

= Eric Burhop =

Eric Henry Stoneley Burhop , FRS (31 January 1911 ? 22 January 1980) was an Australian physicist and humanitarian .

A graduate of the University of Melbourne , Burhop was awarded an 1851 Exhibition Scholarship to study at the Cavendish Laboratory under Lord Rutherford . Under the supervision of Mark Oliphant , he investigated nuclear fusion . He produced a non @-@ relativistic theory of the Auger effect in 1935 , followed by a relativistic treatment the following year . He later wrote a monograph on the subject . He returned to the University of Melbourne as a lecturer in 1936 , and helped Professor Thomas Laby build up the physics department there .

During the Second World War he worked in the Radiophysics Laboratory in Sydney , where he produced a laboratory model of a cavity magnetron . In September 1942 , he returned to Melbourne as the officer in charge of the Radar Research Laboratory , where he continued the development of cavity magnetrons and reflex klystrons for radar sets . In May 1944 , he became one of three Australian physicists who worked on the Manhattan Project , which created the first atomic bombs .

In early 1945 , Harrie Massey offered Burhop a position as a lecturer in the Mathematics Department at University College , London . He fostered international cooperation in nuclear physics . As part of a five @-@ nation study of K mesons and their interaction with atomic nuclei that went on for several years , his group produced a wealth of new results , including the first observation of a double lambda hypernucleus . He spent a year on secondment to CERN , as secretary of a committee that recommended the construction of the Intersecting Storage Rings and the Super Proton Synchrotron . In 1974 and 1975 , an international team under his leadership carried out a successful search for the Λ_c^+ (charmed lambda baryon) .

= = Early life = =

Eric Henry Stoneley Burhop was born in Hobart , Tasmania , on 31 January 1911 , the third child of two Salvation Army officers , Henry Augustus Burhop and his wife Bertha née Head . He had two older sisters , Edna and Vera . His family was not wealthy , and they moved frequently owing to the nature of his parents ' evangelical work . The family moved to Ballarat in 1923 , where he attended Ballarat High School for most of his secondary education , receiving his leaving (Year 11) certificate in 1926 . He transferred to Melbourne High School for his final year .

Burhop won a scholarship , and entered the University of Melbourne in 1928 . He initially studied civil engineering , but switched to science after two years , and majored in physics . In 1929 , he was awarded a bursary that provided financial assistance . He graduated in 1931 with a bachelor of science BSc degree with first class honours in physics . He then earned a Bachelor of Arts (BA) , also with first class honours , in mathematics in 1932 , and a master of science in physics in 1933 .

For a master 's research problem , Professor Thomas Laby had Burhop investigate the probability K shell ionisation by electron impact by measuring the intensity of the resultant X @-@ ray emissions . This aroused an interest in the Auger effect , a subject in which he would later become an authority . By contrast , his master 's thesis on " The Band Spectra of Diatomic Molecules " had little influence on his later work .

= = Cavendish Laboratory = =

The thesis was good enough , though , for Burhop to be awarded an 1851 Exhibition Scholarship to study at Cambridge University 's Cavendish Laboratory under Lord Rutherford in 1933 . The scholarship included a first @-@ class ticket to London on the liner RMS Oronsay . At this time the Cavendish Laboratory was one of the leading centres of physics in the world . In 1932 , Cavendish laboratory scientists John Cockcroft and Ernest Walton split the atomic nucleus , James Chadwick discovered the neutron , and Patrick Blackett and Giuseppe Occhialini confirmed the existence of the positron . Burhop was supervised by a fellow Australian , Mark Oliphant . He was initially

assigned a task of investigating the diffusion of positive alkali metal ions on hot metal surfaces , but soon switch to a more interesting subject , the measurement of the excitation function for the pairs of deuterons producing a triton through nuclear fusion :

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$1D + 2$

$1D \rightarrow 3$

$1T + p$

Burhop was able to observe the reaction at energies of less than 8 keV . He continued his investigations of X @-@ rays and the Auger effect . He conducted investigation of the probabilities of the ionisation of the K and L shells of silver , using the Born approximation . In 1935 , he produced a non @-@ relativistic theory of the Auger effect . This followed by a relativistic treatment in 1936 with Harrie Massey , another Australian expatriate fellow at the Cavendish . His work on the Auger effect would culminate in a monograph , The Auger Effect and Other Radiationless Transitions (1952) .

Before coming to Cambridge , Burhop had not engaged in political activities . At Cambridge he encountered political debate generated by the suffering caused by the Great Depression and the rise of fascism in Europe . While he rejected his parents ' faith in favour of rationalist science , he did not reject their values , especially that of compassion for others , and there was no estrangement between them . At Cambridge he embraced socialism , and believed that scientists had a moral responsibility to society , one that included fighting fascism .

= = University of Melbourne = =

Burhop returned to Australia in 1936 , taking up a position as a lecturer at the University of Melbourne , where Laby was eager to build up the Physics Department by adding expertise in the latest developments in nuclear physics . He married his fiancée , Winifred Ida Stevens , on 23 December 1936 in a Salvation Army ceremony . They had a daughter and two sons . He completed his Cambridge doctor of philosophy (PhD) degree under Laby 's supervision in 1938 . It was in three parts : " The ionization and reorganization of an atom in an inner shell , with special reference to the Dirac theory of the electron " ; " Some problems in atomic disintegration " ; and " Note on the migration of atoms on a surface " . Burhop established the first research program in the field in an Australian university , employing scientific equipment that he brought back from Britain . The centrepiece of the research effort was a 300 keV accelerator that produced a homogeneous neutron beam , which he commissioned in August 1939 . He gave lectures on modern physics to the undergraduates , and on quantum mechanics to the postgraduates .

After the outbreak of the Second World War in 1939 , the Physics Department worked on the development of optical munitions , particularly aluminised mirrors for aerial photography . In February 1942 , Oliphant persuaded Laby to release Burhop and Leslie Martin to work on microwave radar at the Radiophysics Laboratory in Sydney . Burhop and Martin produced a laboratory model of a cavity magnetron on 23 July 1942 . Their magnetron was based on an overseas design , but made entirely from local components so that it could be manufactured in Australia . In September 1942 he returned to the University of Melbourne as the officer in charge of the Radar Research Laboratory , an outpost of the Radiophysics Laboratory , where his task was turning his cavity magnetrons and reflex klystrons from prototypes into production models . Eventually , over 2 @, @ 000 radar sets were produced in Australia .

= = Manhattan Project = =

In January 1944 , Oliphant had Sir David Rivett , the head of the Council for Scientific and Industrial Research , release Burhop to work on the Manhattan Project , the Allied effort to create atomic bombs . In May 1944 , Burhop joined Oliphant 's British Mission at the Ernest Lawrence 's Radiation Laboratory at the University of California in Berkeley . He was one of three Australian physicists working on the Manhattan Project , all at Berkeley , the others being Oliphant and Massey . The

Radiation Laboratory 's task was to develop an electromagnetic isotope separation process . Burhop worked with David Bohm in Massey 's Theoretical Group , studying the characteristics of electric discharges in magnetic fields , today known as Bohm diffusion . They also studied the ionisation of uranium compounds used as feed in the electromagnetic uranium enrichment process such as uranium tetrachloride (UCl_4) and uranium hexafluoride (UF_6) . Burhop 's work involved the occasional visit to the Manhattan Project 's Y @-@ 12 electromagnetic faculty at Oak Ridge , Tennessee .

= = University College , London = =

In early 1945 , Massey offered Burhop a position as a lecturer at University College , London , in the Mathematics Department , of which Massey was the departmental head . He had to wait until he was released by the University of Melbourne , and did not reach London until after the war ended in August 1945 . His wife and family , who had stayed in Australia while he was working in the United States , joined him in London some months later . Living and working conditions in London were much worse than in California or Australia . Wartime shortages persisted , and the college had suffered bombing damage , so the Mathematics Department were located in temporary quarters . He was promoted to reader in 1949 . Massey became head of the Physics Department in 1950 , and Burhop moved there too . He became a professor in 1960 , and Dean of the Faculty of Science in 1967 .

Burhop listed " furtherance of international scientific cooperation " as one of his hobbies . He worked with the University of Edinburgh and the University of Padua to establish a high @-@ altitude cloud chamber on Marmolada that commenced operation in 1953 . In 1957 , he collaborated with Occhialini and C. F. Powell on a five @-@ nation study of K mesons and their interaction with atomic nuclei that went on for several years , and produced a wealth of new results , including the first observation of a double lambda hypernucleus . He spent the 1962 ? 63 academic year on secondment to CERN , and was secretary of a committee chaired by Edoardo Amaldi that drew up its policy for accelerator development . The machines the committee recommended , the Intersecting Storage Rings and the Super Proton Synchrotron (SPS) were built , and became an important part of physics research in Europe for decades to come .

When Burhop took charge of the Bubble Chamber Group at University College in 1967 , he was quick to grasp the advantages of heavy liquid bubble chambers for studying neutrino interactions , and steered the group towards participation in joint European ventures , using the Gargamelle . The group 's discovery of neutral currents in 1973 was a milestone on the road to the theoretical unification of electromagnetism with the weak force . In 1974 and 1975 , with the help of Robert R. Wilson , the director of the Fermilab in the United States , an international team from Fermilab and seven European laboratories under Burhop 's leadership carried out a search for a new particle , the existence of which Burhop had predicted in 1963 . He had suggested that neutrino interactions could create short @-@ lived (perhaps as low as 10^{-14} s) particles that could be detected with the use of nuclear emulsion . Experiment E247 at Fermilab successfully detected particles with a lifetime of the order of 10^{-13} s . A follow @-@ up experiment WA17 with the SPS confirmed the existence of the Λ_c^+

(charmed lambda baryon) , with a flight time of $7.3 \pm 0.1 \times 10^{-13}$ s .

= = Social activism = =

The Australian Security Intelligence Organisation (ASIO) opened a file on Burhop in 1948 , believing him to be a secret member of the Communist Party , and an associate of Ian Milner , who was known through Venona intercepts to have passed secret documents to the Soviet Union . In July 1951 , the British government cancelled his passport when he accepted an offer to travel to the Soviet Union . A new passport was issued after he gave the Foreign Secretary a written assurance that he would not seek to travel to the Soviet Union or other Iron Curtain countries .

Like many scientists who had worked on the Manhattan Project , Burhop was concerned about the

dangers of nuclear weapons , and addressed over 500 public meetings to raise awareness of the subject . He had been a founding member of the Australian Association of Scientific Workers in 1939 , and after the war became chairman of the Atomic Science Committee of the Association of Scientific Workers , and a member of its Science Policy Committee , in Britain . In this capacity he helped organise the Pugwash Conferences on Science and World Affairs in 1957 . He founded the British Society for Social Responsibility in Science in 1969 . He was president of his local branch of the Association of University Teachers from 1970 to 1972 , and of the World Federation of Scientific Workers from 1971 to 1980 .

Over the years Burhop received a number of honours and awards . He was elected a Fellow of the Royal Society in 1963 , and delivered its Rutherford Memorial Lecture in 1979 . He was elected a Foreign Member of the German Democratic Republic 's Academy of Sciences in 1971 . He received the Joliot @-@ Curie Medal of Peace in 1965 , the Lenin Peace Prize in 1972 , and the Bulgarian Order of Saints Cyril and Methodius in 1973 .

Burhop retired in 1978 . He died in Camden , London , from empyema as a result of stomach cancer on 22 January 1980 . He was survived by his wife and children . His papers are in the University College , London , Special Collections .