= Brian Josephson =

Brian David Josephson , FRS (born 4 January 1940) , is a Welsh theoretical physicist and professor emeritus of physics at the University of Cambridge . Best known for his pioneering work on superconductivity and quantum tunnelling , he was awarded the Nobel Prize in Physics in 1973 for his prediction of the Josephson effect , made in 1962 when he was a 22 @-@ year @-@ old PhD student at Cambridge . Josephson is the only Welshman to have won a Nobel Prize in Physics . He shared the prize with physicists Leo Esaki and Ivar Giaever , who jointly received half the award for their own work on quantum tunnelling .

Josephson has spent his academic career as a member of the Theory of Condensed Matter group at Cambridge 's Cavendish Laboratory . He has been a fellow of Trinity College , Cambridge since 1962 , and served as professor of physics from 1974 until 2007 .

In the early 1970s Josephson took up transcendental meditation and turned his attention to issues outside the parameters of mainstream science . He set up the Mind ? Matter Unification Project at the Cavendish to explore the idea of intelligence in nature , the relationship between quantum mechanics and consciousness , and the synthesis of science and Eastern mysticism , broadly known as quantum mysticism . Those interests have led him to express support for topics such as parapsychology , water memory and cold fusion , and have made him a focus of criticism from fellow scientists .

= = Early life and career = =

= = = Education = = =

Josephson was born in Cardiff , Wales , to Jewish parents , Mimi (née Weisbard , 1911 ? 1998) and Abraham Josephson . He attended Cardiff High School , where he credits some of the school masters for having helped him , particularly the physics master , Emrys Jones , who introduced him to theoretical physics . In 1957 he went up to Cambridge , where he read mathematics at Trinity College , Cambridge . After completing Maths Part II in two years , and finding it somewhat sterile , he decided to switch to physics .

Josephson was known at Cambridge as a brilliant , but shy , student . Physicist John Waldram recalled overhearing Nicholas Kurti , an examiner from Oxford , discuss Josephson 's exam results with David Shoenberg , then reader in physics at Cambridge , and asking : " Who is this chap Josephson ? He seems to be going through the theory like a knife through butter . " While still an undergraduate , he published a paper on the Mössbauer effect , pointing out a crucial issue other researchers had overlooked . According to one eminent physicist speaking to Physics World , Josephson wrote several papers important enough to assure him a place in the history of physics even without his discovery of the Josephson effect .

He graduated in 1960 and became a research student in the university 's Mond Laboratory on the old Cavendish site , where he was supervised by Brian Pippard . American physicist Philip Anderson , also a future Nobel Prize laureate , spent a year in Cambridge in 1961 ? 1962 , and recalled that having Josephson in a class was " a disconcerting experience for a lecturer , I can assure you , because everything had to be right or he would come up and explain it to me after class . " It was during this period , as a PhD student in 1962 , that he carried out the research that led to his discovery of the Josephson effect ; Cambridge unveiled a plaque on the Mond Building dedicated to the discovery in November 2012 . He was elected a fellow of Trinity College in 1962 , and obtained his PhD in 1964 for a thesis entitled Non @-@ linear conduction in superconductors .

= = = Discovery of the Josephson effect = = =

Josephson was 22 years old when he did the work on quantum tunnelling that won him the Nobel Prize . He discovered that a supercurrent could tunnel through a thin barrier , predicting , according

to physicist Andrew Whitaker , that " at a junction of two superconductors , a current will flow even if there is no drop in voltage ; that when there is a voltage drop , the current should oscillate at a frequency related to the drop in voltage ; and that there is a dependence on any magnetic field . " This became known as the Josephson effect and the junction as a Josephson junction .

His calculations were published in Physics Letters (chosen by Pippard because it was a new journal) in a paper entitled " Possible new effects in superconductive tunnelling , " received on 8 June 1962 and published on 1 July . They were confirmed experimentally by Philip Anderson and John Rowell of Bell Labs in Princeton ; this appeared in their paper , " Probable Observation of the Josephson Superconducting Tunneling Effect , " submitted to Physical Review Letters in January 1963 .

Before Anderson and Rowell confirmed the calculations , the American physicist John Bardeen , who had shared the 1956 Nobel Prize in Physics (and who shared it again in 1972) , objected to Josephson 's work . He submitted an article to Physical Review Letters on 25 July 1962 , arguing that " there can be no such superfluid flow . " The disagreement led to a famous confrontation in September that year at Queen Mary College , London , at the Eighth International Conference on Low Temperature Physics . When Bardeen (then one of the most eminent physicists in the world) began speaking , Josephson (still a student) stood up and interrupted him . The men exchanged views , reportedly in a civil and soft @-@ spoken manner .

Whitaker writes that the discovery of the Josephson effect led to " much important physics , " including the invention of SQUIDs (superconducting quantum interference devices) , which are used in geology to make highly sensitive measurements , as well as in medicine and computing . IBM used Josephson 's work in 1980 to build a prototype of a computer that would be up to 100 times faster than the IBM 3033 mainframe .

= = = Nobel Prize = = =

Josephson was awarded several important prizes for his discovery , including the 1969 Research Corporation Award for outstanding contributions to science , and the Hughes Medal and Holweck Prize in 1972 . In 1973 he won the Nobel Prize in Physics , sharing the $ 122 @,@ 000 award with two other scientists who had also worked on quantum tunnelling . Josephson was awarded half the prize " for his theoretical predictions of the properties of a supercurrent through a tunnel barrier , in particular those phenomena which are generally known as the Josephson effects . "

The other half of the award was shared equally by Japanese physicist Leo Esaki of the Thomas Watson Research Center in Yorktown , New York , and Norwegian @-@ American physicist Ivar Giaever of General Electric in Schenectady , New York , " for their experimental discoveries regarding tunneling phenomena in semiconductors and superconductors , respectively . " Unusually , none of the winners had held professorships before being awarded the prize .

= = = Positions held = = =

Josephson spent a postdoctoral year in the United States (1965 ? 1966) as research assistant professor at the University of Illinois . After returning to Cambridge , he was made assistant director of research at the Cavendish Laboratory in 1967 , where he remained a member of the Theory of Condensed Matter group , a theoretical physics group , for the rest of his career . He was elected a Fellow of the Royal Society (FRS) in 1970 , and the same year was awarded a National Science Foundation fellowship by Cornell University , where he spent one year . In 1972 he became a reader in physics at Cambridge and in 1974 a full professor , a position he held until he retired in 2007 .

A practitioner of transcendental meditation (TM) since the early seventies , Josephson became a visiting faculty member in 1975 of the Maharishi European Research University in the Netherlands , part of the TM movement . He also held visiting professorships at Wayne State University in 1983 , the Indian Institute of Science , Bangalore in 1984 , and the University of Missouri @-@ Rolla in 1987 .

= = Parapsychology = =

= = = Early interest and transcendental meditation = = =

Josephson became interested in philosophy of mind in the late sixties and , in particular , in the mind ? body problem , and is one of the few scientists to argue that parapsychological phenomena (telepathy , psychokinesis and other paranormal themes) may be real . In 1971 he began practising transcendental meditation (TM) , which had become popular with several celebrities , most famously the Beatles .

Winning the Nobel Prize in 1973 gave him the freedom to work in less orthodox areas , and he became increasingly involved ? including during science conferences , to the irritation of fellow scientists ? in talking about meditation , telepathy and higher states of consciousness . In 1974 he angered scientists during a colloquium of molecular and cellular biologists in Versailles by inviting them to read the Bhagavad Gita (5th ? 2nd century BCE) and the work of Maharishi Mahesh Yogi , the founder of the TM movement , and by arguing about special states of consciousness achieved through meditation . " Nothing forces us , " one scientist shouted at him , " to listen to your wild speculations . " Biophysicist Henri Atlan wrote that the session ended in uproar .

In May that year Josephson addressed a symposium held to welcome the Maharishi to Cambridge . The following month , at the first Canadian conference on psychokinesis , he was one of 21 scientists who tested claims by Matthew Manning , a Cambridgeshire teenager who said he had psychokinetic abilities ; Josephson apparently told a reporter that he believed Manning 's powers were a new kind of energy . He later withdrew or corrected the statement .

Josephson said that Trinity College 's long interest in the paranormal meant that he did not dismiss these ideas out of hand . Several presidents of the Society for Psychical Research had been fellows of Trinity , and the Perrott @-@ Warrick Fund , set up in Trinity in 1937 to fund parapsychology research , is still administered by the college . He continued to explore the idea that there is intelligence in nature , particularly after reading Fritjof Capra 's The Tao of Physics (1975) , and in 1979 took up a more advanced form of TM , known as the TM @-@ Sidhi program . According to Anderson , the TM movement produced a poster showing Josephson levitating several inches above the floor . Josephson argued that meditation could lead to mystical and scientific insights , and that , as a result of it , he had come to believe in a creator .

= = = Fundamental Fysiks Group = = =

Josephson became involved in the mid @-@ seventies with a group of physicists associated with the Lawrence Berkeley Laboratory at the University of California , Berkeley , who were investigating paranormal claims . They had organized themselves loosely into something called the Fundamental Fysiks Group , and had effectively become the Stanford Research Institute 's (SRI) " house theorists , " according to historian of science David Kaiser .

There was a lot of popular and government interest at the time in quantum mechanics ? the American government was financing research at SRI into telepathy ? and physicists able to understand it found themselves in demand . The Fundamental Fysiks Group used ideas from quantum physics , particularly Bell 's theorem and quantum entanglement , to explore issues such as action at a distance , clairvoyance , precognition , remote viewing and psychokinesis .

In 1976 Josephson travelled to California to meet two leading members of the group , laser physicists Russell Targ and Harold Puthoff , authors of Mind Reach (1977) . Targ and Puthoff had set up a parapsychology (" psi ") lab at SRI and had had papers published about their work ? which included testing later @-@ discredited claims by Uri Geller that he could make objects move using psychokinesis ? in Nature and other peer @-@ reviewed journals . The San Francisco Chronicle covered Josephson 's visit .

Josephson co @-@ organized a symposium on consciousness at Cambridge in 1978 , publishing the proceedings as Consciousness and the Physical World (1980) , with neuroscientist V. S.

Ramachandran . A conference on " Science and Consciousness " followed a year later in Cordoba , Spain , attended by physicists and Jungian psychoanalysts , and addressed by Josephson , Fritjof Capra and David Bohm (1917 ? 1992) .

By 1996 he had set up the Mind ? Matter Unification Project at the Cavendish Laboratory to explore intelligent processes in nature . In 2002 he told Physics World : " Future science will consider quantum mechanics as the phenomenology of particular kinds of organised complex system . Quantum entanglement would be one manifestation of such organisation , paranormal phenomena another . "

= = = Reception and views on the scientific community = = =

Josephson delivered the Pollock Memorial Lecture in 2006 , the Hermann Staudinger Lecture in 2009 and the Sir Nevill Mott Lecture in 2010 .

Matthew Reisz wrote in Times Higher Education in 2010 that Josephson has long been one of physics ' " more colourful figures . " His support for unorthodox causes has attracted criticism from fellow scientists since the 1970s , including from Philip Anderson . Josephson regards the criticism as prejudice , and believes that it has served to deprive him of an academic support network .

He has repeatedly criticized " science by consensus , " arguing that the scientific community is too quick to reject certain kinds of ideas . " Anything goes among the physics community ? cosmic wormholes , time travel , " he argues , " just so long as it keeps its distance from anything mystical or New Age @-@ ish . " Referring to this position as " pathological disbelief , " he holds it responsible for the rejection by academic journals of papers on the paranormal . He has compared parapsychology to the theory of continental drift , proposed in 1912 by Alfred Wegener (1880 ? 1930) to explain observations that were otherwise inexplicable , which was resisted and ridiculed until evidence led to its acceptance after Wegener 's death .

Science writer Martin Gardner criticized Josephson in 1980 for complaining to the New York Review of Books , along with three other physicists , about an article by J. A. Wheeler that ridiculed parapsychology . Several physicists complained in 2001 when , in a Royal Mail booklet celebrating the Nobel Prize 's centenary , Josephson wrote that Britain was at the forefront of research into telepathy . Physicist David Deutsch said the Royal Mail had " let itself be hoodwinked " into supporting nonsense , although another physicist , Robert Matthews , suggested that Deutsch was skating on thin ice given the latter 's own work on parallel universes and time travel .

In 2004 Josephson criticized an experiment by the Committee for Skeptical Inquiry to test claims by Russian schoolgirl Natasha Demkina that she could see inside people 's bodies using a special kind of vision . The experiment involved her being asked to match six people to their confirmed medical conditions (plus one with none) ; to pass the test she had to make five correct matches , but made only four . Josephson argued that this was statistically significant , and that the experiment had set her up to fail . One of the researchers , Richard Wiseman , professor of psychology at the University of Hertfordshire , responded that Josephson had no record of publishing on parapsychology . Keith Rennolis , professor of applied statistics at the University of Greenwich , supported Josephson 's position but that the experiment was " woefully inadequate " to determine any effect .

Josephson 's reputation for promoting unorthodox causes was cemented by his support for the ideas of water memory and cold fusion , both of which are rejected by mainstream scientists . Water memory is purported to provide an explanation for homeopathy ; it is mostly dismissed by scientists as pseudoscience , although Josephson has expressed support for it since attending a conference at which French immunologist Jacques Benveniste first proposed it . Cold fusion is the hypothesis that nuclear reactions can occur at room temperature . When Martin Fleischmann , the British chemist who pioneered research into it , died in 2012 , Josephson wrote a supportive obituary in the Guardian and complained to Nature that its obituary had failed to give Fleischmann due credit . Antony Valentini of Imperial College London withdrew Josephson 's invitation to a 2010 conference on the de Broglie @-@ Bohm theory because of his work on the paranormal , although it was reinstated after complaints .

= = Awards = =

= = Selected works = =