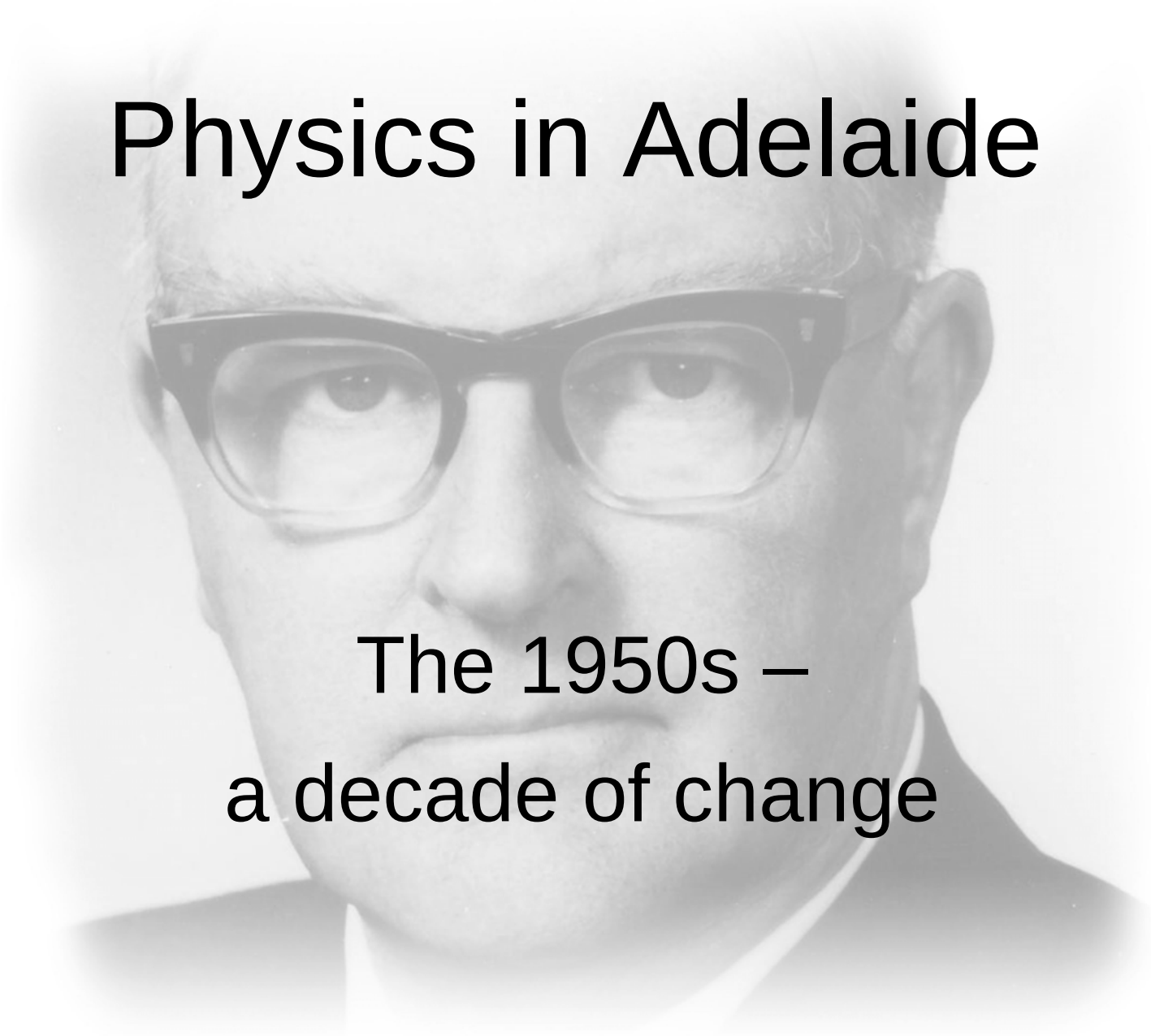
Physics in Adelaide



The 1950s –
a decade of change

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This article is about a very significant period in the history of physics in Adelaide. It is the period following the arrival of Professor Leonard Huxley in 1949 when the discipline underwent a transformation.

The first appointments

The story of physics prior to Huxley's arrival is largely the story of three professors: two who had distinguished research careers after leaving Adelaide and another remembered as one of Adelaide's great characters.

Just two years after its establishment in 1874, the University of Adelaide appointed Horace Lamb, a 26 year old newly married Cambridge graduate, to the Chair of Mathematics that had been endowed by Sir Thomas Elder. As well as teaching mathematics, he gave lectures in what was then called Natural Philosophy. During his time in Adelaide he published some twenty research papers and a book that was the first edition of his famous *Hydrodynamics* which is still in print. His 1883 paper on the application of Maxwell's equations to oscillatory current flow in spherical conductors was arguably the first physics research paper from the University of Adelaide. He returned to England in 1885.

Lamb then joined with JJ Thomson and Sir Arthur Blyth, the Agent-General for South Australia, to choose his successor. They selected another young Cambridge graduate, William Henry Bragg. Bragg was only 23 in 1886 when he arrived to take up his appointment as the Elder Professor of Mathematics and Experimental Physics. As his academic interest shifted from mathematics to physics, he experimented with radio transmission, medical imaging with X-rays and the absorption of α-, β- and ϒ-rays. From 1904 he published extensively on the interaction of ionizing radiation with matter. He left Adelaide in 1908.

It was during Bragg's time that the first lecturers in physics were appointed. The first, in 1888, was Robert Chapman who in 1907 became the first Professor of Engineering and had a distinguished career in the University.

The Kerr Grant era

On Bragg's departure an Adelaide graduate, Herbert Priest, and a Melbourne graduate, Kerr Grant, were appointed as Acting Professors of Physics. In 1911 Kerr Grant was appointed to the Elder Chair of Physics which he held until his retirement in 1948. This was the first appointment to a separate chair in physics.

Kerr Grant had an infectious enthusiasm, established a reputation for his entertaining lectures and undertook and encouraged a variety of research projects. Stan Tomlin wrote of him that he "was not and would never have claimed to be an outstanding physicist". He published more than a dozen papers in international scientific journals, five of them in *Nature*. They were on topics as diverse as the absorption of X-rays, observations of a meteorite and the rhythmic breaking of ship waves, but

he never published more than one paper on a given topic. He regarded research as subordinate to a professor's obligation to train students and to serve the public as an authority and consultant.

The only sustained research program during Kerr Grant's time was the study of surface tension by Roy Burdon. This work had been suggested to him by Kerr Grant following Kerr Grant's visit to the United States in 1919. Burdon's measurements of the surface tension of mercury were highly regarded and his 1940 monograph *Surface tension and the spreading of liquids* went to a second edition in 1949. In 1927 Burdon published a paper on the absorption of gases on the surface of mercury in *Nature* with a young Mark Oliphant. Oliphant later referred to Burdon as a remarkable man and attributed to Burdon's assistance the award of the 1851 Exhibition scholarship that took him to the Cavendish Laboratory to work with Rutherford.

With the coming of the Second World War the resources of the Department and its staff were committed to the war effort. Kerr Grant served on war-time committees as scientific adviser. One of these was an expert panel to advise on the problem of fungal infection in optical instruments in New Guinea. He established a State Centre for Pyrometric Control in the Physics Department to provide advice on the measurement and control of temperature during the production of munitions. The Department workshop undertook the manufacture of precision spirit level glasses for gun sights. John Symonds, who was Dr Burdon's cadet, tells of helping to solve a problem with coloured signalling lights used by the RAAF Pilot Training Group at the Parafield airfield, a task that had been delegated from Kerr Grant to Dr Burdon to him.

In another war-time project, classified work related to radar research was supervised by Dr Burdon and conducted by John Symonds. In 1942, Symonds was sent to Melbourne where he was to link with a group that was delivering a prototype magnetron to the Radiophysics Division Laboratory of the Council for Scientific and Industrial Research in Sydney which had a program of radar research as part of the Allied war effort. Mark Oliphant had brought the design from the UK and the magnetron was constructed in the Department of Natural Philosophy at the University of Melbourne, possibly by Mark's brother, Harry. In Sydney, John was given some crystalline samples of semiconductor materials to take to Adelaide for testing of their suitability as detectors in radar receivers. When he found that some of the samples did not exhibit rectifying properties, Dr Burdon suggested getting John Cowley, an Honours student, to investigate variation of the crystal structure of the samples with the surface electron diffraction camera that he was operating. It was a Finch electron diffraction camera, developed by Professor Ingle Finch of Imperial College and manufactured by Messrs W Edwards and Co, and had been obtained by Dr Burdon in the late 1930s. It was the first major electron optical instrument to be installed in Australia. The discovery by Cowley and Symonds that impurities introduced during the cutting and polishing was the problem was a significant contribution to the success of the work in Sydney.

It is remarkable that, despite the interruption of the war, eight MSc degrees in physics were undertaken during the war years. Only two had been awarded before 1940 and only two more were undertaken between 1945 and Kerr Grant's retirement at the end of 1948.

Notable among those wartime theses was one submitted late in 1945 by John Gooden. He had been in the 1940 Honours class and then worked in Sydney at the Radiophysics Division of CSIR during the war years. His thesis was in the form of four restricted access reports to the CSIR on the design of a

coaxial - waveguide transformer for application to radar. In 1946 he went to Birmingham to work with Oliphant on detailed design of the synchrotron being built there. In 1948 he was appointed as the foundation Research Fellow of the ANU Research School of Physical Sciences and continued to work in Birmingham under Oliphant, who had been appointed Director of the RSPhysS. In 1949, Gooden became ill and was flown to Adelaide where he died in June.

Another notable thesis was submitted in 1945 by John Cowley. It was on an electron diffraction investigation of the structure of crystal surfaces and of lubricants on metal surfaces. His observations were made with the Finch electron diffraction camera but the thesis project was not related to the classified work he had done with John Symonds. Bob Crompton recalls that when he was a cadet assisting Dr Burdon the vacuum housing of the Finch camera leaked badly. This was because the soft solder used in its assembly had been attacked by mercury from the diffusion pump. It was remarkable that the Department should have such an instrument at that time. It appears that John Cowley may have been the only person to have used it.

The war-time silicon surface observations were eventually published. John Cowley wrote the paper with John Symonds as joint author after Symonds had gone to Birmingham in mid-1946 to work with Oliphant. Cowley must have sent a copy to Professor Finch, because Symonds received an invitation to visit him. Finch was, evidently, familiar with Burdon's surface work and wanted to meet the young man who had worked with him.

After working for ten years with Oliphant on his synchrotron project, John Symonds returned to Australia to work with the Australian Atomic Energy Commission, becoming Chief Scientist (Power and Energy), and then was a consultant on matters relating to the recovery and transport of radioactive waste.

John Cowley had a distinguished career, first with the CSIR, then as a Professor of Physics at the University of Melbourne and finally as Professor of Physics at Arizona State University. In 1957 he was awarded a DSc by the University of Adelaide. When he died in 2004, the Arizona State Center for High-Resolution Electron Microscopy was renamed in his honour and a special issue of the *Journal of Electron Microscopy* was dedicated to him.

It is remarkable that so many graduates from the very small Adelaide physics department were making a mark in the world. Often in later life those graduates acknowledged the importance of guidance they had received from Roy Burdon. Roy's interest in his students continued after they ventured into the world. In December 1949 'The Mail' reported that Dr Burdon had been granted study leave in England where he intended to visit a number of Adelaide graduates who were then engaged in 'top-line atomic research' in Birmingham. They were: Professor Oliphant, BSc(Hons) 1923; Dr John Gooden, MSc 1945; John Symonds, BSc(Hons) 1945; WIBS (Wibs) Smith, BSc(Hons) 1941 and Keith Mather, MSc 1944.

Stuart Butler also went to Birmingham in 1949 to begin a most distinguished career. After completing an MSc in Adelaide in 1947, he won an ANU scholarship to undertake a PhD in theoretical nuclear physics. He formed a close relationship with Rudolf Peierls and won the Tom W Bonner Prize for his work. Then he had a post-doctoral appointment at Cornell University where he worked with Hans Bethe and Edwin Salpeter. He returned to a research fellowship at the ANU and, in 1954, he was appointed to a readership at the University of Sydney. There he undertook theoretical research in several fields. He was awarded a DSc by the ANU in 1961 and won the

Thomas Rankin Lyle Medal in 1966. In 1977 he became Director of the Australian Atomic Energy Commission Research Establishment at Lucas Heights and was still in that position when he died in 1982.

The connection with the Radiophysics Division continued into the 1950s. Rod Davies was a member of the 1950 Honours class and then went to the Division where he worked on radio noise from the sun. By October 1951 he had completed an MSc thesis which he submitted to the University of Adelaide. He then became an Assistant Lecturer at the University of Manchester, was appointed Professor of Radio Astronomy in 1976 and was Director of the Jodrell Bank Observatory from 1988 to 1997. He was awarded the CBE in 1995.

Of all the staff appointed by Kerr Grant, Roy Burdon in particular should be remembered kindly by history. He graduated with a BSc from the University of Adelaide in 1916 and had an appointment as lecturer in physics at the University of Melbourne from 1917-18. He was acting Professor of Physics at the University of Adelaide in 1919, Lecturer in Physics at the University of Tasmania from 1920-21, and was appointed Lecturer in Physics at the University of Adelaide in 1922. He acted as head of the department when Kerr went on sabbatical in 1925. In 1935 he received a DSc from the University for his work on surface tension. He was General Secretary of the Australian and New Zealand Association for the Advancement of Science and in 1945 undertook the formidable task of organising the first post-war ANZAAS meeting held in Adelaide in August, 1946. He was promoted to Senior Lecturer in 1947 and Reader in 1950. Perhaps the last act of the surface tension work that he had continued for more than thirty years was to supervise Murray Ziesing's work for an MSc thesis that was submitted in 1951. Dr Burdon retired at the end of 1958 and died in 1966.

During the war years Kerr Grant had only two lecturers to assist him: Roy Burdon and George Fuller who had been appointed as Assistant Lecturer in 1927. At the end of the war there was an influx of students who were in the Commonwealth Reconstruction Training Scheme for returned service-men and -women. The CRTS began in 1944 and operated for six years. In Adelaide the scheme was organised by Harry Wesley-Smith and he arranged for University departments to provide refresher courses to allow applicants to meet University entry requirements. During 1945, Graham Elford and Bob Crompton were engaged as physics tutors for those courses. They were second year physics students at the time. Both were also Departmental Cadets assigned to assist Roy Burdon.

The number of 'civilian' students also increased after the war so that student numbers were more than double the wartime enrolment. CRTS funding allowed the Department to cope with this load by filling new lectureships in 1946. They were: Gordon Aitchison, who had been a demonstrator in the department since 1941 and had been awarded an MSc in 1945; William Brooke, an engineering graduate and Demonstrator since 1939; and Michael Iliffe, who had been appointed as Demonstrator in 1929 but had spent the war years at the CSIR Radiophysics Laboratory in Sydney. George Fuller was promoted from Assistant Lecturer to Lecturer in 1946. Another Demonstrator and MSc graduate, Keith Mather, was appointed as Lecturer but later in the year he left to take up an appointment in the United States and a career that included appointments as Senior Research Officer at the Australian Atomic Energy Commission, Physicist-in-charge at Mawson Station, Antarctica, and Vice-Chancellor for Research and Advanced Study at the University of Alaska.

Since it had been built in 1926, the present Physics building had accommodated both the Physics and Engineering departments, but from 1947 CRTS funds were used to construct new Engineering buildings. Thus, the post-war expansion gave the Physics Department more space as well as more staff.

When Kerr Grant retired at the end of 1948 he left a Department with a lecturing staff of five: Aitchison, Brooke, Burdon, Fuller and Illife. All five were Adelaide graduates and only Roy Burdon with his DSc and Gordon Aitchison with an MSc had higher degrees. Student numbers had increased and the staff had a heavy teaching load. Memories from the late 1940s are of a Department with very little research activity or research culture. Barbara Potts (Kidman) recalls that when she went to Oxford after completing Honours in 1948, she understood for the first time what research is. The undergraduate curriculum is remembered as out-dated and devoid of 'modern physics'.

Physics I lectures were, for many years, given by Kerr Grant at 9am and repeated by George Fuller at 5.15pm. Lectures for medical students were given at 12pm. Demonstrations were a feature of Kerr Grant's lectures and they produced some memorable occasions when students applied their ingenuity to disrupting them. However, Lee Parkin, who enrolled in 1934, recalls Kerr Grant as a 'beaming enthusiast'. Barbara Kidman (Potts) enrolled in 1945 and she recalls Kerr Grant's lectures as 'entertaining but uninformative'. Both attended Kerr Grant's lectures but also went to the evening lectures to take notes. George Fuller's lectures were thought to be 'systematic but uninspiring'. Barbara says that she survived Physics II only by studying a textbook. Perry Miles, who enrolled in 1946, says of his lecturers that "they were all good men but they were the product of their time and background, and theirs was not modern physics." Nevertheless, John Symonds remembers enjoying meetings that Dr Burdon held for discussion about trends in modern physics.

Kerr Grant's lecture notes were printed and bound. They contained sections on metrology, mechanics, geometrical optics, physical optics, heat, electrostatics, the electric current, electro-kinetics and electron theory. They were written in elegant language but they had not even a single diagram and only very basic equations. They were first printed in 1913. The ninth reprinting in 1947 edition still had a distinctly 1913 feel about it and only a few sentences in the last few pages showed signs of revision.

For many years the University Calendar contained advice for students taking physics as a final subject for a pass or honours degree to obtain the five volumes of *A Text-book of Physics* by Ernst Grimsehl: Mechanics, Heat and Sound, Electricity and Magnetism, Optics, and Physics of the Atom. However, there were no formal Honours lectures. Members of the 1948 class recall that they were asked to study certain chapters from *Theoretical Physics* by Georg Joos. They each chose chapters to study and then lectured to one another. David Sutton presented a chapter on elasticity and is said to have found that experience helpful later when he took up research in seismology. At 9am on Mondays the class met in Kerr Grant's office for coaching in scientific German. The nine students competed each week for a place on Kerr Grant's couch. Kerr Grant had acquired an enthusiasm for the German language when he spent a semester at the University of Göttingen after graduating in Melbourne.

The 1948 Honours class did receive one set of lectures. Jim Bosher was then an MSc student in the Department. His undergraduate study in England had included courses in quantum mechanics.

Realising that he was knowledgeable about quantum mechanics, the Honours students asked him to present them with a set of lectures and he did. These unofficial lectures must have been the first in quantum mechanics given in Adelaide.

Jim's MSc project was about factors affecting the relaxation of proton spin excitation. This was remarkable because the first observations of nuclear magnetic resonance had been made only a year or so before Jim began his work. It is a pity that his measurements were never published.

That was the Department at the end of the Kerr Grant era. It had a proud tradition established by Lamb and Bragg. Although it had a reputation for producing graduates who pursued successful careers around the world, there was very little research activity and students were not exposed to a research culture. It had a lecturing staff of five Adelaide graduates, and an undergraduate curriculum that had not kept pace with advances in the discipline. It seems that Kerr Grant had neither the resources nor the vision to build a modern teaching and research department. The Department was at a low ebb.

A time of change

Indeed, the whole University was then at a low ebb. Hugh Stretton, in his *Australian Dictionary of Biography* article about AP Rowe, wrote that in 1948 the University of Adelaide was Australia's worst-financed university.

> "It had next to no research students. There was little graduate support, no public-relations and no long-term planning. Its staff had poor pay, poor research funds, no retiring age and inadequate superannuation. A table in the student-union refectory provided their only social meeting-place."

This was the University that invited Albert Percival Rowe (invariably known as 'AP') to become its first full-time Vice-Chancellor. He took up the position on 1 May 1948. Rowe had an Honours degree in physics from the University of London and during the war he was Chief Superintendent of the Telecommunications Research Establishment (TRE) which led much of the development of radar. There he developed a style of management in which inspiration and command flowed down through the organisation from his leadership.

AP Rowe was a provocative Vice-Chancellor. It was in his nature, but it was also a matter of intent. In his book, *If the Gown Fits*, written after he had returned to England, he refers to the conservatism of Adelaide that resisted change and to the need for change and stimulus in the University. He wrote that the University of Adelaide was 'living in an age that had passed'. He quoted a story about a trawler skipper who after many days at sea would return with fish in much better condition than those brought by other trawlers. The skipper explained that 'for every thousand herrings in the tank I put in a catfish. He may eat a few but he keeps the others alive'. Rowe, evidently, saw himself as the catfish in the University of Adelaide.

Perhaps it was these qualities that enabled him to persuade the Premier, Thomas Playford, to double the university's annual grant. It had increased only 20% over the previous decade, the lowest increase of any of the State universities. He achieved for academic staff higher salaries, half time for

research, better research funding and frequent study leave. In his first two years he made a number of strategic appointments, including twenty-eight new academic positions.

Graham Elford learned of one of those appointments when, as an Honours student, he made an appointment to see the newly arrived Vice-Chancellor. Graham wanted the Vice-Chancellor's advice about opportunities to undertake a PhD in the UK. The University conferred the DSc, but did not at that time offer the PhD. Rowe advised him to stay in Adelaide because the University was to introduce the PhD by the end of the year. Graham was hesitant because he was aware of the paucity of physics research in Adelaide, but the Vice-Chancellor went on to tell him that a new professor of physics with wide research interests was to arrive early in 1949.

The new Elder Professor of Physics was Leonard Huxley. He was an Oxford graduate, having gone there from Tasmania as a Rhodes Scholar in 1923. His DPhil work was done under John Townsend, famous for his work on electrical breakdown in gases. Huxley then had a brief appointment with the Radio Research Board in Canberra before returning to England where he was Head of Physics at what was then University College Leicester. During the war he was recruited into AP Rowe's TRE where he developed expertise in the operation of radar and established and headed a radar training school. At the end of the war he was appointed Reader in Electromagnetism in the Department of Electrical Engineering at the University of Birmingham. His research interests included electron motion in gases and radio wave propagation in the atmosphere. On the latter he collaborated with an old TRE colleague and pioneer of ionospheric research, John (Jack) Ratcliffe of Cambridge.

Mark Oliphant was then at the University of Birmingham and it was he who drew Huxley's attention to the advertisement for the Elder Chair of Physics. It is said that when AP Rowe received his application he accepted it quickly because he had formed a high regard for Huxley during the TRE days. Rowe later wrote that he had invited several sometime colleagues to apply, but without success and added that in the end the chair was 'filled competently'. Perhaps that reflects the tensions that later arose between Huxley and his Vice-Chancellor.

Before leaving for Adelaide, Huxley had conversations with Bernard Lovell of the University of Manchester who studied meteor astronomy using radar echoes from meteor trails recorded at his Jodrell Bank Experimental Station. Lovell was keen for similar observations to be made in the southern hemisphere and urged Huxley to establish such work in Adelaide.

The Huxley era begins

Bob Crompton was a member of the 1948 Honours class. He clearly recalls a morning in January of 1949 when he was standing in the small Department office chatting with a group from his Honours class. A visitor entered. He was dressed in a well-worn tweed sports coat and grey flannel trousers and he wore a felt hat over bushy eyebrows. He quietly announced: "I'm Huxley".

Leonard Huxley had come to take charge of the small department. His task was to lift it out of the doldrums. He had a supportive Vice-Chancellor who was eager to make new academic appointments and establish research activity. He also had a setting up fund of £15,000 that Rowe had persuaded the University Council to provide for the new Elder Professor to re-equip the Department. And he was fortunate that the 1948 Honours physics class, Kerr Grant's last, had been

a remarkable one. It was the largest ever, with nine students, four of whom were given first class Honours: Bob Crompton, Graham Elford, Barbara Kidman and David Sutton.

Within weeks of his arrival, Huxley called a meeting and asked who was interested in research. He wanted to start research in three areas and he was anxious to do it quickly. The first of these research programs was the study of the diffusion of slow electrons in gases. Bob Crompton and David Sutton took up this area and quickly began to construct an electron drift apparatus. Huxley had brought with him the stainless steel apparatus built by a PhD student in Birmingham, but Bob preferred to build a new version made of brass and coated first with silver and then with gold to ensure uniformity of the surface potential. The Birmingham apparatus was part of what Bob describes as a 'pathetic bundle of bits and pieces' that Huxley had brought with him, none of which was used. As they constructed the vacuum systems they needed, Bob and David had assistance from Roland and Nigel Oliphant, Mark's brothers, who had established the company Laboratory Supplies Ltd in 1947 and had a workshop in Gouger Street. A large double walled wire mesh cage was installed to eliminate the effects of electrical interference on their measurements of very small electron currents. Bob had earlier gained experience building equipment as a Departmental cadet. Now he earned a reputation for his exceptional experimental skills, including considerable expertise as a glass blower.

Huxley continued to write theoretical papers on electron diffusion in gases. They were important to the interpretation of the experimental data obtained by Crompton and Sutton until his analytic methods were replaced by numerical methods when computers became available in the early 1960s. Crompton and Sutton worked in close collaboration as they collected data. When, in February 1953, they submitted their PhD theses the titles made a subtle distinction between Bob's study of the collisions of slow electrons with gas molecules and David's study of the motions of slow electrons in gases.

The theses submitted by Bob and David were a considerable achievement in a department that had no tradition of PhD research. Huxley had provided encouragement rather than supervision, allowing his students to 'get on with it' and they had no models to consult when writing up their research. They were among the first PhD theses presented in the University.

The second of Huxley's research programs was a study of radio propagation through the ionosphere. Gordon Aitchison took this up and began assembling equipment to observe cross modulation between two radio beams. One beam was from a high powered Philips transmitter and the other from the transmitter for the ABC station 5CL, used at night after the station closed. Huxley had worked on ionospheric cross modulation with Ratcliffe, and continued to write theoretical papers on the subject in Adelaide. Aitchison received a PhD for this work in 1957. Geoff Goodwin joined the program and received an MSc in 1959. Gordon left to take up an appointment at the ANU in 1962. This was not long before the appointment of Basil Briggs opened a new era in ionospheric research in Adelaide.

The third program, radar meteor astronomy, was begun early in 1949 by Graham Elford. He was later joined by David Robertson from the Long Range Weapons Establishment (LRWE). David had written to Huxley in 1949 enquiring about the possibility of PhD work and enrolled at the beginning of 1951. He brought considerable technical expertise with him, having worked on the radio

frequency aspects of the synchrotron that Mark Oliphant was building in Birmingham and also on Doppler radar at LRWE. Even more to the point, he was an amateur radio ham and had a 500W transmitter at his Mount Lofty home. It was this transmitter, together with receivers in Adelaide, Burra and Kulpara, that was used to make the first observations of meteor trails. In 1950, two Honours students, Des Liddy and Alan Weiss, joined the group.

Graham Elford recalls that Huxley would walk through the laboratory most days, but they were free to develop the project themselves. Huxley formed and attended a weekly literature discussion group. They met on Saturday mornings and began by studying *The Upper Atmosphere* by the Indian physicist Sisir Kumar Mitra. Late in 1951 Huxley suggested that they search the literature for something specific to work on. They discovered a paper on the use of radar observations of the drift of meteor trails to study upper atmosphere winds and decided to make that the focus of their work. Huxley's 1952 paper on the persistence of meteor trails proved to be an important aid to interpreting the rate of decay of the radar echoes. Alan Weiss continued work on meteor astronomy and in 1952 he visited the University of Manchester. Lovell had offered to assist the Department to set up an independent radar to study meteor showers, and Alan returned with equipment for a new system. His work with it formed part of Alan's PhD thesis which he submitted in May 1954.

Early in 1954, the Antarctic Division of the Department of External Affairs sought proposals for study of the upper atmosphere. Graham Elford suggested that the Department build a meteor-radar to measure upper atmosphere winds in the Antarctic. The Division funded the project and Eric Murray developed a new pulsed radar system for the work. In December 1956 Carl Nilsson, a student who had just completed a BSc took the equipment to Mawson Base and operated it there for a year. This was during the International Geophysical year. Eric analysed the data for his PhD thesis. Carl later completed Honour Physics and a PhD on meteor orbits.

John Mainstone joined the group in 1955 and undertook an MSc project that became a PhD measuring the meteoroid speeds. John began this work using a magnetic tape recording system that had been developed by Eric Murray who had been in the 1953 Honours class. However, because the receiving equipment was located at a field station at Salisbury, a recording system that would operate reliably for long periods was needed and John set about designing a new multichannel recorder that came to be known as 'the pie cart'. John's measurements were the first in the Southern hemisphere and the most accurate anywhere.

Dave Robertson submitted his PhD thesis, 'Reflection of radio waves from meteor trails, with applications to the measurement of upper atmosphere winds', in August 1953. With Bob Crompton and David Sutton, he was in the first group of physics PhDs. They were conferred in 1954. Graham Elford followed late in 1954 with his thesis on the investigation of winds in the upper atmosphere.

David Stirling Robertson was a grandson of Sir Edward Stirling, surgeon, scientist and politician, and great grandson of Edward Stirling after whom two South Australian towns of Stirling were named. David graduated from the University of Adelaide in 1941 and went to work for Amalgamated Wireless Australasia. In 1948 he completed an MSc at the University of Birmingham under the supervision of Rudolph Peierls and then took up a position at the LRWE, Salisbury. After completing his PhD, David was a Fellow and then Senior Fellow at the ANU where he worked with Oliphant. For two years he was a Principal Research Scientist at the Brookhaven National Laboratory and then, in

1966 he returned to what was now the Weapons Research Establishment at Salisbury. There he took part in ground breaking work on Very Long Baseline Interferometry. In 1975 he received a DSc from the University of Birmingham. But always he was a radio ham, communicating with friends around the world. He retired from WRE in 1980 and died in 1999.

Huxley's initiative in starting these programs, his good fortune in having very able and enthusiastic students and his encouragement of them produced a new spirit of research in the department. It was an exciting time and it is remarkable that all three of his research programs have their successor in work that still continues.

This new research activity required funding and Huxley was active in seeking it. On his arrival in Adelaide, he renewed his contacts with the Radio Research Board in Canberra, became a member and chaired it from 1956-1961. Research funding from the Board was small but critical to the establishment and maintenance of his research initiatives. Some funding was also obtained from other sources such as the Antarctic Division of the Department of External Affairs. However, during Huxley's time in Adelaide, research work was always seriously underfunded.

In his first year Huxley threw himself into lecturing to Physics I students as his predecessor had done over a long period. He quickly realised that the rigour of his presentation was too demanding for the students and after that first year he concentrated on teaching electricity and magnetism. He was essentially a classical physicist and the introduction of modern physics into the courses was to come from others. However, Huxley's correspondence shows that within weeks of his arrival at the beginning of 1949 he was making extensive enquiries about the availability of text books, particularly in areas such as quantum mechanics and atomic physics. He was clearly determined to modernise the curriculum.

Edward (Ted) Radoslovich was a member of the Honours class in 1949. His experience was very much like that of preceding classes – the students lectured to one another from the Grimsehl texts and they learnt no modern physics. After his Honours year, Ted took up a position with the CSIRO Division of Soils at the Waite Campus. There he worked with Keith Norrish who was keen to build an X-ray fluorescence spectrometer that could identify the elemental constituents of minerals. Ted quickly learned some atomic physics and built a successful XFS instrument. He wrote a thesis on his work and took it to Professor Huxley who enquired who his supervisor had been. Ted confessed that he had not had one, but in due course the thesis was accepted and he was awarded an MSc in 1952. As a member of the CSIRO he was not permitted to undertake a PhD, but he obtained a CSIRO overseas scholarship that took him to Cambridge where he worked on X-ray crystallography of minerals. When he had completed his thesis work his project was taken up by John Kempster who was later appointed to a lectureship in Adelaide. After completing his thesis, Ted went to the Pennsylvania State University as a Fulbright Scholar and then returned to the Soils Division where he continued work in X-ray crystallography. In 1968 the University of Adelaide awarded Ted a DSc for his work on the determination of the crystal structures of minerals.

In February 1950, Huxley submitted to the Registrar details of teaching he wished to be done by senior students of the Department. The lecturing arrangements included three of the young researchers: Bob Crompton (3 Honours lectures on cosmic rays, 12 third year lectures on vector analysis and 10 second year lectures on physical optics); David Sutton (6 Honours lectures on the

wave nature of the electron, 10 third year lectures on modern physics and 10 second year lectures on vibrations and waves); and Graham Elford (6 Honours lectures on fundamental particles, 10 Honours lectures on statistics and 13 third year lectures on physical optics). Crompton and Sutton were listed as students with a Commonwealth Research Grant. Elford was listed as a student without a grant.

The first year lectures were scheduled to be given by George Fuller (9am), William Brooke (5.15pm) and Gordon Aitchison (12.15pm for medical and dental students). Huxley lectured to second and third year classes on electricity and magnetism and to the Honours class on mathematical physics.

Other topics included in the Honours lecture program in 1950 were: properties of electromagnetic waves (John Thomas), thermodynamics and quantum theory of heat (Roy Burdon), special theory of relativity (Murray Andrews), particle accelerators (Don Stevenson), nuclear transformations (Perry Miles), Magnetism (John Colville), radar circuit techniques (William Brooke) and scientific German (Sir Kerr Grant). Thomas, Andrews, Stevenson, Miles and Colville had all been members of the 1949 Honours class.

This was a big change from 1948 when there were no formal Honours lectures. The heavy dependence on recent Honours graduates to give the lectures was a matter of making best use of the resources available.

AP Rowe's endeavours provided Huxley with funding for new lecturers, and in March 1950 he appointed Bob Crompton and Graham Elford. Brooke resigned at the end of first term to take up a position at the LRWE and in June David Sutton was appointed as his replacement. Harry Medlin, who completed Honours in 1950, was appointed in April 1951. They were thrown into the deep end of lecturing while working towards their PhDs. That they all had very successful academic careers is a sign of Huxley's good judgement.

In a short time Huxley had stimulated a new spirit in his Department. It became a place where interesting things were happening. He loomed large in it, but he was normally a quiet man, somewhat shy and could seem aloof. While his peers called him Len, he was 'Prof' to everybody else. He had a formal manner that masked a puckish sense of humour. He had a clear vision of the traditions of the university as an institution and was noted for the depth and breadth of his scholarship. He was sometimes regarded as a strict disciplinarian. Bob Crompton tells a story that may shed some light on that perception. Huxley was sensitive to any noise entering the room when he was lecturing. One day some happy soul ambled past the upstairs lecture room, blithely whistling. Huxley's sandy eyebrows rose in anger, he wrenched the door open and roared "stop that whistling!" That had a dramatic impact on corridor behaviour.

The appointment of Stan Tomlin

There were two further appointments made by the University in the early 1950s that were landmarks in the development of the discipline of physics in Adelaide. The first to be appointed was Stan Tomlin.

Stan grew up in Rochford, Essex and won a scholarship to King's College London. In 1937, after only two years of undergraduate study, he graduated with first class Honours in Physics. He then began

PhD studies on a largely theoretical project concerning magnetic lenses to focus beta particles. Before he could complete his thesis war broke out and he was drafted into Standard Telephones and Cables where he worked on the development of the klystron as a microwave amplifier for radar receivers. He was granted patents for several electron velocity modulated devices and he received an award for this work. He completed his thesis in his spare time and graduated with a PhD in 1945. At the end of the war he returned to a lectureship in physics at Kings College and took up research in biophysics. He studied cell membrane structure using electron microscopy.

When he applied for a lecturing position that had been advertised by the University of Adelaide, Stan's motivation came from his belief that his daughter, who suffered from a respiratory condition, would benefit from the drier Adelaide climate. He was offered a senior lectureship and negotiated with the University to purchase an electron microscope with which he could continue his research in biophysics. He arrived in Adelaide in May 1950.

Stan established a biophysics research laboratory and two lines of work soon emerged: electron microscopy and X-ray diffraction. In 1951 Stan became a foundation member of the National Committee for Electron Microscopy. When the Philips EM100 electron microscope arrived in the Department in 1952, it was the third large electron microscope to be installed in Australia.

X-ray diffraction work was begun by Harry Medlin and Roy Worthington. Worthington was the first of Stan's students to enrol for a PhD. He constructed a high intensity X-ray tube for low angle diffraction studies of protein fibres. After completing his thesis he went to the Brooklyn Polytechnic Institute in New York, King's College in London, and then back to the United States where he pursued a career as a biophysicist at the University of Michigan and Carnegie Mellon University.

But it was Harry Medlin who first set up an X-ray tube in Tomlin's laboratory. His journey there had been an interesting one. He grew up in Orroroo until the family moved to Adelaide in 1930, was apprenticed with the Adelaide Electric Supply Company in 1935 and began attending evening courses in engineering at the South Australian School of Mines and Industries. In 1938 he enlisted in the Royal Australian Engineers and rose to the rank of Captain. After the outbreak of World War II he served in the Northern Territory and in Timor where, in early 1942, he was taken prisoner of war. About seven months later he was transferred to a prison camp in Batavia (Jakarta). There two remarkable things happened. First, in one of the camps there was a library of books taken from a school and among them Harry found a copy of *The Mathematical Theory of Electricity and Magnetism* by James Jeans. He obtained permission from his Japanese guards to keep it and another book. Harry was by this time suffering from beriberi and dysentery was rife. He was taken to the Mater Dolorosa Hospital that had been established in an old church. Harry's second piece of good fortune was to meet there Lieutenant Ir Felix van Wijk (Ir indicates an Ingénieur or Engineer), a fellow prisoner. Felix had been a lecturer at the Bandung Institute of Technology and to Harry he seemed to know everything about mathematics and physics. For the next 16 months Harry became Felix's student and together they studied the Jeans textbook that Harry still had with him.

After the war Felix took up a chair of Metallography in The Hague and Harry, when he was sufficiently recovered, pursued his heightened interest in mathematics and physics at the University of Adelaide where he enrolled as a CRTS student. By 1948 Harry was a third year student and, on the urging of Barbara Kidman, he joined the Committee of the Science Association and began his

lifelong interest in student and university politics. In 1949 he commenced Honours Physics, but in the middle of the year he was persuaded by Brian Rofe, recruiting officer of the LRWE, and another friend to join LRWE under a scheme that gave him the opportunity to undertake a PhD in England. He withdrew from the Honours class, travelled to England where he was accepted as a PhD student at the University of Cambridge and began work on an X-ray crystallography project. However, Harry became dissatisfied with the Department of Supply and early in 1950 he returned to Australia and resumed Honours physics. For his Honours project he set up an old X-ray tube, a relic of the Bragg days.

In April of the following year Harry was appointed Lecturer in Biophysics and in August he enrolled for a PhD. During his Honours studies Harry had been impressed by Stan Tomlin. He decided to work towards his PhD in Stan's laboratory and embarked on the determination of the structure of compounds of biological significance using X-ray diffraction. Each Monday morning Harry had a meeting with Stan, but Stan never became actively involved in Harry's project. In February 1955 Harry submitted a PhD thesis on the structure of parabanic acid crystals.

There is a sad but interesting story about Harry's work on the structure of parabanic acid. Sometime in 1954, when Harry's work was well advanced, Ren Potts of the Department of Mathematics drew Harry's attention to the 22 May issue of *Nature* in which there was a brief letter on the structure of parabanic acid by David Davies and JJ Blum of Caltech. This was a great disappointment to Harry and he sent off a letter to *Nature* with his own results. Harry had discovered some unusually short carbon-oxygen contacts in the parabanic acid crystal that had been overlooked by Davies and Blum. The Editor sent Harry's letter to Linus Pauling at Caltech for refereeing and in August 1954 Pauling replied to the Editor advising him that Harry's letter should not be published in *Nature* because Harry's results were not significantly different from those already published by Davies and Blum. He suggested that it might be sent to a specialised journal such as *Acta Crystallographica*. In September 1954 Davies and Blum submitted a more extensive paper on the structure of parabanic acid to *Acta Crystallographica*. Strangely, that paper did not refer to their earlier letter to *Nature*, but it did contain a footnote added in proof in February 1955 (the same month that Harry submitted his PhD thesis) saying that: "Some of the molecular contacts shown in Fig. 3 were overlooked by us and were called to our attention by Mr E. H. Medlin. They included the distances of 2.77 Å between O1 and C2 which is rather surprisingly short." Harry's work was never published and that footnote is the only recognition he received for a significant discovery. The experience must have had a profound impact on Harry and, although he was later to supervise some talented post-graduate students, it is not clear that, except for a period of study leave in Cambridge in 1965-66, he ever again did hands-on experimental work.

In 1952 the new electron microscope was installed in the Department of Physics. The first post-graduate student to work with it was Barbara Potts (Kidman). In 1948 she had been the first woman to complete Honours Physics. She then went to the University of Oxford where she joined a research group investigating the biological effects of radioactive strontium and enrolled for a DPhil. In 1951 she withdrew and returned to Adelaide with her new husband, Ren Potts, who had been appointed to a lectureship in applied mathematics.

Barbara immediately noticed that the Adelaide department was greatly changed - it was now busy with research activity. She enrolled for a PhD Tomlin's laboratory and began an electron microscope

study of the microanatomy of several biological structures. She remembers Stan Tomlin as an inexperienced but helpful supervisor. He worked in the laboratory himself so that she had constant interaction during which he often made helpful suggestions about experimental techniques.

Soon after Barbara Potts submitted her thesis, Barbara Hall (Possingham), who had worked in the electron diffusion laboratory, submitted hers. In 1956 they were the first women to receive PhDs from the University. Barbara Potts had a subsequent career in computer science and Barbara Possingham in secondary teaching.

By January 1953, there were four PhD candidates working in Tomlin's laboratory: Murray Andrews, Harry Medlin, Barbara Potts and Charles Worthington. Andrews had been a brilliant undergraduate student, but he withdrew from the PhD and went to Melbourne to work with the CSIRO. At that time Huxley was supervising six PhD candidates: Gordon Aitchison, Bob Crompton, Graham Elford, Dave Robertson, David Sutton and Alan Weiss.

Stan's publications were mainly articles written jointly with his students on biophysical topics involving the techniques of electron microscopy, X-ray diffraction and electrophoresis. There were also papers on the intensity of X-ray emission and, later, the optical and electrical properties of thin films.

On his arrival in Adelaide, Stan was astonished by the lack of topics such as quantum mechanics and relativity in the Department's courses. The modernisation of the undergraduate curriculum began as a result of his influence. He presented the first sophisticated courses in what was then called modern physics, contributing particularly in topics such as thermal physics, statistical mechanics, quantum mechanics and solid-state physics.

The advent of Mathematical Physics

The other key appointment of the early 1950s was that of Bert Green. In 1949 AP Rowe had decided, in consultation with Huxley, to create a chair of mathematical physics. Angas Hurst later wrote in his memoir on the life of Bert Green that the chair was meant to be a fillip to mathematics research and was modelled on a chair of mathematical physics in Birmingham held by the distinguished physicist Rudolf Peierls. Bert himself wrote that there was "some hope of reviving the traditions set by Horace Lamb and William Bragg". At that time a new chair meant a new department. The new Department of Mathematical Physics was located in the Physics Building because, according to Bert, that was considered the best way of optimising relationships with the Departments of Physics and Mathematics. It was a brilliant appointment and, although the new department was never to have more than four academic staff, it became a jewel in the University's crown.

Bert was born in Ipswich, England, and from an early age his outstanding mathematical ability was evident. He won a Royal Scholarship that took him to the Imperial College of Science and Technology, London, and he graduated with first class honours in mathematics in 1941. During the war years he was a Meteorological Officer in the RAF and developed insight into environmental matters. After the war he went to the University of Edinburgh where he worked with Max Born. His work on a general kinetic theory of liquids earned him a PhD in 1947 and he was awarded a DSc in

1949. He went to the Princeton Institute for Advanced Studies for a year and then for the year 1950-51 he was with Erwin Schrödinger at the Dublin Institute for Advanced Studies.

When the University of Adelaide advertised for a professor, a reader and a lecturer in Mathematical Physics, Bert applied for the chair and was appointed. He had been offered positions in the United States but, according to Angas Hurst, his acceptance of the Adelaide position reflected his preference to be free to follow his own path rather than be immersed in the hothouse atmosphere of American science. He arrived in Adelaide in August 1951.

The first accompanying appointment, to a senior lectureship, was Harry Messel who had worked with Bert in Dublin. Harry arrived in September 1951 on the same ship that carried Barbara and Ren Potts. Ren was a graduate of the Physics Department and had gone to Oxford as the 1948 Rhodes Scholar where he worked in mathematical physics. He was returning to take up a position in the Mathematics Department. Thus an interesting set of relationships between Physics, Mathematical Physics and Mathematics was set up.

The Department of Mathematical Physics was soon a lively part of the University. The Department always had the character of a small research institute of international distinction based around the brilliance of Bert Green. His interests ranged over particle physics, quantum mechanics, statistical physics, general relativity, biophysics, environmental physics and neurophysiology. Peter Szekeres later commented that it was this amazing coverage of the subject that made the Department the unique place that it was.

During the nine months before Messel left to take up the Chair of Physics at the University of Sydney, he and Bert worked feverishly on their theory of cosmic ray air showers, continuing work they had begun in Dublin. It seemed an odd pairing. Bert was of a retiring disposition and Harry was an extrovert, but they combined well and published thirteen papers in that short period! At the time this work allowed a breakthrough in the interpretation of experimental cosmic ray observations, but their analytic approach was later replaced by numerical Monte Carlo calculations.

One weekend in 1952 Bert 'filled in time', as Angas Hurst later put it, by devising a new theory for the generalised statistics of particles. The paper he wrote that weekend was published in the *Physical Review* under the title 'A Generalized Method of Field Quantization'. That work became the origin of the field of parastatistics and the paper remains the most often cited of all Bert's publications.

Messel was replaced in 1953 by John Ward, another brilliant physicist famous for his work in quantum electrodynamics, but after less than a year he left for an appointment at the University of Maryland. In 1957 Angas Hurst was appointed to the position and he was to play a major part in the story of physics in Adelaide.

Angas Hurst was a graduate of the University of Melbourne. He enrolled in 1941, but after one year he decided to enlist in the Air Force. He trained to operate and maintain radar equipment, acquiring skills in circuit theory and soldering, and was posted to command radar stations on Normanby, Tami and Manus Islands off the coast of Papua New Guinea. He finally graduated with Honours in mathematics in 1948 and obtained a scholarship to undertake a PhD at Cambridge, following his

father who had been the first South Australian to graduate from Cambridge. When Angas' supervisor left after one term he 'fossicked around' to find his own problem and wrote a thesis on perturbation expansions in quantum field theory. His time in Cambridge was very import: he met and was influenced by Paul Dirac and he learnt that he had 'as much right to tackle hard problems as anybody else'. During his subsequent career he always instilled that attitude in his students.

As he was finishing his PhD, Angas received an offer of a senior lectureship in mathematics at the University of Melbourne and he returned there in 1952. It was from there that he was appointed as Senior Lecturer in Adelaide.

When he arrived in Adelaide, Angas had difficulty obtaining University support to obtain a loan to purchase a house. Because the two appointees preceding him had stayed for only a short time, the Registrar, Vic Edgeloe, had formed the view that it was a temporary position so that Angas was not eligible for assistance.

Angas quickly acquired a reputation for his intellectual prowess and for uncompromisingly challenging lectures and exams. Peter Szekeres, who was later appointed to the Department, claims that he doesn't remember managing to solve a single problem in the exam paper when he took Angas' course in classical mechanics. Following his Cambridge experience, Angus worked on fundamental problems in quantum electrodynamics, looking for a rigorous basis. In an interview with Bob Crompton he later said of this work that "it is not new particles and it is not new laws of physics, but it puts things on a solid foundation. I am very proud of that."

The pairing of Angas and Bert Green was very special. At one time they collaborated on the Ising model of order-disorder phenomena such as ferromagnetism. As Angas described it, however, collaboration meant that Angas told Bert of an idea he had for a fundamentally simpler basis for a solution, Bert said "that is interesting" and then Bert came back with a paper in which the mathematics was worked out. Angas admired Bert and regarded him as a genius who was very original and always followed his own ideas. He said that "people were not always sure about Bert. They found out that a lot of the things he was saying were right – but not at the time."

In 1952, Otto Bergmann from the Institute for Advanced Studies in Dublin was appointed as a Research Fellow. He was followed by a succession of visitors of distinction, and an ability to attract outstanding scholars became a characteristic of the Department. The list of visitors to the Department reads like a 'who's who' of physics: Paul Dirac, Freeman Dyson, Murray Gel-Man, Rudolph Peierls, Ed Salpetre, John Bell and so on.

The first student of the Department was Ian McCarthy. He was in the 1952 Honours Physics class and then undertook a PhD on the behaviour of particles obeying generalised statistics under the supervision of Bert Green.

In the beginning there was no expectation that the Department of Mathematical Physics would contribute to teaching or committee work. However, to give it the ability to attract post-graduate students, Mathematical Physics gradually became a teaching department in its own right. At first it contributed to higher level subjects offered by the Departments of Physics and Mathematics. Bert Green introduced a relativity unit for physics students in 1952 and also a course in particle physics.

Angas taught topics such as classical mechanics and ordinary and partial differential equations in Applied Mathematics. In 1953 Honours in Mathematical Physics was offered for the first time and the first student, Marta Sved, enrolled in 1955. By 1960 there were six Honours students, including Lindsay Dodd who was later appointed as a lecturer and had a long career in the Department. Also in that year, two new third year subjects were introduced: Mathematical Physics A, to be taken concurrently with Physics III, and Mathematical Physics B, to be taken concurrently with Applied Mathematics III.

The Department of Mathematical Physics made a sometimes uncomfortable triangle with the Departments of Physics and Mathematics. Tension could be related to competition for students that arose from the way the University funded its departments. Much later it was related to the formation of the Faculty of Mathematics and to the unfortunate developments that led to the demise of Mathematical Physics as a separate department.

A time of consolidation

AP Rowe was convinced that one of the main handicaps of Australian universities was isolation from overseas centres of learning. He introduced a study leave scheme that was then the most generous in the country. It was not a sabbatical scheme but leave granted on the basis of the benefit that would be obtained. Bob Crompton was the first of the new physics lecturers to take advantage of this opportunity. He went to Swansea in Wales soon after he had submitted his PhD thesis in 1953. When he returned he began work on the construction of a new electron drift apparatus that allowed the drift distance to be varied so that measurements could be extended to lower electron energy. It was a masterpiece of design for ultra-cleanliness. Bob was assisted by John Gascoigne, a talented technician in the physics workshop whose contribution became so important that he was seconded to the electron diffusion laboratory. This was the first time technical support had been provided directly to a research laboratory by the Department.

Soon after Bob Crompton's return in 1954, David Sutton took study leave. According to the Registrar's letter granting leave, it was understood that he would work "either at University College, London, under Professor Massey or at Imperial College under Professor Blackett." Huxley must have known Massey as he communicated a paper by Crompton, Huxley and Sutton to the Royal Society of London. It is not clear how the idea of working with Blackett arose, but it was to Imperial College that David went. Because Bob Crompton was taking the lead in the slow electron work, it is likely that David was keen to change his research field.

At Imperial College David worked with Blackett on the development of a new magnetometer for studies of the magnetism of rocks. Earlier, while at the University of Manchester, Blackett had built a sensitive magnetometer that had been used by several researchers to obtain data on palaeomagnetism.

After his return to Adelaide in 1955, David continued to work on geomagnetism. He took on a graduate student, William Mumme, and in 1957 they published a paper on the interpretation of airborne magnetic surveys. For his MSc and subsequent PhD work, Mumme constructed two magnetometers of differing sensitivity and made measurements of magnetism in samples of rocks from Victoria and NSW that had recently been studied by Edward Irving and colleagues from the ANU. While he was a graduate student at Cambridge, Irving had used Blackett's magnetometer to

study the magnetism of rocks from Scotland and had demonstrated that there had been movement relative to the magnetic pole. In 1954, at about the time David Sutton went to Blackett's laboratory, Irving took up a position at ANU, and his work on the magnetism of Australian rocks showed that movement relative to the magnetic pole did not match that found in Europe. This result pointed clearly to continental drift and helped settle the dispute that had been raging.

David must have been close to these dramatic events while working in Blackett's laboratory, but it is not clear that this influenced his subsequent work because his research interest moved to seismology. He joined a consortium to make seismic observations during the 1956 atomic bomb tests at Maralinga. The project had been suggested by Sir Edward Bullard, a geophysicist who had been a student of Blackett. The University of Sydney and the Australian National University were also involved in the project.

There had been a seismograph in the Department for some time. When the Adelaide Observatory was closed in 1948, the Milne-Shaw seismograph then in operation was transferred to the University of Adelaide. It was eventually installed in the basement of the new Observatory Building where, according to Kerr Grant's geophysicist son Colin, it was 'thrown out of action' by the Adelaide earthquake of March 1954. For the 1956 seismic project, David Sutton replaced it with a Benioff seismograph. However, vibration caused by local traffic was a problem and, part way through the project, the seismograph was moved to a Postmaster General's Department site at the summit of Mount Bonython near Adelaide.

Also in 1956, Huxley obtained an International Geophysical Year grant of £6,000 to purchase a Benioff-type seismometer to become part of an international network of identical instruments. David then wrote to the Registrar requesting a grant to pay his airfare to visit the University of Queensland which was installing an identical seismometer. He explained that Professor Huxley had asked him to install and operate the Adelaide seismometer and that in Queensland he would study the installation and operation of the seismometer and the interpretation of its records.

In 1957 a further IGY grant of £2,000 was obtained for the construction of the vault needed to accommodate the seismometer on the PMG site at Mount Bonython. The Adelaide Seismograph Station commenced operation at Mount Bonython in 1958, but it was not until 1962 that that it became part of the World Wide Standard Seismograph Network. Two further stations, at Hallet and Cleve, were added to the Network and gradually a further ten small stations were installed, mainly in the Flinders Ranges.

David's work in seismology made an important contribution to the understanding of the seismicity of South Australia. After David's premature death in August 1981, the seismograph network that he had developed was maintained by Bob Nation while Roy McDougall managed the data analysis. In 1985 the network was transferred briefly to Flinders University and then permanently to the SA Department of Mines. It is still in operation.

In 1955, Harry Medlin took study leave and he returned to the Cavendish Laboratory in Cambridge to work on X-ray crystallography. Then, in 1956 as Harry was leaving the Cavendish, it was Graham Elford's turn for study leave and he too went to the Cavendish Laboratory where he worked with Jack Ratcliffe. While there he met and was impressed by Basil Briggs who, a few years later came to

Adelaide and began construction of the Buckland Park array that made possible major advances in ionospheric research.

The mechanical workshop was a key facility for teaching and research in experimental physics. In the time of Kerr Grant, there were two or three technicians in the workshop and their work was mainly to build and maintain apparatus for lecture demonstrations and the undergraduate teaching laboratories. Perry Miles said that in 1950, when he designed a vacuum apparatus he needed for his MSc project, he received no critique of his design and little assistance from the physics workshop. But, gradually the size of the workshop grew and it acquired the skills needed to respond to the new research requirements. When Huxley arrived the workshop foreman was Cyril Paul. He was assisted by an instrument maker, an electronics technician and several trainees, including a young John Gascoigne. When Cyril Paul retired in the mid-1950s, the new workshop foreman was Lindsay Hettner.

For many years it was common for post-graduate students in experimental physics to design, and frequently to build, their own apparatus. This had the benefit that they acquired technical skills that were valuable in their later career and Adelaide graduates in experimental physics were then known worldwide for their technical design skills.

Late in 1957, Malcolm Elford, Graham's brother, completed a PhD project in the electron diffusion laboratory and left Adelaide to take up a post-doctoral appointment in Canada. Whereas Adelaide students going overseas only a few years before were impressed when they found a research culture they had never known in Adelaide, Malcolm was impressed by the level of funding available to researchers. In Adelaide he had been accustomed to obtaining glass-metal vacuum seals by salvaging them from old equipment. Hook-up wire for electrical circuits was carefully recycled. In the Canadian laboratory researchers had free access to a liberally stocked store. When in 1959 he returned to Adelaide, the lack of adequate funding was threatening the continuation of the electron diffusion work.

The end of the Huxley era

At the end of 1959 Huxley resigned to take up a position on the Executive of the CSIRO. After holding the Elder Chair of Physics for eleven years he had decided that it was time to move on. He left a Department radically different from the one he came to. He had enabled the spirit of research to take root so that the Department boasted several significant research programs. The problem now was the lack of funding for the equipment and facilities it needed to better compete on the world stage of experimental physics.

The Physics Department had a greatly improved undergraduate curriculum and a lecturing staff of twelve, more than double the size of the department Huxley came to. Four had been appointed in his final year: Arthur Bevan, a graduate of the Universities of London and Sydney, Charles Kempster, a Cambridge graduate, Bob Lawrance, an Adelaide graduate, and Leon Ericson, another local graduate. Lawrance and Ericson had both undertaken a PhD in Tomlin's laboratory. In addition, there were three full time demonstrators, three laboratory technicians, two data analysis staff and a workshop staff of five.

At this time, Bert Green and Angas Hurst were still the entire academic staff of the Department of Mathematical Physics. In 1960 Ian McCarthy was appointed to a lectureship, taking the academic staff of the Department to three.

Together, the two departments represented strength in the discipline of physics of which, in contrast with the situation in 1948, the University was entitled to be proud.

Huxley stayed with the CSIRO for only a short time. Before 1960 had ended he had taken up an appointment as Vice-Chancellor of the Australian National University. He persuaded the Commonwealth Treasury to provide funding to establish an Electron and Ion Diffusion Unit and the entire Adelaide research group, Bob Crompton, Malcolm Elford and their technician John Gascoigne, accepted the invitation to move to Canberra as foundation members of the new laboratory. This was a great loss to the Adelaide department.

An interregnum

After the departure of Huxley, Stan Tomlin was made interim Head of the Department of Physics. It was then that a remarkable development occurred that would resonate around the University. A Departmental Committee was established with a membership that included the academic staff and representatives of the general staff and students – both undergraduate and post-graduate. Its role was to make governance decisions and not just give advice to the Head of Department. This outbreak of academic self-government was a radical departure from the tradition of autocratic leadership by the professor.

While it is true that Stan believed strongly in academic freedom and the vigourous academic debate that could occur in such a committee, it was Harry Medlin's passionate interest in governance matters that gave life to the initiative. Stan 'encouraged and allowed' it, and invited Harry to become the Convenor and Secretary of the Committee.

It is most unlikely that this development could have occurred while AP Rowe was Vice-Chancellor. Although Huxley had enjoyed the support of an enthusiastic Vice-Chancellor after he arrived, he valued the traditions of universities as academic communities and later clashed with Rowe over his desire to 'run the University like a government department'. But AP Rowe had resigned his position as Vice-Chancellor on 1 May 1958, ten years to the day after taking up the appointment, and by 1960 Henry Basten was Vice-Chancellor. He was not an impediment to the move to departmental government. Within a few years departmental government became University policy and continued until it was overtaken by a new era of managerialism two decades later.

There can be no doubt that Stan Tomlin dearly aspired to the vacant Elder Chair. He had expanded his laboratory to include several fields of solid state physics research, hoping that the initiative would strengthen his application. However, he was profoundly disappointed by the way events emerged. This disappointment added to the sadness he had carried since the death of his daughter. Nevertheless, he continued to be a distinguished member of his department. The solid state physics work flourished and he wrote papers on traffic flow with his son John who did a PhD in applied mathematics with Ren Potts. In 1970 Stan's achievements were recognised by the University of London with the award of a DSc. When he retired in 1981 he had supervised 11 MSc projects and 25 PhDs.

Stan was a quiet person with a dry sense of humour. At meetings he would occasionally make an incisive observation with only the slightest hint of a smile. He had a strong and somewhat formal sense of decorum. He was the type of person who did the *Times* crossword over lunch. He was an outstanding physicist and an impressive scholar with broad interests.

When the Elder Chair was advertised, Mark Oliphant was at the ANU as Director of the Research School of Physical Sciences. It was he who urged John Henry Carver, a graduate of Sydney and Cambridge who was then a Senior Fellow in the School, to apply for the position. Carver was appointed. This meant that a second successive Elder Chair appointment had been influenced by Mark Oliphant. It seemed to close a cycle.

Acknowledgements: This article is based on a series of interviews conducted in 2011-12, other published and unpublished material and documents held in the University archives. The use of material from interviews, conversations or correspondence with the following is acknowledged: David Boyd, Roger Brown, Mary Carver, Robert Crompton, Graham Elford, Malcolm Elford, John Gascoigne, Don Griffin, Angas Hurst, Max Lohe, Brian Matthews, Don McCoy, Harry Medlin, Perry Miles, Bob Nation, Lee Parkin, Barbara Possingham, Barbara Potts, Ted Radoslavich, John Tomlin, John Symonds and Peter Szekeres.

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Thanks are due to Helen Bruce of the University of Adelaide Archives.

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5 May, 2013