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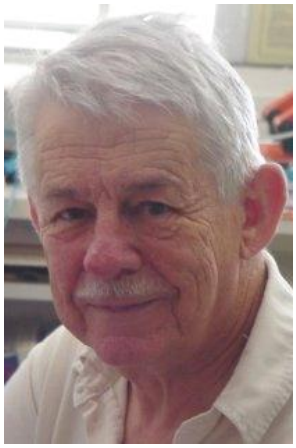


Frank Brooks
1931-2012

Francis Dey Brooks, Emeritus Professor in the Department of Physics at the University of Cape Town, died in hospital on 30 August 2012, a few days after a fall in his home. Frank was a pioneer in the physics and applications of neutron detection and spectrometry.

Frank Brooks was born on 9 December 1931 in Pretoria, where he attended both primary and high school. He went on to study physics at Rhodes University and was attracted to undertake an MSc working in the group of J.B. Birks, who was a leading figure in the early development of scintillation detectors and author of the "Birks relation" describing the light yield per path length for a charged particle traversing a scintillator. Franks MSc project was focused on the pulse height response of the organic crystal anthracene to low energy X-rays. When Birks returned to England, Frank completed his MSc under J.A. Gledhill and G.T. Wright, who were also well known for their work on scintillator materials. In particular, Wright developed the technique of pulse shape discrimination (PSD) which allows the identification of different types of charged particles in certain scintillator detectors by means of the characteristics of the scintillation decay. PSD is most often used to separate signals associated with neutrons or gamma-rays in mixed radiation fields, and this became a theme in Frank's research life.

In 1955 Frank moved to the Nuclear Physics Division of the Atomic Energy Research Establishment (AERE) at Harwell, England, to take up a Commonwealth Junior Research Fellowship. His work at Harwell extended the state of the art in the physics of scintillation mechanisms, including building the first practical PSD system. He was allowed register a patent on his method of pulse shape discrimination, but was obliged to sell it back to the AERE for 1 pound.

Frank moved back to South Africa in 1964 to take up the newly created Chair of Nuclear Physics in the Department of Physics at the University of Cape Town, a position he held until his formal retirement at the end of 1996. He immediately put his efforts into developing nuclear physics research at the university, building on the research-led legacy left by R.W. James, who died that same year. The Southern Universities Nuclear Institute (SUNI) was established at the same time at Faure, near Cape Town, which later expanded in the late 1980s with the newly built k = 200 MeV cyclotron to become the National Accelerator Centre (now iThemba LABS). Much of Frank's early work with the newly commissioned 5.5 MV Van de Graaff accelerator at SUNI employed novel uses of organic crystal and liquid scintillators to explore fundamental properties of 2-nucleon and 3-nucleon systems, a theme which emerged later in the 1990s. Frank's experimental prowess was well established in these early years. He brilliantly exploited the fundamental physics of detector materials, for example directional anisotropies and scintillation variations, as well as often using the scintillator both as a target and detector.

In the 1980s Frank's attention turned to the then topical subject of muon-catalyzed fusion. He played a leading role in experimental studies of the alpha-muon sticking coefficient in muon-catalysed d-t fusion, in which it became clear that neutron detectors having good PSD characteristics were essential to the success of these measurements. Many of these experiments were undertaken at the Rutherford Appleton Laboratory in collaboration with the University or Birmingham.

The commissioning of the k = 200 MeV cyclotron at the newly formed National Accelerator Centre provided a new energy regime for fast neutron physics research in South Africa. In the early 1990s Frank designed experiments to measure differential cross sections of neutron-proton radiative capture and neutron induced cross sections relevant to cosmic ray studies. He also turned his attention to applications in medical physics, designing novel ways of measuring the energy spectra of both the neutron and proton therapy beams at the NAC. During this time he also established a very productive collaboration with the neutron metrology group at the Physikalisch-Technische Bundesanstalt, Germany, which remains strong with UCT Physics to this day. In 1996, just before retirement and remarkably after never having completed a PhD, Frank was awarded the degree of DSc by Rhodes University.

In the later years of his research career Frank turned his attention to more applied topics, often working within programmes managed by the International Atomic Energy Agency. In the 1990s Frank had begun to explore techniques using fast neutrons to detect hidden contraband and explosive materials. Later on he turned his attention to the humanitarian problem of locating hidden anti-personnel landmines, by detecting neutrons which had been slowed down through collisions in the hydrogen-rich explosive in the mine. In recent years, Frank also worked on new ideas to detect antineutrinos, showcasing his progress in a departmental seminar in April 2012.

Frank's teaching mirrored the way he thought about research. His lectures were extremely well structured, often supported by carefully hand-written lecture notes which he always made available to students. He particularly enjoyed laboratory teaching at the senior levels and attracted many students for post graduate research by displaying passion and dedication to the task. Over the course of his career at UCT he supervised 19 MSc and 18 PhD students. Frank served as Head of Department between the years 1979 and 1981, and then for nearly two more years after the sudden death of W.E. Frahn in April 1982. Frahn was instrumental in developing theoretical physics at UCT, and Frank recognised the importance of continuing this trend. Although the next years were somewhat complicated for the department, Frank always provided a consistent voice of reason.

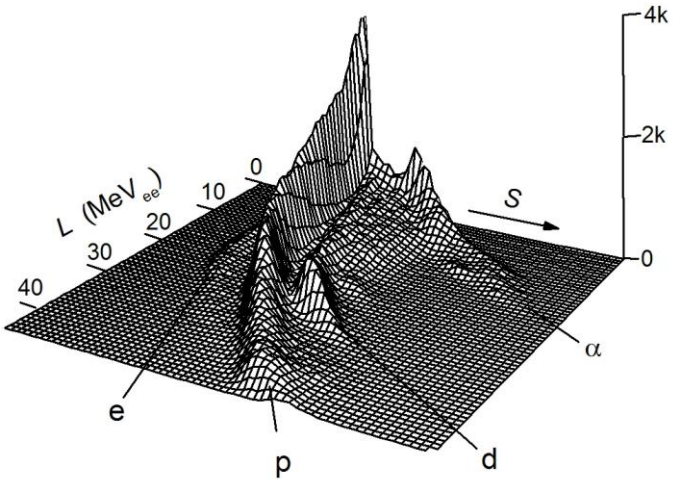
Frank Brooks will be remembered for his ground-breaking work in neutron detection and spectrometry using organic scintillator detectors. Although his research articles will remain as a formal testament to his academic authority, his legacy will be continued through the living testimony of his research students, many of whom remain active in research today. Frank was happiest in his laboratory at UCT, or tweaking racks of electronics before a night's run at iThemba LABS. The experiment was everything to him. He paid careful attention to detail; the sequence of the electronics modules in a rack, the number of cables needed, even the width of the columns to be ruled in the experimental journal. His beloved LINK 5010 PSD unit would nearly always command a central position. He was an eternal optimist and would see the beginnings of enhancements in data (where others would just stare) and smile contentedly when a signal began to appear. Frank was extremely supportive of his post graduate students and spent hours with them in the laboratory, never shying away from doing all-nighters at the lab. He never tired of correcting drafts of papers and theses, over and over again, making careful "suggestions" for improvement (he was always right). He was a meticulous writer and cared passionately about producing scientific prose which was both succinct and accurate. Frank allowed his passion for scientific exactitude to be balanced somewhat by the state of his laboratory which could only very kindly be described as a creative space. He was a consummate collector of anything which could find future scientific use. Even small pieces of tin foil were carefully curated.

"FDB" will be remembered by those who knew him as a trusted and unassuming colleague, a loyal supervisor, a passionate educator, an innovative and intuitive researcher and, above all, a gentleman. He developed many deep friendships across the university, and the world of neutron physics. He was also dedicated to his family, and will be sorely missed by his wife, Kathleen, his children Louise, William, Peter and James, and eight grandchildren.

Frank Brooks understood the behaviour of neutrons like no other. It is my view that time will reveal his scholarly contributions to the Physics Department at UCT as the most substantive since the time of R.W. James.

Andy Buffler
Head of Department
5 September 2012

On behalf of the staff and students of UCT Physics



A visualization of data demonstrating pulse shape discrimination, characteristic of Frank Brooks' research.

Counts (vertical) versus pulse height *L* and pulse shape parameter *S* for events in an NE213 liquid scintillator of cross-section 13 × 13 cm^2 and thickness 7 cm, when irradiated by a neutron beam of energy 62.5 MeV . The labels indicate loci attributed to recoiling charged particles of different types: protons (p), deuterons (d) and alpha particles (α), as well as escaping protons (e).
Adapted from *Nuclear Instruments and Methods in Physics Research A* **476** (2002) 181–185.