

Professor Sir Sam F. Edwards FLSW FRS FIMA (1928–2015)

Founder Member of the IMA and IMA president 1980–81

Sir Sam, or simply Sam, as he insisted that people refer to him, was one of the giants of the modern era of physics. With Pierre-Gilles de Gennes, the 1991 Nobel Laureate, he helped establish the new field of soft matter physics. This field deals with systems that are easily deformed under normal temperatures and pressures and includes polymers, colloids, particulates, liquid crystals, powders, and most biological systems. Sam worked hard to introduce rigorous mathematics to this field. Many of us in the community believed that he deserved to share the 1991 Nobel prize, although Sam never expressed this feeling himself.

Sam was born in Swansea on 1 February 1928. He did very well in school and was sent to Swansea Grammar School, where his potential was recognised immediately. The Headmaster convinced him to study Latin instead of Welsh, anticipating early on a potential application to Oxford or Cambridge.

Sam often recalled to me the joy he felt at 15, when his studies narrowed to focus on Physics, Chemistry and Mathematics. Not that this reflected on his very well rounded education – throughout the years he was a fountain of knowledge in history, classical music, gardening, politics, food, as well as a consummate wine buff.

At 17, as the second world war ended, Sam came to Gonville and Caius college on a Chemistry scholarship, but switched to Mathematics, which was then the only route into theoretical physics. Nevertheless, of the many accolades showered on him later in his life, he was particularly proud to be awarded the Davy Medal for Chemistry from the Royal Society in 1984. Sam always saw himself as an intuitive thinker and, while enjoying very much the application of mathematics to understand physical systems, he was not much into proving theorems. In 1949, he became a graduate student in Caius and this marked the start of his illustrious research career.

In 1951, Sam was awarded a year fellowship in Harvard. The story goes that the then master of Caius, the 1935 Nobel Laureate Professor Sir James Chadwick, summoned Sam to ask why he had not applied for a research fellowship in the college. Sam's response was: 'Well, I applied last year and you did not accept me, so I saw no point in applying again' and then adding coolly: 'besides, I received an offer from Harvard!'. Sam nevertheless acknowledged that Chadwick had encouraged him to go to Harvard to establish his research career.

In Harvard, Sam approached Julian Schwinger, the 1965 Nobel Laureate, for a problem that he could sink his teeth into. Schwinger set him on a set of differential equations, which he had derived earlier. Sam produced a clever approximation that solved the equations, which earned him Schwinger's respect, but not before Sam had worked hard to convince him of the solutions' validity.

From Harvard, Sam continued to the Institute of Advanced Study in Princeton, but the year he spent there turned out not to be very fruitful for him scientifically. The only interesting story he had to tell from that period concerned his morning travels to the Institute on the same bus with Einstein.

Sam returned to the UK in 1953 for a lectureship position in Birmingham with Sir Rudolf Peierls and he married Merriell.



From Birmingham, Sam and Merriell moved to Manchester, where Sam started to produce excellent work with a string of good students and visitors. In 1972 Sam was elected John Humphrey Professor of Physics and he moved to the Cavendish Laboratory in Cambridge, where he lived the rest of his life. In 1984 he was elected the Cavendish Professor, a position he held until 1995.

He also held government positions. In 1973, he succeeded Brian Flowers as the Chairman of the Science Research Council (SRC), the predecessor of EPSRC and BBSRC. His service on the SRC earned him a knighthood in 1975. He used the experience he gained to then become the Chairman

of the Defence Scientific Advisory Council and later the Chief Scientific Advisor to the Department of Energy.

His many interesting stories from that period could fill a volume, but he did not let his government work stop his research pursuit. While much of his research during this period was carried out on weekends in Cambridge, some was done during SRC meetings under the guise of taking notes. Amazingly, it was during this period that his mathematical approach started to transform polymer science into a fundamental theoretical field. Masao Doi joined him and together they wrote a series of papers that forever changed the field. Sam liked to say that trying to keep up with Doi often left him breathless. Their work culminated in a definitive textbook on Polymer physics, which is used in university courses to this day.

I met Sam in 1989, when I came as a postdoc to work with Robin Ball at the Cavendish Laboratory. As soon as I arrived, Sam, who was the group leader, summoned me to his office to both study me and give me some advice. The lecture I received I later titled *How not to be a theoretical physics prima donna*. Sam believed that inventing simplistic spin models is not too exciting and that I would benefit much more from looking at problems important to the industry. These problems are more challenging, he said, they often involve several physical mechanisms, several scales and, importantly, any progress I make might actually benefit someone. Ever since, I choose which problems to work on in light of that lecture.

Sam lived his life to the full, always enjoying the moment and pursuing one of his many passions: physics, his family, fine wine, good food and many others. Although a great dinner host, he was not one for small talk. I remember coming back to the UK, after five and a half years in the US, during which we had very little contact, and phoned him to let him know of my arrival. I opened with: 'Hello Sam, this is Rafi'. His response was: 'Rafi, consider a foam flowing around an obstacle' and we dived into a 30-minute scientific discussion, as if continuing from the previous day.

In 1989, Sam formulated a new statistical mechanics for granular matter, which opened a new direction in the physics community. He influenced Robin Ball to work in this area and Robin hired me to work with him in Warwick University. The following year I started to collaborate much more closely with Sam, a collaboration that continued until this year – our last paper together was published in 2015. I was captivated by him and our collaboration.

We would have long physics discussions, which would trigger stories and discussions on French wines, new world Chardonnay, the use of polymer physics to improve beef dishes, British history, and the relations between frost and sweetness of peas.

Sam also had a very keen sense of the proper etiquette and integrity in science. A good example is the following story. Sam was not computer savvy, which led to many amusing anecdotes that could fill yet another volume. In 2005, he was scheduled to present at a Powders and Grains meeting in Stuttgart our joint paper on force-based statistical mechanics and our newly proposed concept – ‘Angoricity’. I prepared for him a PowerPoint presentation, but not having used this software before, he asked me to print it as overhead transparencies, which I did. Just before he was about to deliver the talk, he slipped and the transparencies scattered. People collected them for him, but they were out of order. Sam apologised to the audience, saying that I had prepared the transparencies and that he was unsure of the correct order. Nevertheless, he went on to give a clear presentation, using the out-of-order transparencies. Unfortunately, he did not notice that my name was omitted from the co-authorship of that paper in the proceedings. In spite of me making light of the matter, Sam felt

that this omission reflected somehow on his integrity and kept agonising and apologising over it for years later.

After my parents passed away Sam took on the role of my mentor. It was always a pleasure to be with him. He was witty, wise, funny and very knowledgeable. I often found that, after being with him, I had learned something new. Not necessarily in science; he educated me about fine wine, good food, British history, politics and the machinations of the university and colleges. But above all, it was his passion for physics and the pursuit of understanding that made him the focus of attraction for so many.

Sam was a giant of a physicist and an amazing human being. He was inspirational, admired and loved by those of us closest to him. I feel blessed for the privilege to have been a close companion of his in the afternoon and evening of his life. On several occasions Sam said to me: ‘Rafi, if I drop dead tomorrow, I’ve had a good run’. You had a great run, Sam. You had a run that most scientists can only dream of. You have enriched many lives and you left a fantastic legacy. Our thanks and love go with you on your last journey. Goodbye!

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