College of Fellows 2025

Professor Andy Buffler
Department of Physics
Faculty of Engineering & the Built Environment

It gives me the greatest pleasure to nominate Professor Andy Buffler for election to the University of Cape Town (UCT) College of Fellows.

Professor Buffler is an applied nuclear physicist with internationally-recognised expertise in the fields of radiation metrology (the measurement of radiation) with a particular focus on fast neutrons. Appointed ad hominem Professor at UCT in 2014, Buffler has been associated continuously with UCT for 40 years, starting as a BSc student in 1985, and appointed as a lecturer in physics in the UCT Academic Development Programme in 1992.

His PhD from UCT, awarded in 1998, developed innovative methods of interrogation of materials in bulk using fast neutrons with a particular application to threat aversion in the airline industry. Since then, he has pioneered and built a substantial and demonstrable research domain defined by the development, metrology, and characterisation of instruments and facilities to investigate fast and high-energy neutrons. Along the way, his research has been acknowledged in several ways by multiple organisations. This nomination considers, sequentially, Buffler's research profile; his contributions to technical advancement in his field; and the international recognition that he has garnered for his work.

Research profile

Buffler has produced 77 peer-reviewed papers, with an ISI h-index of 24. His Google Scholar profile shows 3 100 citations and an h-index of 31. An assessment of his publication record reveals two distinct research foci, both of which have been highly influential, and highly cited. The first builds on his doctoral research on the application of neutron radiation for screening in the airline industry, a topic which gained international momentum following the Lockerbie bombing in 1988. A number of publications followed but most notably a single-authored review published in 2004 which captured the state-of-the-art application of energetic neutrons for contraband detection, which was cited over 250 times in a short time following publication. This work has, over time, extended to newer, applications; radiation dosimetry at high altitudes (again, of particular relevance to aviation and space travel). Recently, it included the use of proton therapy for health, an area of work that is truly transdisciplinary across physics, the life sciences, and medicine. Of particular note are a number of publications over the last decade which describe the development of compact neutron detectors using modern plastic materials which can discriminate between neutrons and gamma rays by the time dependence of the burst of photons in the scintillator, as discussed further below. This method of so-called "pulse shape discrimination", invented in organic scintillators by his PhD supervisor in the 1960s, is one of the hallmark techniques which underpins much of the research pursued in Professor Buffler's group, and which they have advanced in the modern age of digital electronics. The titles of his papers over the past decade map out the evolution of these contributions.

The second (but less significant of late) focus stems from his first UCT appointment as a lecturer

in physics in the Academic Development Programme (ADP). This body of work, also highly cited, has helped shape the teaching and pedagogy of physics, and especially the teaching of metrology. It is the focus on metrology, particularly, that binds Buffler's research endeavours: a focus on high-impact research on fundamental measurement techniques and the development of applications to broader science, tied to a desire to ensure that teaching in the field of metrology remains cutting-edge and socially relevant.

In advancing his research, Buffler founded and has been the Director of MeASURe (the Metrological and Applied Sciences University Research Unit at UCT since its inception, and has built formidable research linkages, both academic and organisational, across the world. These linkages include leading many measurement campaigns at accelerator facilities in France and Germany, and maintaining collaborations with international institutes of metrology for decades, most notably the Physikalisch-Technische Bundesanstalt (PTB) in Germany, and the Authority for Nuclear Safety and Radiation Protection (ASNR) in France. He is presently a Board Member of the National Metrology Institute of South Africa (NMISA). Professor Buffler also constructed the first "kibble balance" for South Africa, through a postgraduate project, which became the precursor for the new mass reference standard for the NMISA, presently being constructed by the UK National Physical Laboratory (NPL).

Contributions to technical advancement and facility development

On a technical, physics-engineering, mode, much of his recent research has focused on developing and pioneering the use of organic scintillators in novel compact devices for neutron detection. The two main application areas are concerned with the neutron radiation that one is exposed to at flight altitudes and in space, and in and around man-made accelerator facilities such as those used for proton therapy. In both cases, there are urgent demands for real-time monitoring with lightweight instrumentation, which has traceability to international reference standards. Their most recent work is poised to revolutionise neutron detection in terms of sensitivity and efficiency, and is presently under review for a patent with a view to commercialisation.

One of the most important reference standards for such instrumentation is a high energy neutron beam which has been characterised to an internationally recognised metrological level. It is not by chance that the only such facility in the world which is presently suitable for this purpose is at iThemba LABS national facility in Faure, Cape Town. Professor Buffler is the university PI on an international collaboration which includes the PTB, NPL and ASNR, which is working towards defining and demonstrating the standards required for this purpose. This work led the National Metrology Institute of South Africa to formally declare the high-energy facility at iThemba LABS as a "designated facility" of the NMISA.

In addition to this, Buffler constructed the only university-based accelerator facility producing energetic neutrons in Southern Africa (the "n-lab"), which is housed in the Department of Physics and underpins most of the neutron-related R&D within MeASURe. In 2010, he was also central in establishing a positron emission particle tracking laboratory ("PEPT Cape Town"), only the second of its type in the world, and which features what is still the most sensitive PET scanner ever constructed by Siemens. This scanner has been adapted to image flows within industrial systems, for example, tumbling mills and froth flotation tanks in the minerals industry. These are further examples of the manner in which Professor Buffler seeks real-world applications of

radiation physics, and has contributed to the development of those applications from scratch. In 2024, he co-proposed and was appointed chair of the UCT Proton Therapy Initiative which has as its primary goal the establishment of a proton therapy centre in Cape Town. When brought to fruition, this would be only the third such facility in the Southern Hemisphere, and it would not only ensure new and ground-breaking treatments of cancers, particularly among children, that are at present unavailable in the sub-continent, but also provide new avenues for basic research. The proposal also includes the establishment of a secondary facility with a smaller cyclotron dedicated to radioisotope production (both routine for PET, and novel) and beamlines for research spanning physics, engineering, radiobiology, medicine and space science.

National and international recognition

Professor Buffler's contributions to the advancement of knowledge in his field have led to recognition at the highest levels. His contributions have been peer-reviewed and accepted by the International Bureau of Weights and Measures (the BIPM; the Paris-based international organisation responsible for metrology). In 2024, he was asked by the BIPM, as the acknowledged expert in the field, to present the "reference" webinar on high-energy neutron metrology. He is the only university-based expert (ie not attached to a National Metrology Institute) on the Consultative Committee on Ionising Radiation of the BIPM; and the only non-European member by invitation of Working Group 11 (on neutron fields in the workplace) of the European Radiation Dosimetry Group (EURADOS).

As further evidence of his international standing in the field of metrology, he has been invited by the BIPM to attend the conference of the 150th anniversary of the Metre Convention (at UNESCO Paris and Versailles) in May 2025, and was the proposer and is co-chair of the organising committee of a conference organised by the International Atomic Energy Agency (held in July 2025). This meeting is set to transform the field of high-energy neutrons over the next decade, a field in which the high energy neutron beam facility at iThemba LABS has, as a result of Professor Buffler's involvement, a singularly important role to play.

Other achievements and service

While the sole criterion for election as a member of the College of Fellows is – rightly – original and distinguished academic work (and regarding which, Buffler is certainly a most worthy candidate), it would be remiss not to make mention of Professor Buffler's singular contributions to the university's administration and governance, in addition to his academic achievements and recognition.

In addition to a ten-year term as Head of the Department of Physics (2012-2021), Buffler has served the university in a great many other ways, including as a Senate-elected member of the Senate Executive Committee (from 2018 to date); as Chair of the University Equipment Committee (2016-2024); member of the University Research Committee (2016-2024); and Senate elected member of the Senate Teaching and Learning Committee and University Finance Committee (since 2024). A more comprehensive account of his service in this regard is contained in the CV attached to this nomination. Buffler truly is an exceptional institutional citizen.

Finally, Professor Buffler's contribution to pedagogy should also be recorded. In part, this aspect was covered in the description of Buffler's research profile. Despite his increasingly

high international profile, and commitment to governance and administration of the university, a large part of his academic life involves teaching physics to many students at both undergraduate and postgraduate levels; and he has made significant and long-lasting contributions to the teaching of physics, both at UCT and internationally. This commitment to teaching and producing future generations of physicists has been awarded with the UCT Distinguished Teacher's Award, and his authorship of an open-access textbook on teaching measurement at the university level which is widely used internationally.

Conclusion

Reverting to the call for nominations, the call records that "[a] fellowship is awarded in recognition of the original body of work (in any form) which:

i) has promoted a research culture which has had a profound influence on the recipient's discipline and possibly other (cognate) disciplines, as gauged by the most stringent and prestigious international measures, and/or

ii) has had a major and quantifiable 'societal impact'."

Buffler has not only produced an original body of work that – in its (narrow) field – is world-leading, but he has done so by building large and multi- and trans-disciplinary teams that seek to both advance our understanding of high-energy physics but also develop and implement applications of that knowledge that serve the community and society of which the university is part.

Based on this assessment, Professor Buffler is a particularly deserving nominee to the College of Fellows at UCT.

Nominator: Tom Moultrie, Professor of Demography