near perfect diamond from the aspects of synthesis, processing, characterisation and surface physics.

Prof Simon Connell with collaborators Jürgen Härtwig and Fabio Masiello (both from the ESRF), dressed for entry to a clean nano-metric laboratory.

From UJ to CERN: Claire Lee moves to the worlds largest Particle Accelerator

On 22 June this year Physics UJ staff member and PhD student Claire Lee, her husband and one-year-old son packed up as much of their lives as they could fit into three suitcases, and moved to Switzerland.

Claire Lee shakes hands with SA Minister of Science and Technology Ms Naledi Pandor. Alongside them are Sergio Ballestrero, UJ (in orange) and Peter Jenni, ex-ATLAS (Photo: copyright CERN).

Since the beginning of 2010, the Large Hadron Collider (LHC) has been running at ever-increasing luminosities, producing proton-proton collisions at world record energies, in order for physicists working on the data to be able to investigate some of the great mysteries in physics. Claire is lucky enough to be one of those physicists. Her PhD thesis is on the search for the Higgs boson, the particle hypothesized to give mass to everything in the universe, and the reason for the move was to be able to complete her PhD right where the experiment takes place.

The experiment she is working on is called ATLAS (there are in total four major LHC experiments). ATLAS is a general-purpose detector, meaning it has been built to investigate a range of different physics, and the collaboration totals at somewhere over 3000 people. Not everybody is at CERN, of course, but it definitely is the best place to be as you are right in the hot seat where the action is happening, the air buzzes with new results and new theories, and you can bump into Nobel Prize winners in the cafeteria at lunch.

Claire and her family arrived on a sweltering summer's day in Geneva after a long overnight flight. Before they could even check into their hotel they headed to the ATLAS control room at CERN where the South African Minister of Science and Technology, Ms Naledi Pandor, was visiting. They got to meet Minister Pandor, and discuss with her a bit about CERN, ATLAS, physics, as well as the South African group's participation in the experiment. The rest of the SA-ATLAS group went out for dinner that night, but they were exhausted from the trip and just wanted to get to their hotel, which was in a neighbouring French town called Gex. Since then the Lee family has moved to hotels in two other nearby French towns, and housesat for friends for three weeks in downtown Geneva, all the while looking for a place of their own. Finding permanent housing in Geneva is quite a process, but they eventually found a lovely apartment about 1km from CERN.

The great thing about working at CERN is that Claire really is in the centre of so much of what is happening. Even her office is in the corridor where the World Wide Web was developed in the 1990's. She is part of a group from Academia Sinica in Taiwan, and shares the office with other students and postdoctoral fellows. It's great to be in there, if she runs into a problem she usually just has to turn around and ask one of the other people in the room.

The group is currently working frantically on a set of performance analyses that another member of the group is going to show at the ATLAS Hadronic Calibration workshop in California. Claire also attended a conference in Trieste, Italy at that time. After that, the group will probably be extending what they have been working on so far to Physics analyses, and she will start to get properly stuck in to searching for the Higgs, which is what her PhD is on after all. And somewhere in between Claire will start to take shifts in the control room as well.

VISITS BY PROFESSORS GIRAUD AND AMOS

The Department of Physics hosted two visitors in June and July to continue research in Nuclear Physics Theory with Prof Steven Karataglidis. They were Prof Bertrand Giraud, of CEA/Saclay in France, and Prof Ken Amos, of the School of Physics, University of Melbourne.

Prof Giraud was here for two weeks, to continue research on Analytic Density Functionals, which has been ongoing. This new approach to Density Functional Theory, which uses the density of macroscopic systems (atoms and molecules, condensed matter, and nuclei) to find the energies of those systems, represents a major step forward, as the traditional approach has been numeric, requiring large-scale computing to solve the problems. The analytic, or algebraic, approach is not so computer-intensive, and provides for an exact solution of the density functional for the systems under consideration. The work has resulted in a publication in Physics Letters B, outlining the method for a simple case. It was also presented at the recent South African Institute of Physics (SAIP) meeting in Pretoria. Work is continuing for more realistic systems, which will present a challenge in computation.

Prof Amos visited for all of July. The collaboration between Prof Amos and Prof Karataglidis has been on-going for 25 years, and has resulted in 50 publications in various topics in Nuclear Physics. This visit was part of the collaboration, and the work in this case was a continuation of the Multi-Channel Algebraic Scattering (MCAS) Theory, which is a four-nation (Australia, South Africa, Italy, Canada) collaboration. Further work on nuclear structure in intermediate-energy scattering was also planned, in conjunction with Prof Werner Richter of iThemba Labs. Prof Amos also gave a plenary talk at the SAIP meeting on 100 years of Nuclear Theory, in celebration of the 100th anniversary of the discovery of the nucleus by Rutherford. That plenary, which closed the meeting, was widely regarded as the meeting's most interesting presentation.

Prof Ken Amos of the School of Physics, University of Melbourn

Prof Bertrand Giraud of CEA / Saclay in France

University of Frankfurt visit

Prof Azwinndini Muronga visited the Johann Wolfgang Goethe-University Frankfurt am Main (www.uni-frankfurt.de) from 1 to 19 September 2011. The University has four campuses and a total of about 40000 students. He was on a collaborative research visit funded jointly by South Africa's NRF and Germany's DFG. Prof Muronga is collaborating with researchers from the Institute for Theoretical Physics (ITP) in the Physics Department of the University located in the Science Campus Riedberg and those from Frankfurt Institute of Advanced Studies (FIAS) located in the Science Campus Riedberg. He also visited GSI Laboratory in Darmstadt.

The ITP (http://www.uni-frankfurt.de/fb/fb13/itp) boasts 64 Diplom (Bachelor – MSc) students, 38 PhD students; 10 full professors; 2 junior professors; 9 honorary professors; 5 emeritus professors and 37 postdocs and an admin staff of 14.

FIAS (http://fias.uni-frankfurt.de) is a new platform for interdisciplinary research, which cross-links the existing high-class research institutions in the Rhine Main area through a new research center for theoretical natural science. The interdisciplinary topic being *Structure formation and self organization of complex systems* – a challenge for many areas in science. FIAS areas of research are: Nuclear and heavy ion research, clusters and nanoparticles, quantum chemistry, molecular networks, biomolecules, computer science, neuroscience, immunology and cancer modeling. FIAS has graduate programs as well as fellowship programs.

Prof Muronga is collaborating with Prof Dr DH Rischke and his group on relativistic hydrodynamics for nuclear collisions; Prof Dr C Greiner and his group on partonic microscopic transport models; Prof Dr M Bleicher and his group on hadronic microscopic transport models. His visit to GSI (www.gsi.de) was to find ways UJ can collaborate with the laboratory. He met its director Prof Dr Horst Stoecker also from University of Frankfurt and his collaborator. Prof Stoecker will be visiting UJ in November.

The picture from left to right: Prof Dr Horst Stoecker (Scientific Director and CEO, GSI), Cynthia Lin (Special Assistant, Office of the Under Secretary for Science US Department of Energy), Prof Azwinndini Muronga (University of Johannesburg), Dr Steven E Koonin (Under Secretary for Science, US Department of Energy), and Prof Dr Karlheinz Langanke (Research Director, GSI).

Martin Cook, doctoral student in the group of Prof Simon Connell was awarded the prize for the Best Oral Presentation by a PhD student in Nuclear, Particle and

More information on the SAIP can be found on their website www.saip.org.za.

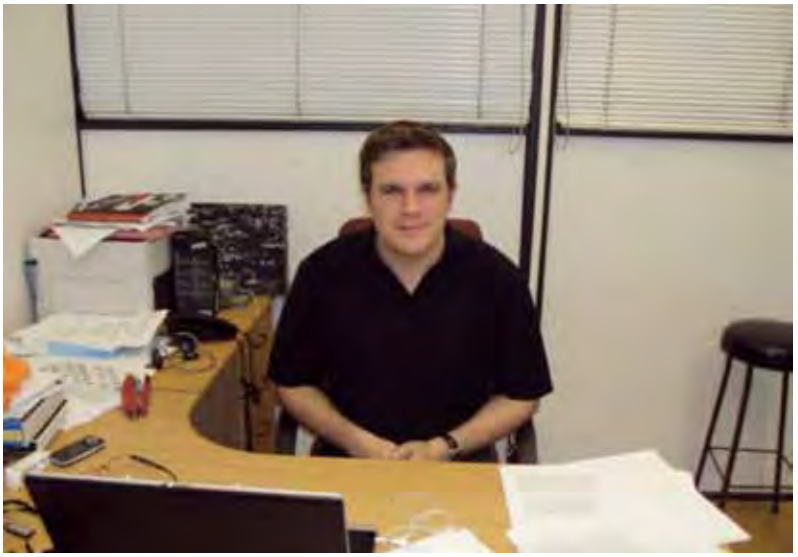
SOUTH AFRICAN INSTITUTE OF PHYSICS CONFERENCE 2011

The annual conference of the South African Institute of Physics (SAIP) was held from 12 to 15 July 2011 at the St Georges Hotel close to Pretoria. The Physics Department of UNISA hosted the event this year. The SAIP has seven divisions or specialist groups, comprising Nuclear, Particle and Radiation physics, Condensed Matter Physics and Material Science, Education, Applied Physics, Astrophysics and Space Science, Lasers, Optics and Spectroscopy and Theoretical Physics. This year, Physics at UJ contributed to five of these research divisions with a total number of 33 presentations. UJ Physics boasts mature research groups in Condensed Matter Physics, Nuclear and Particle Physics as well as Astrophysics and Space science, all under the same roof – a rarity in the South African Physics community.

Two PhD students from the UJ Physics Department won awards at the SAIP 2011 conference for 'Best Oral Presentation' in their respective specialist groups: Mr Martin Cook (PhD student supervised by Prof Connell) in Nuclear, Particle and Radiation Physics and Mr Jasper Snyman (PhD student supervised by Prof Strydom) in Condensed Matter Physics and Material Science.

As of 2011, Physics UJ prides itself in our special relationship with SAIP, as the new President of SAIP is Prof Simon Connell, a UJ member of staff in Physics. The Physics Department at UJ is therefore well placed to make leading contributions to the cause of Physics research and education in South Africa, also through the country-wide activities of the SAIP.

Prof Simon Connell, newly elected President of the South African Institute of Physics.



Jasper Snyman, lecturer in Physics and doctoral student in the group of Prof André Strydom PhD was awarded the prize for the Best Oral Presentation by a PhD student in Condensed Matter Physics and Material Science during the 2011 South African Institute of Physics Conference held in Pretoria.

RESEARCH THRUSTS WITHIN THE DEPARTMENT

Experimental studies of strongly correlated electron systems

The research group of Prof AM Strydom conducts experimental studies in strongly correlated electron systems. Prof P du Plessis is also an active member of this group and several postgraduate students are involved with the work, including Mr Snyman (Lecturer in Physics UJ), Mr Peratheepan, Mr Ghosh, Mr Britz and Ms Sondezi-Mhlungu (Lecturer in Physics UJ).

The group has grown its research into aspects founded on Physical Chemistry also through studies of nucleation and in-situ generation of magnetism in organic polymers, metallo-organic materials and nano-scaled organic structures, synthesized by Dr Kauchik Mallick, a former Postdoctoral Fellow of Prof Strydom.

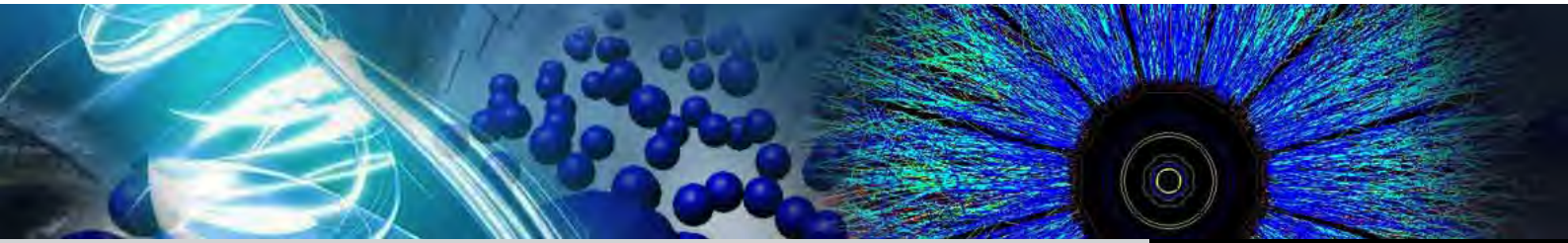
In a recent new venture into theoretical condensed matter Physics, Dr Saad Elgazzar joined the group during 2011 as Postdoctoral Fellow of Prof Strydom. Dr Elgazzar is a band-structure specialist and brings valuable new expertize to the group through calculations of electronic band structures and energy levels. Dr Elgazzar is stationed in the German city of Dresden and accesses the high-performance computing facilities at the University of Uppsala in Sweden for his research. Dresden also hosts the Max Planck Institute for Chemical Physics of Solids, to which Prof Strydom has been a visiting researcher on invitation by the founding Director and leader of the Solid State Physics group, Prof Dr Frank Steglich.

Heavy-fermion (HF) systems are alloys and compounds based upon intermetallic compounds of 4f-electron rare-earth elements such as cerium and the 5f-electron actinide element uranium. Research on HF systems at UJ is driven by the curiosity to explore new properties and ground states of metals and semi-metals, and the need to gain knowledge of the interactions between atomic particles and excitations. HF systems, forming part of the broader class of strongly correlated electron systems, have been challenging scientists' understanding of metallic behaviour by having revealed a variety of new ground states and exotic phenomena in condensed matter physics.

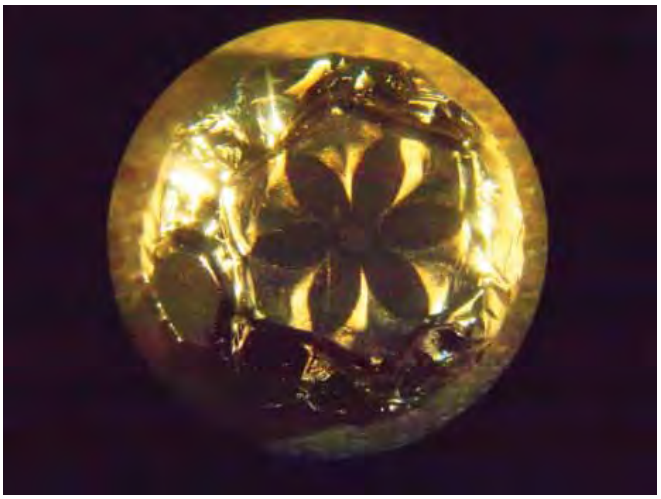
Prof Andre Strydom at home in his laboratory for low-temperature physics.

Postgraduate students in the group of Prof Strydom. From the left Douglas Britz, Sarit Ghosh, Jasper Snyman and Buyi Sondezi-Mhlungu.

Near room temperature HF systems behave like ordinary metals when the magnetic susceptibility is measured for instance, but the really exciting reasons for studying HF systems are found at low temperatures: when a HF metal is cooled down to near the boiling point of liquid helium, physical properties start to take many unexpected turns. The specific heat behaves in a manner that leads physicists to think in terms of the electrons having become extremely massive indeed (hence heavy fermions).



Prof Paul du Plessis and Prof Herman Alberts discussing publications relevant to their research.



Single crystal formation revealed through reflective photography. Sample syntheses and intermetallic compounds form a central part in the condensed matter physics research of the group and collaborators of Prof André Strydom.

Snowed-over front entrance of the Max Planck Institute for Chemical Physics of Solids in Dresden, Germany where Prof André Strydom has been a regular invited researcher since 2003. The Institute is renowned world-wide for cutting-edge research under leadership of the founding Director Prof Dr Frank Steglich in topics such as superconductivity, quantum criticality, non-Fermi-liquid phenomena and instabilities in magnetic phase formations.

Installation team of Quantum Design (San Diego) Dr. Jim O'Brien (far left) and Bryan Craner (far right) flanking Prof André Strydom (back) and Prof Kinta Burger (Dean, Faculty of Science) during a recent delivery and commissioning of an ultra-low temperature facility in the laboratory of Prof Strydom. This new acquisition is opening up vast new opportunities in the group of Prof Strydom for glimpsing into the energies and interactions right at the very verge of cooperative phenomena such as magnetic ordering and superconductivity.

Neutron detectors and cryogenic arrangement on the D23 beamline on the research reactor of the Laue-Langevin Institute, situated on the Isère island on the outskirts of Grenoble (France), where Prof André Strydom recently participated in a Austria-France-South Africa jointly proposed experiment to search for coherent signatures of magnetic ordering in the intermetallic compound Ce3Pd20Si6. This material has the unique feature of quantum criticality in a 3-dimensional crystal structure deep within a quadrupolar electric ordered phase. This is a work in progress and findings are expected to be published soon.

Members of the Chromium research group, from left to right: Susan Jacobs, Prof Alet Prinsloo, Pieter Gouws (technical assistant), Dr Charles Sheppard and Blessed Muchono.

Chromium based Research

The Chromium Research Group was established by Prof Herman Alberts. Presently the group consists of several staff and students including Prof Herman Alberts, Prof Aletta Prinsloo, Dr Charles Sheppard and Dr Krish Reddy. Dr Reddy obtained his PhD in September 2010 and has continued research in this field. Susan Jacobs also recently started her PhD as part of this group. This group is exceptionally proud to say that one of the students working on a project in this field, Blessed Muchono, was the first student in the Physics Department to have his MSc upgraded to a PhD during 2010.

The group has over the past few years made important contributions to the knowledge in this field. Chromium alloy systems exhibit a great variety of interesting antiferromagnetic properties that are associated with nesting of the Fermi surface sheets. The beauty of the properties of these materials originates in their spin-density-wave (SDW) state which contributes a large component, of magnetic origin, to nearly all their physical properties. What makes these materials more attractive is the fact that, due to the large contribution of SDW origin to their physical properties, once the fundamental role of the SDW in these properties is understood, one can tailor the alloys to give desired physical properties that can be useful in practical applications. Significant innovation will be the role of dimensionality effects in the properties of Cr and its alloys through the studies on magnetic thin films. There is renewed interest in literature in the physical properties of dilute Cr alloys, particularly in their magnetic phase diagrams and more recently in the quantum critical point effects in dilute Cr alloys. In studies on single crystalline alloys, in their anharmonic effects and in their role as spacer layers in magnetic multilayer thin film structures with giant magnetoresistance properties. Studies at UJ are aimed at gaining insight and understanding into the unique effects of the spin-density-wave on the physical properties of chromium and its alloys, both in bulk and thin film forms.

Collaboration exists with national and international research groups. Neutron diffraction projects are done in collaboration with colleagues at Necsa and a proposal on the project of Blessed Muchono was accepted at the ANSTO facility in Australia. Prof Aletta Prinsloo and Blessed Muchono travelled to Australia to participate in the experimental work that concluded his experimental work on his PhD. work on thin films done in collaboration with colleagues at the University de Bretagne Occidentale in Brest, France and University of California San Diego (UCSD), USA. Prof Prinsloo spent two months during 2010 at UCSD to prepare thin magnetic films and multilayers for characterization at UJ.

Research work was presented at the 2011 South African Institute of Physics Conference held in July 2011 at the St Georges Hotel in Pretoria. Three presentations were made by staff and students – these were accepted well and interesting discussions with others in the field lead to new insight into recent results.

Blessed Muchono, Dr Krish Reddy and Prof Herman Alberts in the magnetism research laboratory.

From left to right: Suzan Bvumbi; Bogani Maqabuka; Dr Mathieu Aurousseau; Martin Cook and Prof Simon Connell in front of the screen in the Physics entrance hall running live feed from CERN.

High Energy Physics, Nuclear Physics and Diamond Physics

Pictured here is the Honorable Minister Ms Naledi Pandor (centre) together with researchers at ATLAS.

1. High Energy Physics

The UJ High Energy Physics group is a member institution of SA-ATLAS working on the giant multi-purpose ATLAS detector, one of the experiments at the Large Hadron Collider (LHC) at CERN in Switzerland. ATLAS is investigating a wide range of physics, including the search for the Higgs boson, extra dimensions, particles that could make up dark matter and the quark-gluon plasma. The UJ group is participating in the search for the Higgs and also physics beyond the Standard Model. This group plays an important role in the development of the UJ high performance computing cluster for local data analysis and Grid computing.

2. Nuclear Physics

UJ has launched a new Honours and Masters Course in the Science and Organisation of Nuclear Energy (M'SONE). The course material has been developed in close collaboration with iThemba LABS, NECSA and UNISA. Topics include the physics and mathematics behind nuclear reactions, statistical risk analysis, environmental impact and safety. The Masters involves a research dissertation. The Nuclear Physics Experimental Group operates a research program at iThemba LABS on nuclear reaction mechanisms and nuclear structure. There is also an Applied Nuclear Physics programme to develop an online ore-sorter for dimondiferous kimberlite based on PET technology.

Second year M'SONE students registered for MPhil degrees working in an office in the Physics Department. Corner Left: Tshegofatso Moipolai; Bongani Maqabuka; centre: Richard Brayshaw; Takalani Ndanduleni; Happy Vilakazi; Eric Chinaka and Sipho Shongwe.

Second year M'SONE students registered for MPhil degrees working in an office in the Physics Department.

3. Diamond Physics

Diamond exhibits more than 20 properties, which represent an extreme when compared to any other material. Diamond near the theoretical limits of perfection would make an excellent host the fabrication of electronic devices, particle detectors, X-ray optical elements or, more speculatively, as a crystal undulator laser source of gamma rays, amongst other applications. This group studies the physics and the engineering of diamond to realize these devices.

4. You can run .... but you can't hide

The hunt for the Higgs particle at CERN is reaching a critical point – and its proceeding faster than expected. The current status is an exclusion of the existence of the Higgs to the 95% confidence level over most of the mass range from 145 – 466 GeV. Whether the Higgs is found or not, particle Physics is on the brink of new discoveries. UJ was the first South African University working in the ATLAS collaboration, participating in this search. UJ is a founder member of the SA-CERN programme as well as the SA-Grid, a high performance computing system that allows the data from CERN to be transferred here and analyzed locally. The UJ team participates in other searches for Physics beyond the Standard Model.

UJ staff member and PhD student, Claire Lee, explained her work to the Honorable Minister of Science at CERN during her visit. Claire and Nicolin Govender are currently placed full time at CERN. Phineas Ntsoele, an MSc. student in this group, also spent three months at CERN during 2011. Dr Ketevi Assamagan, a long-time collaborator and regular visitor to UJ is co-supervising several UJ students and plays a leading role within ATLAS in the search for the Higgs and Super Symmetry.

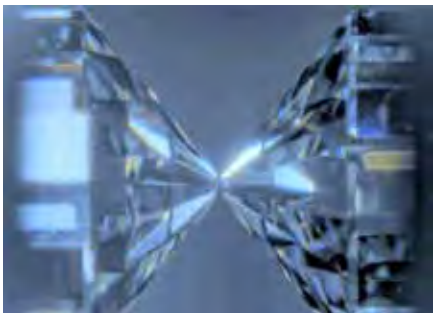
MATERIALS PHYSICS AT EXTREME PRESSURE-TEMPERATURE Conditions In The Diamond Anvil Cell

In the last two years this research group has established capabilities for attaining extreme pressure conditions using diamond-anvil cells (DACs). Pressure is a key thermodynamic parameter for *clean and controlled* tuning of the physical properties of a material (eg, structural changes to new phases with advanced properties). Pressures up to 30 GPa (300 000 atmospheres) can be reached on a routine basis, concurrently with temperatures of 2 – 2000 K. Low temperatures are obtained with cryogenic facilities and high temperatures are reached with the aid of laser heating. In the DAC, a tiny amount of sample material is sandwiched between the flat tips of two opposed diamonds with truncated tips. A force is applied to the back of the diamonds driving the anvils together so as to create the high pressure conditions at the sample area. The use of diamond anvils is important not only because of their high hardness but also because of the transparency. It permits optical access (eg, sample color and shape changes may be discerned) and other forms of probing radiation (eg, X-rays) may be transmitted to the pressurised sample.

There are have various versatile miniature DACs for the *in situ* characterisation of materials under extreme pressure-temperature (P-T) conditions. These DACs readily fit into cryostats, under microcopes, in furnaces and so on. The availability of existing characterisation facilities like Raman or Brillouin spectrometers for investigating mechanical-elastic properties may be exploited, 57Fe Mössbauer spectroscopy to probe magnetic-electronic properties, XRD for structural evolution and lead wires can be introduced into the sample cavity for electrical-transport studies, as a function of pressure in various materials comprising mainly metal oxides. These include (i) strongly correlated systems like Mott (magnetic) insulators with spectacular pressure tuned magnetic-electronic properties, these also have considerable overlap with the physics involved in deep Earth materials of the geo-sciences, (ii) pressure response of nanomaterials as well as (iii) a search for potentially new ultra-hard ultra-stable materials (*superceramics*).

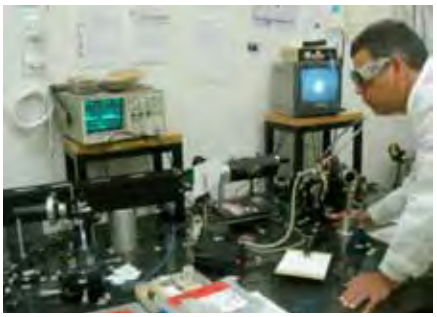
The above mentioned techniques are used on a routine basis to pressures of ~30 GPa in the DAC. Where necessary this can be extended to much higher pressures into the megabar (~100 GPa) regime. These pressures correspond to depths ranging from a few hundred to about two thousand kilometers in the earth. The DAC is therefore a window into the interior (lower mantle) of the planet and is regarded as a very important tool in the geo-sciences.

Aside from these laboratory based capabilities there are various contacts at synchrotron X-ray facilities for using synchrotron specific research techniques like X-ray absorption spectroscopy (XANES/EXAFS for electronic and atomic scale structure information) and magnetic dichroism (XMCD for magnetic studies). These techniques allow to probe specific elements in a compound (eg, Fe, Ti, Cr , etc) under extreme P-T conditions and may provide information on their role in determining the physical properties.



View of a pair of diamond anvils being aligned for experiments.

PhD student Wisdom Sibanda and Prof Hearne in the Mössbauer laboratory.



Prof Hearne operating the laser heating facility. Laser hot-spot in the DAC cavity is seen in the background

Spectacular picture of one of our miniature DACs warming up, after having loaded a cryogenic pressure transmitting medium into the sample cavity.

Gold wire leads arranged onto the tip of a diamond anvil in preparation for electrical-transport measurements. The tiny ruby balls in the centre are for determining the pressure.

The electronic structure and surface science group

The electronic structure and surface science group based in the Physics Department at UJ is made up of Dr Bryan Doyle (Senior Lecturer), Dr Emanuela Carleschi (Lecturer), and the three MSc students Prosper Ngabonziza, Mubarak Yagoub and Arlette Sohanfo Ngankeu (who just very recently joined the group). The current research topics investigatedby this group are mainly based on the study of the interplay between magnetism, superconductivity and other exotic behaviours in correlated transition metal oxides, as well as the study of the effect of the dopants on the electronic structure of p-conjugated molecules adsorbed on metal surfaces.

The experiments are carried out in collaboration with European groups based in Dresden, Salerno, Trieste and Modena, and are mostly performed at synchrotron radiation source facilities located in Europe, such as Elettra (Trieste, Italy), BESSY II (Berlin, Germany) and Soleil (Paris, France). Trips to Europe are funded either by the National Research Foundation or the Faculty of Science of the University of Johannesburg. Synchrotron radiation is an indispensable tool for our research, because it provides high-brilliance and high-resolution monochromatic radiation with polarization and energy tunability.

Dr Bryan Doyle, Mubarak Yagoub and Prosper Ngabonziza next to a Superconducting Quantum Interference Magnetometer.

ACTIVITIES OF THE ASTEROSEISMOLOGY RESEARCH GROUP DURING 2011

Some of the participants at the Workshop on Convective Processes in Stars, held in the Council Chambers.

1. Workshop on Convective Processes in Stars

The year 2011 has been a very busy one for this recently-formed research group in the Department of Physics under the guidance of Dr Chris Engelbrecht. The year kicked off with a successful research workshop on *Convective Processes in Stars*, which was co-organised by Dr Chris Engelbrecht of UJ and Dr Fabio Frescura of WITS and hosted in Council Chambers on the APK campus. For eight full days, the 31 participants were treated to a master class in the topic of convective processes, presented by Vittorio Canuto (Columbia University/NASA), Joergen Christensen-Dalsgaard (Aarhus University), Douglas Gough (Professor Emeritus at Cambridge University) and Gunter Houdek (University of Vienna). As a direct result of this workshop, the group has forged strong links with Aarhus University, which will give the group direct access to the leading stellar structure and pulsation codes being used in the world today. This will strongly support the theoretical component of the group's research activity (carried out in strong collaboration with Dr Frescura and students at WITS).

2. The Kepler Space Telescope

The Asteroseismology Research Group joined the Kepler Asteroseismic Science Consortium (KASC), an international body of astrophysicists, in 2010. *Kepler* is a 600- million-dollar NASA mission, launched in 2009, which has changed the face of asteroseismology in its first two years of operation. Dr Engelbrecht has co-authored one paper on *Kepler* data in 2011, while CT Middleton has just completed his MSc dissertation at UJ on an intriguing Kepler discovery. The current postdoctoral fellow in the group, Dr Ceren Ulusoy, has organised and executed a very successful trans-continental follow-up campaign on yet another *Kepler* target, involving researchers in Mexico, the USA, Italy, Turkey, Japan and South Africa. Tim Gülmez, a PhD student in the group, has assisted admirably in the execution of the campaign.

The launch of the Kepler space telescope

Postdoctoral fellow Dr Ceren Ulusoy in the group of Dr Chris Engelbrecht.

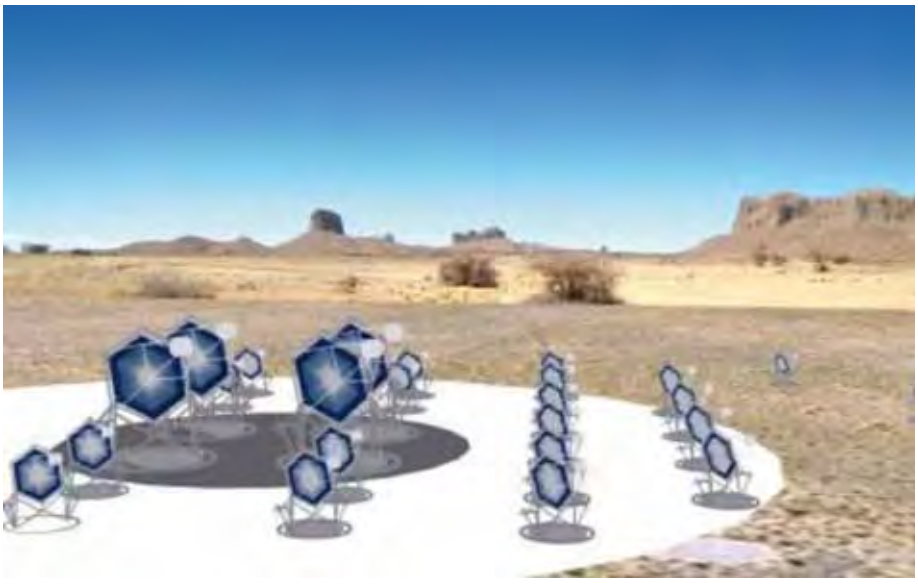
Chris Middleton lecturer on the DFC campus and MSc student in the group of Dr Chris Engelbrecht.

Mr Tim Gülmez, a PhD student in the group of Dr Chris Engelbrecht.

3. Conferences and collaborations

Dr Engelbrecht spoke at the Second Middle-East and African Regional Conference of the International Astronomical Union (MEARIM-2) as well as at the Annual Conference of the South African Institute of Physics. Dr Ulusoy presented a poster at the bi-annual Stellar Pulsation Conference, *Impact of New Instrumentation and New Insights in Stellar Pulsations* in Granada during September. Dr Engelbrecht concluded an agreement with the University of the Free State that gives the group access to the Boyden telescope at UFS for research. This is the third largest telescope in South Africa, and the agreement will allow the group to gain more experimental data than before, at significantly lower cost than is entailed in using the NRF National Facility at Sutherland (which the group will continue to use as well). A similar agreement has been made with Northwest University's Department of Physics for the use of their 0.4-m telescope.

Besides the well-established partnership with Dr Frescura and his students at WITS, Dr Engelbrecht is also collaborating with Dr LA Balona of the South African Astronomical Observatory in Cape Town on a long-term observing project and with Prof RT Medupe of Northeast University (Mafikeng) on other projects. The well-established collaboration with Dr G Handler of the Kopernicus Astronomical Institute in Warsaw continued during 2011.



An artist's impression of the Cherenkhov Telescope Array

4. Supporting South African astronomy and astrophysics

Dr Engelbrecht taught parts of two Masters courses in the National Astrophysics and Space Science Programme and is also a member of the Sutherland Telescope Users Comittee that was established in March 2011. This committee advises the South African Astronomical Observatory and includes researchers from UCT, UFS, the University of Southampton (UK), the SALT programme and the South African SKA Office. Under Dr Engelbrecht's leadership, UJ submitted a strong contribution to DST's panel reviewing the future of South African Astronomy and Astrophysics, as well as a firm letter of support for South Africa's site proposal for the multinational Cherenkhov Telescope Array.

The first 7 dishes erected on the MeerKAT site

Dr Chris Engelbrecht at Sutherland.

5. Participation in MeerKAT/SKA

Dr Engelbrecht is a member of the international TRAPUM consortium, one of the survey projects that was successful in obtaining MeerKAT observing time for the first 5 years of operation (anticipated to be 2014 – 2018). TRAPUM has been allocated 3000 hours of observing time to detect and observe new pulsars, one of the five key science programmes in the international SKA project.

MULTI-WAVELENGTH ASTROPHYSICAL RESEARCH

Dr Lerothodi Leeuw

Dr Lerothodi Leeuw conducts multi-wavelength astrophysical research on the evolution of elliptical galaxies and their progenitors, in both gravitationally lensed and un-lensed systems. For this he exploits observations at infrared to radio and complementary wavebands obtained using ground and space telescopes, both large and small. Recently publication highlights from this research includes *The Detection of a Population of Submillimeter Bright, Strongly Lensed Galaxies by M Negrello, et al, Science*, 330, 800-804 (2010) and *Observation of H_2O in a strongly lensed Herschel-ATLAS source at z = 2.3* by A Omont, et al, *Astronomy & Astrophysics*, 530, L30 (2011).

This research has attracted interest for graduate projects from students as far as Cape Town, with Sidiki Zongo of the African Institute of Mathematical Sciences having recently completed his Postgraduate Diploma Essay and Itumeleng Monageng of the University of Cape Town starting his Honours Project in this area. Further, Bernard Asabere just joined the group to begin his PhD on *The submillimetre-to-radio view of high- redshift star-forming galaxies and galaxy clusters* co-supervised by Prof Cathy Horellou of Onsala Space Observatory and Chalmers University of Technology in Sweden. Bernard, who is under the South African Square Kilometer Array Project Postgraduate Scholarship Programme, hails from Ghana where he was a research scientist at the Ghana Space Science and Technology Centre and the project manager of the African Very Large Baseline Interferometer Network-Ghana.

NUCLEAR THEORY RESEARCH – NUCLEAR STRUCTURE AND REACTIONS

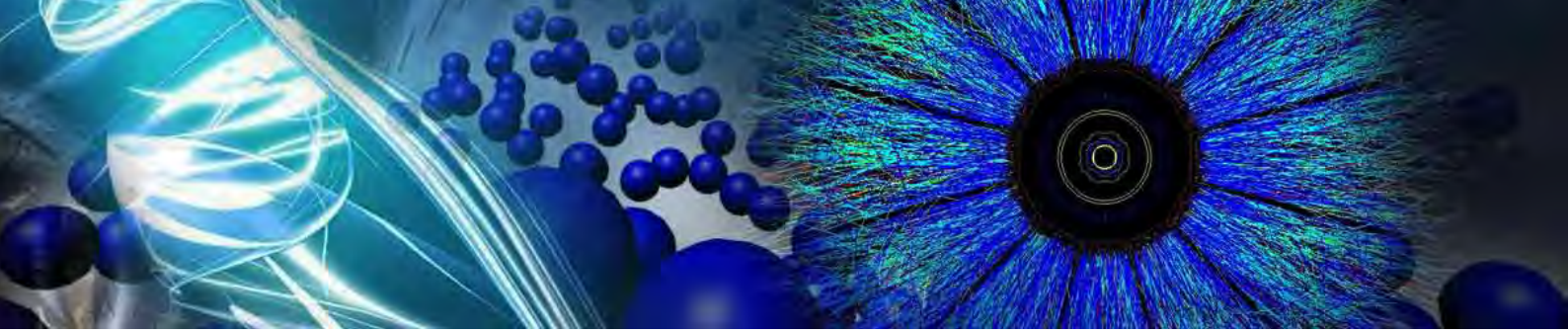
Prof Steven Karataglidis joined the Department of Physics on April 1, 2010. This is not quite indicative of any omen with regards to his tenure, given the date, but rather just a curious coincidence. Prof Karataglidis' expertise lies in both Nuclear Structure and Reaction Theory, and the overlap between them, and works with colleagues around the world, both in theory and experiment, to gain a better understanding of that still most elusive of creatures: the atomic nucleus. He heads the Nuclear Structure and Reactions Group.

Prof Karataglidis obtained his PhD from the University of Melbourne (Australia) in 1995, after which he had several postings around the world at various labs and universities (Michigan State University, TRIUMF, Los Alamos National Laboratory, CEA), before coming to South Africa in 2006 to join the Department of Physics and Electronics at Rhodes University. He became Head of that Department in 2009 and stayed at that post for a little over a year before coming to Johannesburg. During this time, he also became Head of the Programme Advisory Committee at iThemba Labs (Faure), a post which he held until April 2011. His colleagues are from around the world: the University of Melbourne; the University of Padova (Italy); the University of Manitoba (Canada); CEA (France); Tohoku University (Japan); among others. His most fruitful collaboration is with his former thesis advisor from Melbourne, Prof Ken Amos, a recent visitor to the University of Johannesburg, and with whom he has published almost 50 papers.

The nucleus is an elusive beast: a many-nucleon (proton and neutron) system which can only be studied through reactions. But this is a catch-22: the purpose of the reactions is to gain knowledge of its structure but, to understand the reactions, one needs to know *a priori* its structure. This double-edged sword is where the problem lies, and can only be done through modelling. Prof Karataglidis uses both structure and reaction theory to work towards that end. The microscopic theories of scattering he has developed with his colleagues overseas, in particular, has shed new light on the structures of exotic nuclei (those that decay a short time after being formed in the laboratory). For halo nuclei, where one or two nucleons lie well outside the nuclear core, forming an odd bound system, the work has shown that the nucleon density forming the halo is depleted in the core. This is contrary to the view of cluster models, which hold that the core remains unchanged from those of stable nuclei. A proper many-body understanding is needed, and the large-scale shell model work on the structure side of Prof Karataglidis' research has proved essential.

2011 marks the centenary of the discovery of the nucleus by Ernest Rutherford. After 100 years we are much closer in understanding what makes the nucleus tick, but there is still much work ahead in trying to unlock its secrets.

Prof Karataglidis.



Theoretical High Energy Nuclear, Particle And Astro-Physics

Prof Azwinndini Muronga's main field of research is in theoretical high energy nuclear, particle and astro-physics. Astrophysical objects and processes, both connected with very early and very late phenomena in the cosmological evolution of strongly interacting matter, present an enormous challenge to modern nuclear and particle physics: can scientists recreate – in experiments carried out in the terrestrial laboratory – the conditions prevailing during the first microseconds of the cosmological expansion, or during the late stages of a violent supernova stellar implosion? These investigations culminate for the time being in the Large Hadron Collider (LHC) at the European Center for Nuclear Research (CERN), Geneva, and in the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL), USA. Under extremely high temperatures and densities, protons and neutrons overlap to such a degree that a quark–gluon plasma is formed. The universe, 1 microsecond after the Big Bang, is believed to have been a plasma of weakly interacting quarks, gluons and leptons. This plasma might even still exist in the deep interiors of neutron stars. Observing the plasma is one of the world's most prominent scientific goals. Detection of the quark–gluon plasma would not only serve as direct evidence of quarks and gluons, but would also open a new era in physics. Measurements and studies of its properties would hopefully allow scientists to answer some of the fundamental questions about the origin of the universe.

Prof Muronga's main focus is in the understanding of matter under extreme conditions of temperature and density. This is accomplished by studying ultra-relativistic nucleus-nucleus collisions such as those at RHIC and LHC. The study of ultra-relativistic heavy-ion collisions brings together aspects of nuclear, particle and astro-physics. His approach involves using relativistic dissipative fluid dynamics and relativistic microscopic transport models to study space-time evolution of hot and dense nuclear matter - from the initial stages of compression via the expansion to the final stage of observables.

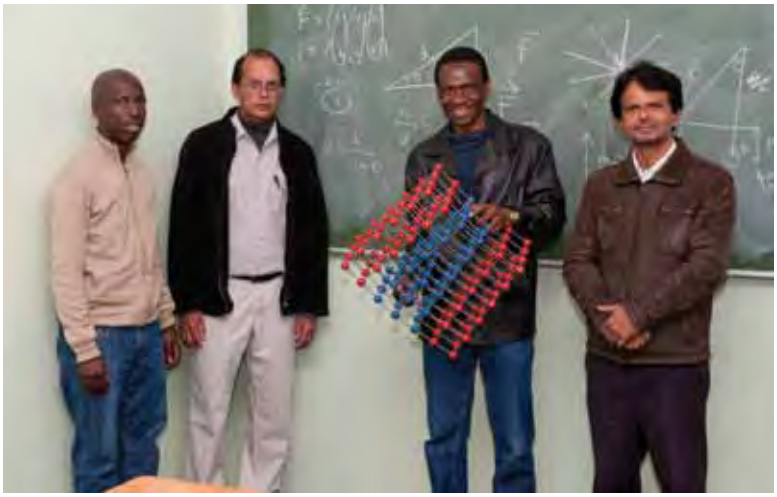
In the above picture is, sitting: Prof Azwinndini Muronga; left: Tshilidzi Thovhogi; middle: Garry Kemp and Jonathan Hartman; right: Dr Chris Engelbrecht

Astrophysics and Solar Energy

Under the guidance of Prof Hartmut Winkler a team in the Department is quantifying the ground-level characteristics of solar radiation with the aim of determining its solar energy generation potential in the Gauteng urban environment, considering specific location altitude, land aspect, aerosol concentrations and weather patterns. This project aims to create an internet-based provincial solar atlas that will be available as a resource to the solar power industry and the public for solar panel installation. The work is part of the regional Enerkey initiative, which is exploring Gauteng's energy consumption, management and future requirements.

Prof Winkler is also studying the variations and optical spectral characteristics of active galactic nuclei (AGN). He is developing a web-based atlas of the visual spectra of comparatively nearby Seyfert galaxies, as well as a catalogue of AGN based on a revised, more sophisticated, spectral characterization scheme.

Prof Winkler



Paul Molefe, Dr Reddy, Ramaila and Dr Nair specialize in science education.

SCIENCE EDUCATION

Science educational research has become critical with the advent of new curricula in the school sector and the challenges these pose to teachers and learners. Furthermore, the quality and competency of school leavers from science streams entering the higher education institutions demand innovative solutions for shaping the science in South Africa as well as achieving sustainable outputs in the higher education sector.

Dr PAP Nair, Sam Ramaila and Dr Krish Reddy, working on the DFC campus of the Physics Department, are involved in research regarding models for the promotion of science in school education and higher education sectors. This also forms part of the PhD study of Sam Ramaila and the group has made several presentations at the annual conference of the South African Institute of Physics. Recently Paul Molefe, a lecturer on the APK campus, also registered for a PhD in the field of science education.

Experimental research in Physics on the Doornfontein Campus

One of the reasons Themba Mathe joined UJ in 2010 was that this University emerged as an institution which is doing cutting edge research output and great technological advancement. The Department of Physics prides itself with state-of-the-art equipment which has positioned the institution on the global map of world-class universities. Mathe is of the opinion that being part of UJ, will therefore enhance his research skills and provide him with an opportunity to interact and collaborate with international experts in his field of research. Themba is based on the Doornfontein campus and is currently doing research based on thin films of mixed spinel ferrites. These thin films are prepared from bulk samples in pellet form. The pellets are then ablated using the Pulsed Laser Deposition (PLD) technique. Thin films are then grown on glass and silicon substrates at various ambient temperatures and in an oxygen environment. Subsequently, a study is made to investigate structural, electrical, magnetic and optical properties of the films. Several measurement techniques are performed in this regard, namely, X-Ray Diffraction (for structural properties), four-probe resistivity (for electrical properties), Vibrating Sample Magnetometer (for magnetic properties) and Fourier Transform Infra-Red spectroscopy (for optical properties). It is envisaged that these thin films may be used in the fabrication of solar cells and photovoltaic devices. Themba will soon be finishing his PhD on work in this field.

Themba Mathe

Paulus Masiteng, who also joined the Department on the Doornfontein Campus in 2010, research interests involves the physical properties of atomic nuclei. He is currently in the process of completing his PhD in this field. His research is focused on chiral symmetry breaking in rotating atomic nuclei. He collaborates with Dr EA Lawrie and iThemba LABS Nuclear Structure research group and Professor AA Pasternak from the AF Ioffe Physical-Technical Institute, St Petersburg, Russia.

The Department envisage building out the research on the Doornfontein Campus and appointments made over the past two years on this campus have been strategic. With proper funding this division of the Department can soon be expanded to be included postgraduate training.

Paulus Masiteng

TECHNICAL SUPPORT

An experimental department such as Physics can't function without strong technical support. Within the Department they are fortunate to have the technical expertise of Pieter Gouws and Theron Slattery. The Department is also supported by the Technical Workshop and the Glass Blowing Unit.

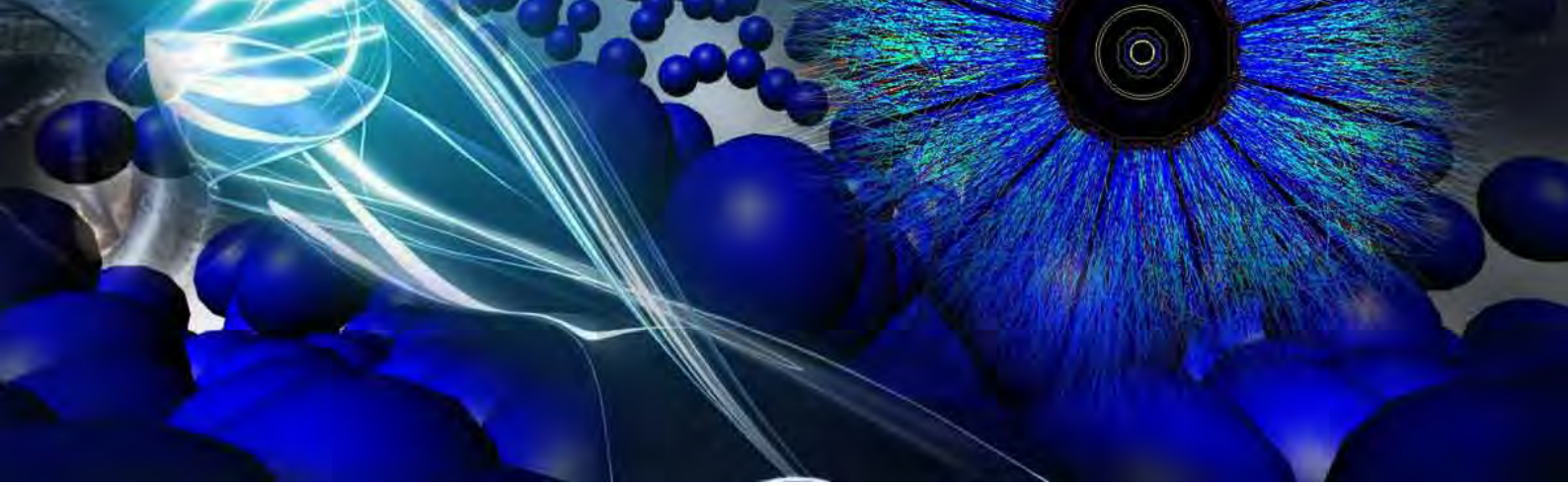
Pieter has been in the employment of UJ for many years and provides all Physics staff with technical support in the undergraduate and research laboratories. He assists everyone with technical problems, from something as simple as finding a screw to servicing research apparatus such as the spark erosion machine or the arc furnace. Pieter is well known to the first year students and is the technical person responsible for the running of the practical classes for the three year and four year programmes. His friendly nature makes him accessible to students and staff alike. To many he is central to the operations in the Department.

Theron only joined UJ in 2009. His extensive knowledge regarding instrumentation using liquid helium has benefitted the Department. He is dedicated to helping staff and postgraduate students in the research laboratories. His impact in the research laboratories will become even more evident in the years to come.

The technical assistants in the Physics Department APK: Theron Slattery and Pieter Gouws.

Kenny Vuma

Kenny Vuma was employed as a laboratory helper in the old TWR from 5 November 1986 to the present day. In view of the fact that about 5 000 students per year perform experiments in the seven laboratories on the Doornfontein Campus, it is evident that an experienced and reliable person is required to help to prepare the laboratories for each practical session. Kenny Vuma, with his 24 years of experience is therefore a very valuable member of our Department of Physics and his maintenance input in the laboratories is greatly appreciated.



Abdulla Kraft

Abdulla Kraft started working as a Data Capturer in the Doornfontein Physics laboratories in 1991. His main task entails data capturing of Physics practical experimental results, utilize marking software to mark student practical reports and deal with student queries about their marks. Abdulla Kraft with his 20 years of experience fulfils a very important duty in the Physics laboratories and his continued fair and accurate marking is highly valued in the Department.

The Faculty of Science has a Technical Workshops run by Glen Schlachter and his assistant Lucky Ngwena. They assist staff in the Faculty of Science with the development of apparatus and spend time understanding the needs of researchers. The advice rendered to staff and students during the developmental work is essential for ensuring success in technical development. The Workshop offers work of a high standard and without their support the Faculty will find it difficult to function.

René Buker is the manager of the Glass Blowing Unit and together with his assistant, Leslie Seleke, they deliver precision custom made glass work to staff within the Faculty of Science. René is a perfectionist and it is always a pleasure to watch him work meticulously on the apparatus required, knowing that you will have exactly what you need in the end.

The Faculty of Science is proud to have the support of these technical experts, helping to do creative and original experimental research.

Glen Schlachter and Lucky Ngwena busy in the workshop.

The glass blower René Buker and his assistant Leslie Seleke.

The administrative staff in the Department of Physics on the Auckland Park Campus. From left to right: Rebecca Mokoena, Lianie Döman and Reshika Moodley.

ADMINISTRATIVE SUPPORT STAFF

Martie Wallace, the Departmental secretary on the DFC campus.

The Department of Physics would fail to function efficiently on a daily basis without the support of three iron ladies; Reshika Moodley, Rebecca Mokoena and Lianie Döman. Reshika and Rebecca, the front office staff, are always willing to go over and beyond their call of duty to assist all – staff and students. Travel arrangements, temporary appointments, diary management, postgraduate administration, event management are a few of the many areas where they play a vital role in the Department of Physics.

Lianie Döman, the financial and M'SONE programme coordinator within the Department, is a true role model to many due to her excellent organizational and administrative abilities. The Department has had a smooth sailing with regards to financial issues since her joining the Faculty in 2010.

Martie Wallace is the secretary assisting Physics staff on the DFC campus. Although Martie works for the Department of Statistics, Mathematics and Physics she gets everything done very efficiently. Martie handles all queries relating to student affairs and academic matters. Her friendly, approachable and reliable nature makes her an asset for the Department of Physics and she plays a pivotal role in the Department.

SPECTRAU

The Central Analytical Facility of the Faculty of Science, Spectrau, is dedicated to providing state of the art equipment and expertise to the solution of analytical challenges in academic research. Staff and students from the entire Faculty are highly dependent on the state of the art apparatus and expertise found in Spectrau.

The UJ Analytical Facility was established in 1999, when all existing analytical equipment and instrument scientists in the Faculty of Sciences were relocated into a centralized facility. The purpose was to establish a one-stop state-of-the-art facility that could be effectively managed and staffed to ensure an effective analytical service to support research in the faculty. This concept is unique to all tertiary educational centers in South Africa. During 2002, UJ carried out a multi-million-rand upgrade and expansion of the existing Central Analytical Facility to establish Spectrau – a regional analytical center in Gauteng. The center offers wide and comprehensive solutions for a broad range of applications utilizing state-of-the-art high-tech equipment. Equipment include: Electron Microscopy, Light Microscopy, Mass spectroscopy, Nuclear Magnetic Resonance, Optical spectroscopy, Thermal analysis, X-ray analysis, Ar-Ar spectrometer, SQUID and IGP-MS-LA.

The Centralized Analytical Facility operates 24 hours per day and serves UJ staff and students, researchers from other tertiary institutions and commercial clients. Proceeds from the use of the facility by outside clients have made the facility economically viable with respect to daily maintenance and upgrade of equipment.

SPECTRAU continue to employ the most competent and dedicated instrument scientists, whose skills will be updated at regular intervals, to deliver service of the highest quality to staff, students and clients from outside the University. Prof André Strydom is the Scientific Director of Spectrau and Dr Willie Oldewage the Technical Director. Dr Christian Reinke is a senior instrument scientist that specializes in AMP, XRF, XRD and SEM. Jonas Shai is an instrument scientist specializing in XRF and XRD. Eve Fischer is working as an instrument scientist in this division at present focussing on IGP (MS and OES) and SEM.

The University anticipates that a continued dedication to precision, accuracy and service will ensure that Spectrau will become, and remain, an African leader in the analytical field. Spectrau is also committed to student training and to provide future analytical specialists.

Eve Fischer: Instrument scientist at Spectrau.

Dr Christian Reinke is a senior instrument scientist at Spectrau.

COMMUNITY ENGAGEMENT

The Department of Physic is active in promoting the Sciences to young learners. The staff in the Department participates in public lectures, visits schools, give popular talks and host workshops.

Scientiae@UJ - The Science Association for Gauteng High Schools - under the auspices of the Faculty of Sciences at the University of Johannesburg - aims to promote an interest in the natural sciences under learners at schools in the Gauteng area and to expose them to the wonders of natural sciences. Physics participate in events organized by this association and Prof Aletta Prinsloo, the Deputy Head of Physics APK, is the Chairperson of this association and is actively involved in the marketing of the Faculty of Science at UJ and works closely with Sandra van der Walt in this regard.

Prof Azwinndini Muronga of Physics APK is also the Director of The Science Center established on the Soweto Campus of UJ under the guidance of the Faculty of Science. This Center gives high school learners from the Soweto area the opportunity to attend additional classes in Mathematics and Science on Saturdays and have made a huge difference to their future. School teachers also have the opportunity to attend courses in order to improve their knowledge of the school curriculum during organized workshops.

Dr Bryan Doyle entertaining high school learners with demonstrations.

Prof Azwinndini Muronga the Director of the Science Center on the Soweto campus of UJ.

PHYSICS NEWS FROM THE LIBRARIAN

The UJ Sciences Librarian Pavlinka Kovatcheva.

The staff in the Department of Physics is strongly supported by the UJ Sciences Librarian Pavlinka Kovatcheva.

Pavlinka provided training to staff and postgraduate students from Department of Physics on the 2nd of June 2011. Some of the topics discussed were: Journals and e-Book Databases; Astronomy & Physics Portals; Additional resources; Searching strategies; How to find relevant information for your research; Reworks overview, etc.

Yann Amouroux, a Regional Manager from Institute of Physics (IOP) Publishing visited the UJ Physics Department on the 3rd June 2011. He met individually with most of the academics in the Department and discussed matters related to publishing in IOP journals and IOP accredited journals with all those interested.

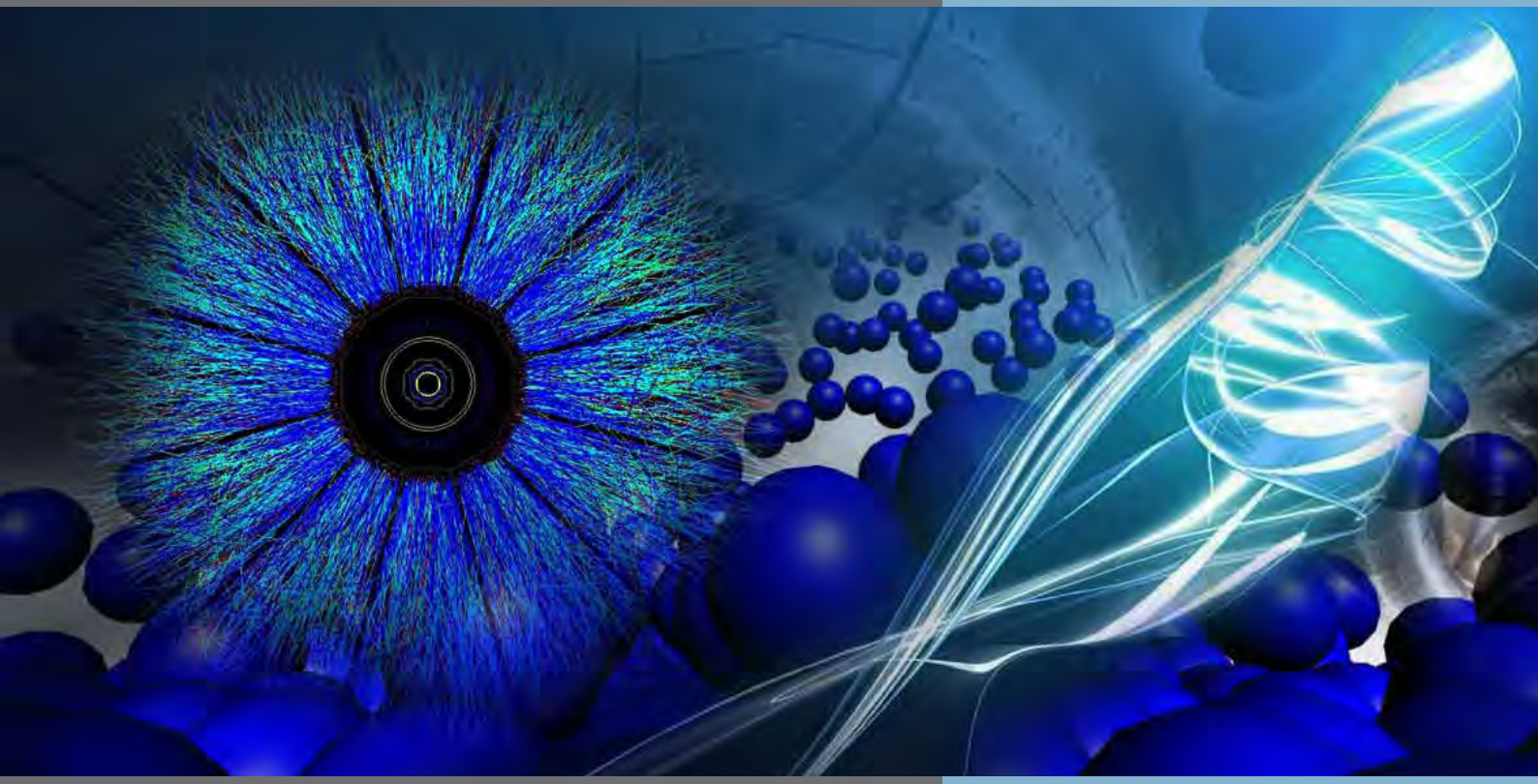
Pavlinka conducted a survey during September 2010 among the UJ Physicists staff and postgraduate students on both Campuses. Twenty out of the fourty three distributed questionnaires were completed for a response rate of 47%. The academics were represented by 50% of all the academics in the department. She found that overall the most important resources for teaching are textbooks (93%) and search engines (86%), while for research the top choices are journals (100%), search engines (85%) and textbooks (79%). Personal communication with (79%)

and conferences attendance (74%) are thought to be quite important too. With sixty-nine per cent each, both the pre-prints and the databases are considered important for research, but did not hold the same value for teaching. The most popular methods for keeping current with the latest research are browsing e-journals (95%) and personal communication with colleagues or other researchers (90%). The physicists place equal value for keeping current to searching the Internet, browsing e-prints archives and conference attendances with 85%. The top method used by the physicists on a daily basis for searching articles is Google with 35%, while an additional 25% make use of Google between 2 to 3 times in a week. For all physicists respondents the subject databases and journals websites are the top two methods for searching journal articles. More than half (55%) make use of these two methods on a daily basis or two to three times a week. Overall the top subscription journals, which the physicists browse in a various range of frequencies are Physical Review Letters (85%), Reviews of Modern Physics, Science and Nature with 80% respectively, followed by Journal of Applied Physics, Journal of Physics D and Physical Review B with 75%. The top databases accessed by over 50% of all participants are: Springer Link, Science Direct, IOP Science, APS Prola, ISI Science Citation Index and Wiley Online Library. The results indicated that the majority of the physicists made use of Scholar Google followed by Arxiv with 85 and 65 percent respectively. Arxiv was most frequently accessed by half of the physicists, with rate of two to three times a week and two to three times a month. The astrophysicists' and nuclear and particle physics researchers were those who made most use of Arxiv, Cern Document Delivery, NASA Astrophysics Data System (ADS), and SPIRES-HEP. When asked to name their top Internet resources, once again Google and Scholar Google were favoured by nearly half of the researchers. The staff in Physics is very dependent on the physics subscription journals (45%) and quite dependent on the subject databases and the print books collection with 50% respectively. Seventy-five percent are dependent on the library website. Additional 60% rely on the Astronomy and Physics subject portals to access library and additional resources and services.

The results indicate that physicists are complimentary towards the library, expressing satisfaction with the collections of physics books and databases available either in print format or electronically. Some academics think that although the access to databases and research journals is already very good, there is still scope to broaden the journals base and the access to them. Some of the physicists expressed concerns about the decreasing and very limited budgets for books and journal subscriptions. Another concern expressed by one of the academics is about the library as a study space. During the semester the library is teeming with students, with no space for academics who need to use it for research activities. These observations are also confirmed by the results which show that physicists never use the library as a quiet study place.

Mr Jann Amouroux

Prof Giovanni Hearne and Wisdom Sibanda at the training provided to Physics staff and students in the library.



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