International Newsletter on Physics Education
International Commission on Physics Education • International Union of Pure and Applied Physics

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Editor's Corner

Hello All,

In this issue we bring you highlights, ranging from using concept surveys in thermal as a Teaching Tip, C14 member profiles to conference and thesis updates.

We welcome contributions, news, teaching ideas to summaries. We will work with you to include your news in our newsletter.

IUPAP C14 is planning a ***PANORAMA*** capturing physics education across the world. It is important to capture the status of the field so we can work together and grow together. A survey will be circulated in due time.

For information on the activities of ICPE please see the IUPAP website.

Subscribe to this newsletter.

In the meantime, I have a little story to share. I was busy last year designing new labs. The image below shows one of the old labs with red cross benches. It was a good lab space.

Our new labs cover the same floor area and are based on fluid learning & playful learning. The benches, of different heights and colours are shaped like boomerangs and witchetty grubs. The walls are curved with whiteboards, there are huddle spaces with side tables and cushions. The mood has changed, the space is welcoming. Students are hanging around and engaging effectively. Tutors are interacting in diverse ways. We have connectivity and a community feel in the space.

In this Issue:

(Hot) Teaching Tips: Thermal Physics Concept Inventories

Thermal is possibly a topic which is under taught and under researched, and yet it is a topic which underpins physical and natural sciences, as well as technological developments, industrial applications and climate change modelling. It binds the disciplines with each other and with society. It is truly multidisciplinary/interdisciplinary as well as encapsulating science in society. In the teaching, thermal is often 'left to the other discipline to teach'. In terms of research in physics, Dr Helen Georgiou's research sheds light on how one can improve student understanding of thermal physics using Interactive Lecture Demonstrations, a snapshot of students understanding in various countries and an analysis of coverage in the school curriculum.

One wonders, how do we ascertain student understandings. Different surveys and instruments are available. Diagnostic multiple-choice tests are widely used to unravel student alternative conceptions in a variety of topics, including thermal physics. These types of tests are easy to administer in large classes, relatively low cost and also easy to mark and analyse the results. A number of concept inventories have been developed to address different thermal physics concepts. A good way of investigating our own students' understanding is to explore diagnostic tools, listed below. One could also use these surveys as a basis for conducting physics education research. These are not necessarily designed for use in examinations and there are protocols for using them.

Concept Inventories:

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Brown, B. 2015, Survey of Thermodynamic Processes and First and Second Laws (STPFaSL), PhD thesis, University of Pittsburgh, supervised by Singh, C.

Midkiff, KC., Litzinger, TA., and Evans, DL., 2001, Development of Engineering Thermodynamics Concept Inventory Instruments, *Proceedings, Frontiers in Education Conference*, Reno, Nevada, 10–13 October 2001.

Prince, M., Vigeant, M., Nottis K., 2012, Development of the Heat and Energy Concept Inventory: Preliminary Results on the Prevalence and Persistence of Engineering Students' Misconceptions. *Journal of Engineering Education*, 101(3), 412-438.

Kamcharean C. and Wattanakasiwich P., 2016, Development and Implication of a Two-tier Thermodynamic Diagnostic Test to Survey Students' Understanding in Thermal Physics, *International Journal of Innovation in Science and Mathematics Education*, 24(2), 14-36.

Erceg N., Aviani I., Mešić V., Glunčić M., and Žauhar G., 2016, Development of the kinetic molecular theory of gases concept inventory: Preliminary results on university students' misconceptions, *Physical Review Physics Education Research*, 12(2).

By *Manjula Sharma and Vicky Tzioumis*

Integrating Science with Society

15-16 December 2018

Conference Report

The inaugural National Conference on the theme 'Integrating Science with Society' was opened by Professor Suranjan Das, Vice Chancellor, Jadavpur University at Gandhi Bhavan, Jadavpur University, Kolkata, on December 15, 2018. In his inaugural address, Professor Das said that the Science movement led by the 'Breakthrough Science Society' is a timely step towards building scientific temperament in the society. He stressed that education based on scientific reason can help the country to come out of the present crisis.

One of the two sons, who is a physicist and a passionate teacher of quantum physics and who shuns unscientific thinking and practices, counsels his family members and helps them to come out of their irrational shell. The play tries to give the message that uncertainties in life often make people slip into irrational practices.

On the second day (December 16), Session 4 on 'Reforming Science Education' was chaired by Professor Narayan Banerjee, Professor, IISER,

The first session, ‘History and Philosophy of Science’, was chaired by Professor Dhruba Mukhopadhyay, former Professor of geology, Calcutta University and President, Breakthrough Science Society. Professor S G Dani, former President, National Board of Higher Mathematics and Professor at the Centre for Excellence in basic sciences, Mumbai made a beautiful presentation on the gradual development of Scientific Materialism and defended why scientific materialism is required in all fields of epistemology. Professor Nagarjuna, Professor, TIFR – Homi Bhabha Centre for Science Education, Mumbai enunciated the concept of constructionism in the field of education and philosophy. Dr. Liaquat Ali, Honorary Director, Pothikrit Centre for Health Studies and former Vice Chancellor, Bangladesh University of Health Sciences showed the limitations of Bengali Renaissance and spoke about the future tasks of the science movement.

Session 2 on ‘Cultivation of Scientific Temper’ was chaired by Professor Abhijit Majumder, Dept of Chemical Engineering, IIT Mumbai. The speakers in this session were Professor Ajit Srivastava, Institute of Physics, Bhubaneswar, Professor Palash Baran Pal, Popular science writer and former Professor, Saha Institute of Nuclear Physics, Professor Mangala Narlikar, former Professor of Mathematics, University of Bombay and Prof Aniket Sule, Professor, TIFR-Homi Bhabha Centre for Science Education, Mumbai.

Session 3 on ‘Ethical Practice in Science’ was chaired by Professor Naba Kumar Mandal, former Professor, TIFR. The speakers were Professor Dipankar Chatterjee, former President, Indian Academy of Sciences and Honorary Professor, IISc, Bangalore, Dr Prabhakar Reddy, Professor of Cardio- Thoracic and Vascular Surgery, Government Medical College, Kurnool, Andhra Pradesh and Professor Soumitro Banerjee, IISER, Kolkata.

In the evening, a humorous play titled ‘The Uncertainty of Principles’ was staged by a group of professional scientists. The play was about an educated, middle class family which gets steeped in superstition and into the clutches of a 'Godman' due to a very tragic event in their lives.

Centre for Science Education, Mumbai, Professor Umesh Kadhane, Indian Institute of Space Science and Technology, Thiruvananthapuram, Professor R Ramanujam, Institute of Mathematical Sciences, Chennai and Professor Mayank Vahia, Professor, TIFR, Mumbai.

Session 5, Panel Discussion on ‘The role of scientists in society’ was chaired by Prof Amitava Datta, INSA Senior Scientist, Department of Physics, Calcutta University. The panelists were Dr. C M Nautiyal, former scientist, Birbal Sahni Institute of Paleosciences, Lucknow, Professor Pradipta Bandyopadhyaya, School of Computational and Integrative Sciences, JNU, Delhi, Professor Prajval Shastri, Indian Institute of Astrophysics, Bangalore and Prof Guruprasad Kar, Dept of Physics, Indian Statistical Institute, Kolkata.

Open session - December 16

The concluding session of the conference was an Open Session (for the public) at the Open-air theatre of Jadavpur University. Professor Dhruba Mukhopadhyay, President, Breakthrough Science Society, presided. Professor Pradip Kumar Ghosh, Pro VC, Jadavpur University, gave the welcome address. The main speaker was the eminent astrophysicist Professor Jayant Narlikar. He spoke on the problems facing the development of scientific culture in India. Narrating interesting stories and anecdotes he explained the need to develop scientific temper in the society. He suggested that one method that may be of use in controlling the spread of superstitions is to develop suitable tests to check whether the predictions of these superstitions are correct. He cautioned that we must learn to be patient and tactful rather than aggressive or abrasive in tackling superstitions.

The conference ended with an emotional call by Professor Soumitro Banerjee, General Secretary of the Breakthrough Science Society to take up earnestly the task to make India scientifically literate. He also thanked the speakers and the delegates.

By *Mayank Vahia*

Active learning in Japan - A Fulbright Specialist Project

David R. Sokoloff

From August 6-20, 2018, I was fortunate to be sponsored as a Fulbright Senior Specialist in Japan, carrying out the project 'Promoting Active Learning Instructional Strategies in College and High-School Physics.' During this time, I was hosted in three Japanese cities, Niigata, Kagawa, and Tokyo to facilitate workshops for secondary and university faculty on active learning strategies. My hosts were Sachiko Tosa (Niigata), Jumpei Ryu (Kagawa) and Hideo Nitta (former Chair of IUPAP Commission 14) and Shuji Ukon (Tokyo).

The goal of the project was to introduce Japanese secondary and university faculty to active learning strategies—especially ILDs, and to present ILDs to them in a variety of areas of physics, with their active participation. During these two weeks, a two-and-a-half-day workshop was presented at Niigata University, a three-hour workshop for over 150 educators was presented at The Physics Education Society of Japan Conference at Kagawa University and three-hour workshops were presented at Tokyo City University (TCU) and Tokyo Gakugei University (TGU).

All of the workshops went very well, and there was a high degree of interest and participation. Only in Niigata was there enough time to have participants practice presenting their own ILDs, and for them to receive feedback from the other participants and me.

I believe that the workshop at the conference in Takamatsu had the largest audience I have ever had together in one workshop! The audience participated in ILDs in several areas of physics, including ones using clickers. The audiences at TCU and TGU participated in ILDs in several areas of physics, and each had more than an hour question and discussion period at the end.

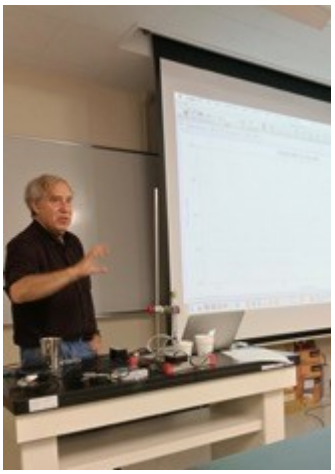

Image 2: David Sokoloff presenting ILDs on Heat and Temperature to mostly Secondary teachers, as part of seminar/workshop at Tokyo Gakugei University, August16, 2018.

Discussions at all four workshops indicated a strong interest in ILDs and active learning, and a likelihood that many faculty will implement them in their classes. My hosts strongly supported this belief. Since there is apparently a push from above to make science education in Japan more active, this was an opportune time for this project. As a result of this visit, we have begun discussions with the publisher of ILDs (Wiley) to arrange for distribution of translations of at least a subset of the materials.

Of course, the biggest challenge was language. The translation of my PowerPoint slides into Japanese, and distribution of printed copies helped with the comprehension of my presentations. However, discussions required interpreters. Fortunately, there was always someone available to act in this capacity.

I want to emphasize that this project could not have been successful without the significant efforts of my hosts. They arranged for local equipment, translated my PowerPoints and handouts, distributed copies of my PowerPoint slides, served as interpreters during my presentations, and arranged memorable dinners with participants to continue our discussions.

Image 1: Participant presenting ILDS to secondary and university teachers in a workshop at Niigata University, August 9, 2018.

Image 3: Finally viewing Mt. Fuji, from Tokyo SkyTree, August 15, 2018.

Over 150 secondary and university participants at ILD workshop presented at The Physics Education Society of Japan Conference, August 12, 2018 at Kagawa University.

UNESCO/ICTP ALOP Workshop - 2018: Guayaquil, Ecuador

David R. Sokoloff

The UNESCO/ICTP Active Learning in Optics and Photonics (ALOP) program continues robustly as it enters its 15th year of presenting active learning workshops around the world, mostly in developing countries. The most recent ALOP was presented in Guayaquil, Ecuador at Escuela Superior Politecnica del Litoral (ESPOL), 11-16 November, 2018. This was the 34th ALOP since the program's inception in 2004. The current principal sponsor of ALOP is SPIE.

ALOP is a five-day teacher enhancement workshop that updates secondary and university teachers on basic optics and introduces them to innovative, active learning approaches to teaching. The program is characterized by the CDs, optical fibers, and acting as student learners—making predictions and testing them through hands-on/minds-on activities.

Image 1: Souad Lahmar of Tunisia (right) presenting on interference and diffraction.

and presentation by a team of teacher trainers from developing and developed nations who volunteer their time to participate. The workshop includes five modules: Introduction to Geometrical Optics, Lenses and Optics of the Eye, Interference and Diffraction, Atmospheric Optics and a capstone, Optical Data Transmission (with Wavelength Division Multiplexing). More information on ALOP can be found at: https://pages.uoregon.edu/sokoloff/ALOPwebpage.html

The three presenters at ALOP Guayaquil were Souad Lahmar from Institut Preparatoire Aux Etudes Scientifiques et Techniques in La Marsa, Tunisia, Omar Ormachea, from Universidad Privada Boliviana in Cochabamba, Bolivia, and David Sokoloff from University of Oregon in the USA. The extremely competent and supportive local host was Eduardo Montero, of ESPOL. There were 36 participants from all over Ecuador, who spent an enthusiastic week in the excellent lab facility at ESPOL manipulating lenses, lasers, spectroscopes made from pieces of discarded

implement them in their classes. All of the student activities on optics are contained in the *ALOP Training Manual*, which also includes a teacher's guide on each module. The *Manual* is available in English, French, Spanish and Arabic. More information on the *Manual* can be found at the above link.

Image 2: Participants working with an optical fiber during the 5-day ALOP workshop in Guayaquil, Ecuador.

Following up on the highly successful ALOP in Guayaquil, there are currently three ALOPs scheduled for 2019: Lima, Peru in August, Bandung, Indonesia in October and Pune, India in December.

Exoplanets Workshop RSEF-IOP

REAL SOCIEDAD ESPAÑOLA DE FÍSICA
DIVISIÓN DE ENESEÑANZA Y DIVULGACIÓN DE LA FÍSICA

The workshop was organized by Jenaro Guisasola (member of the C14-IUPAP) on behalf of the Spanish Royal Society of Physics (RSEF) and the Teachers Center Berritzegune of the Basque Country. The seminar was given by Professors Taj Bhutta and Ellen Phillips from the Institute of Physics (IOP). It was held the last week of October in San Sebastian (Basque Country-Spain) and the maximum number of attendees (25 teachers) was completed.

The Institute of Physics (IOP) has developed the Exoplanet resource to help teaching this exciting new area of Physics research to the Secondary classroom. The workshop consists of five practical activities related to the curriculum for students from 12 to 16 years old in the European Union. Each activity can be used in Secondary science classes or as part of scientific literacy courses in Secondary Schools and Science Centers. The workshop has been designed to present the activities to Secondary School science teachers of the Basque Country (Spain) and to carry out several practical experiments that they can use in

All materials that were used during the workshop are uploaded on the website of the Berritzegune Teacher Center to be available for Secondary teachers in the Basque Country.
https://sites.google.com/site/zientziahezkuntzaekimena/exoplanets

The evaluation of the Seminar by the teachers has been very positive (overall rating 9/10). The teachers highlighted the applicability in the classroom of the activities carried out and their high value of scientific literacy.

Report by *Jenaro Guisasola*

Student research

COMICS IN PHYSICS: A METHODOLOGY FOR USING COMICS FOR TEACHING PHYSICS

Phd in Biosciences and Health Teaching

Souza, E. O. R. Física em Quadrinhos: Uma metodologia de utilização de quadrinhos para o Ensino de Física. Tese (Doutorado em Biociência e Saúde) – Instituto Oswaldo Cruz, Fundação Oswaldo Cruz, Rio de Janeiro, 2018.
Advisor: Deise M. Vianna
Available at: https://www.arca.fiocruz.br/bitstream/icict/26658/2/eduardo_souza_ioc_dout_2018.pdf

ABSTRACT

The objective of this research was to investigate how comics can provide a more critical perspective that takes advantage of the potential of the comic language in the construction of scientific knowledge. For this research I performed a systematic search of the comics present in the Physics textbooks recommended by the PNLDEM of 2017, to verify the popularity of comic strips in Physics teaching.

We also looked at how the elements of comics can aid in a critical teaching approach by triangulating the references of the Language of Comics and Research Teaching. Initially, we ran a series of workshops to evaluate the potential obstacles to the proposition of using comics in Science Teaching. These workshops took place at different times and with a diverse audience, allowing us to observe different aspects of the

Our observations were captured in recordings of the interactions between the research participants, undergraduate students in Biological and Physical Sciences and Physics teachers. These recordings were transcribed and analyzed for scientific literacy indicators. The results showed that comics with or without clear scientific content can be used as an investigative activity and for the construction of knowledge. The elements of the comic language were very well used in the dynamics of the workshops and helped in the teaching-learning process.

The results of the analysis can be applied in other contexts, with the impact of the study of comics in both the language field and Science Teaching. In parallel, the results broaden the studies and applications of comics strips, promoting discussion about scientific phenomena through the situations portrayed in this medium.

Image Title: Physics Comics – Image Inversion II.
Image 1: Do you know what I found out? What? **Image 2:** That the image that forms in the mirror is an inverted image?

Student Research

Evaluating the professional development of elementary school teachers

assessing the innovative elements in teaching resources designed by the teachers, under the supervision of university educators, to teach physics content. 2018, 215p. School of Sciences, State University of São Paulo - UNESP, Bauru Campus, São Paulo, Brazil.
Advisor: Professor Roberto Nardi
Available at: http://www.fc.unesp.br/#!/ensino/pos-graduacao/programas/educacao-para-a-ciencia/home/

ABSTRACT

This study is part of the research carried out within the Group of Research in Science Teaching (GRST), coordinated by Prof. Roberto Nardi, one of the research groups of the Science Education Graduate Program, School of Sciences, São Paulo State University (UNESP), Bauru Campus, São Paulo, Brazil. The central question of the research sought to evaluate how a sample of teachers from the early years of elementary education responded to a continuing training course on Physics teaching, carried out in the school, under the supervision of university staff. The evaluation was based on the innovative elements included in the teaching resources produced by the teachers.

This study focused on the following: the continuing education of elementary school teachers; educational innovation and, science teaching research outcomes. In Brazil, the majority of teachers at this level of education (so-called 'generalist teachers') teach a number of disciplines that cover several areas of knowledge. Thus, the discipline 'Sciences' is only one of the disciplines present in a diversified curricular structure. In the course, research activities were developed and prioritized based on the methodological and conceptual difficulties of the teachers. The study had as theoretical-methodological reference, the notions of Discourse Analysis in the French line, whose analytical device included dialogue with authors who discuss educational innovation and professional teacher development. The teachers' discourses, throughout the course of the partnership, were recorded in questionnaires, transcriptions of reflections, and in the teaching resources designed by them for distinct stages of course development.

The results of this study indicate that the ongoing advice and presence of university educators in a particular school can gradually change the culture of traditional science education, such as the school science fair, which usually presents only subjects of biology. After the training, teachers developed the autonomy to develop resources that included Physics content. Being aware of teachers' resistance to change, we are creating ways to circumvent the obstacles that interfere or delay innovation in science teaching.

The research carried out in this cooperative project between the university and the school, shows that teachers' resistance to using new ways to teach diminished and the degree of autonomy (in producing resources for teaching physics concepts) increased, thus highlighting the need for new studies on the subject.

Science Olympiads - India

India has participated in the Olympiad programme in the science subjects (Biology, Chemistry, Junior Science and Physics) since 1997. The Homi Bhabha Centre for Science Education (HBCSE) is the nodal centre of the country for this programme. The programme aims at promoting excellence in science and mathematics among pre-university students.

Recently (2016-2019), Indian students competed very successfully at the International Olympiads. The major highlight during this period was that all 19 Indian students at the international Olympiads in Junior Science (2017) and Physics, Chemistry and Biology (2018) returned with medals. This was the second instance since 2015 when each student in the Science Olympiads received either a gold or a silver medal. A report of the Olympiad results was published in the August 2018 issue of the *Resonance* journal.

The most remarkable performance was in the International Physics Olympiad (IPhO 2018) where all five Indian students received gold medals, lifting the country to the top position in the medals tally along with China, a first in 21 years of Indian participation in IPhO. This performance received wide coverage in the media and was appreciated by the Atomic Energy Commission and the Governing Council of Tata Institute of Fundamental Research (TIFR). The medallists from all the international Olympiads were recently greeted by the Honourable Prime Minister of India at a function in New Delhi.

Before the international events, the national programme ran smoothly to select the Indian teams and orient the students. After the publication of Indian National Olympiad (INO) results at the end of February 2018 (within a month of conclusion of INO, including re-evaluation), the students were invited to participate in the Orientation-cum-Selection Camps (OCSCs) in different subjects. The camps in Physics, Chemistry and Biology were all held in parallel between late May and early June, after the major competitive examinations in the country were over. These factors perhaps combined to result in a high attendance rate of nearly 90% in the OCSCs. The teams to the international Olympiads were trained at HBCSE in the Pre-Departure Camps (PDCs) for one to two weeks in July 2018.

Several Resource Generation Camps (RGCs) have already been held in different subjects in preparation for the Olympiad programme, in particular, INO and OCSC 2019. Exposure Camps (ECs) in all subjects were held in late October and November 2018.

We thank the dedicated hard work of the HBCSE Olympiad cell members, the teacher associations and many resource persons from across the nation which makes it possible to implement the Olympiad programme year after year and also to reap rich rewards at the international arena.

Introducing New members of the C14 Commission

My research focus is on high energy astrophysics, mainly Cosmic Rays, X-rays and Gamma Rays, using a combination of experimental work and modelling. I have participated in experiments such as *Anuradha* that was flown on the Space Shuttle in 1985 and *Indian X-ray Astronomy Payload* that was flown on an Indian Satellite in 1996. I have also participated in the *Solar X-ray Spectroscopy Experiment* that was launched on India's GSAT 2 satellite in 2003. I am now involved with the *ASTROSAT*, India's most ambitious multi wavelength astronomy satellite.
In my phenomenological research, I have explored particle acceleration in solar and stellar flares. I have also been interested in the origin of *Gamma Ray Bursts*, which I suspect may be flares on binary stars that are normally too faint to be seen.

Recently, my interests have shifted to the movement of the interstellar medium and acceleration of cosmic rays in the Heliopause. I am also interested in the origin of the solar system.

My latest field of curiosity is the field of Archaeoastronomy.

Science Popularisation is my hobby and I like creating programmes as well as giving lectures to students on issues of astronomy as well as science and society. I am very interested in science education and the impact of science on society.

Emeritus Professor **Julio C. Benegas**
Universidad Nacional de San Luis, Argentina

My formal education in Physics includes a Licenciado en Física degree from the Universidad Nacional de Cuyo, Argentina, which was completed with MA and PhD degrees from Washington University at St. Louis, USA. The later programs working in the field of experimental Cosmic Rays Astrophysics. After this graduate work I returned to my home institution in Argentina, by that time named Universidad Nacional de San Luis, were I eventually became full professor of Physics and later was awarded a position as Emeritus Professor, which I currently hpld.

When I returned to Argentina, Cosmic Ray research was not a practical choice, so I eventually changed to theoretical biophysics, developing a research group on theory and simulation of charged effects on biological linear macromolecules in solution.

In the last 20 years, my interest shifted to physics education, forming and leading a group on different aspects of physics and math education. My main interest is on the

I believe that good science education is a mandatory condition for the social and economic progress of developing countries and that active learning teaching methodologies, in physics and other experimental sciences, have demonstrated much higher learning efficiency that other teaching approaches. I also believe that teacher professional development is fundamental to spread the active learning approach. For that reasons, I proposed and managed a graduate program, Master of Physics Education, in my university. This program has attracted physics teachers and university professor from several provinces of the central part of Argentina.

With the same objectives, I also proposed and managed a series of South Cone Workshops on Active Learning of Physics. These 5-day workshops, modeled after the successful ALOP workshop developed by UNESCO, were run in four successive years on the subjects of Optics, Mechanics, E&M and Fluids and Thermodynamics. In each of them participated physics teachers and professors from Argentina and most South American countries. For each workshop a complete teacher training manual was edited (in Spanish) and published, being available at no cost to interested physics teachers.

application of active learning teaching methodologies both at the secondary and introductory university levels.

Professor Naoshi Takahashi
Higher Education Center,
and Department of Physics, Faculty of Education, Kagawa University,
Kagawa, Japan

I was born in Japan in 1966. I received my BSc and MSc degrees from Kanazawa University, Ishikawa, Japan in 1992 and 1994, respectively. I worked as a doctorate course student at a synchrotron facility, UVSOR, Institute for Molecular Science in Okazaki, then received my PhD (in science) degree from the Graduate University for Advanced Studies, Kanagawa, Japan in 1997.

I started my research career at the Institut für Angewandte Physik, Düsseldorf University, Germany in 1997 as a post-doctoral researcher, then moved to the Department of Physics, University of York in UK in 1998. I worked mainly in the research laboratories of the Department of Physics, University of

For my doctoral research I focused on the electronic state and spin condition of thin films of pure and oxidized metals on semiconductor surfaces, so-called surface science field, by using photoelectron spectroscopy of X-rays and synchrotron light.

My first mission in our research group was the construction of a spin detector for spin-resolved photoelectron spectroscopy at the UVSOR facility. During that period, I also investigated the surface condition of negative electron affinity surfaces.

When I was in Europe, I concentrated my research on a ferro-metal/semiconductor system by using spin-resolved photoelectron spectroscopy at Berlin and Warrington.

After coming back to Japan, I started MBE work and lab-based X-ray photoemission as well. At the same time, due to the duty work of my position, I started physics and science education research together with Professor Kawakatsu. The conference held in Lund, in 2002, was my first as a co-worker of the LADY CATS. For nearly 20 years I have been interested in creating teaching materials, from simple toys to some types of high-tech

Leeds and Barcesbury Laboratory in Warrington.

In 2000, I took up an academic position as assistant professor at Kagawa University. I have been a professor in the Faculty of Education at Kagawa University since 2012.

Since 2014 I have held a concurrent post in the Higher Education Center of Kagawa University, now I am working as Director of the Center.

materials, for example thermography.

Since 2014, I have worked as a vice director and director of the Higher Education Center of Kagawa University. This means that my current work is largely focussed on general education in the university sector.

Professor Mohammed U. Degereji, PhD

I obtained my PhD in 2011 from the University of Leeds, UK. Currently, I am a Chief Lecturer in the Federal College of Education, Yola, and the immediate past Dean in the School of Science of the College. I also visit some Nigerian Universities as an associate Professor of Physics.

My research interest is in energy studies and I have investigated several cases of particle trajectories under high temperatures. I have published some of my research works on particle expected-behaviour and sticking tendency in boiler situations, with particular reference to coal and biomass combustion.

Computational fluid dynamics (CFD) and other numerical techniques are frequently employed in my research activities. I have developed and tested a numerical slagging index (NSI), which is being referenced in the prediction of coal / biomass slagging propensities.

My area of interest is multidisciplinary, therefore, I belong to some professional associations, namely; IOP, IEEE, ASME, etc.

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