Professor Charles Frank

An obituary

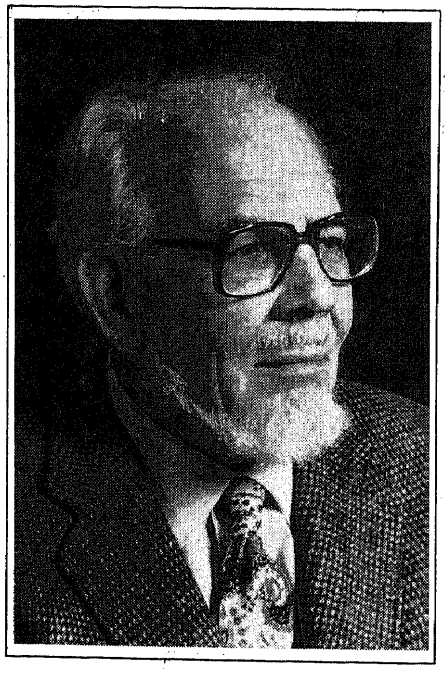
In the death of Professor (Sir) Charles Frank on 5 April 1998 in Bristol at the age of 87, the world has lost one of the most brilliant and original scientists of this century.

His original contributions cover a wide range, from many areas of condensed matter, geophysics, cold fusion to scientific intelligence work of great military significance.

Frederik Charles Frank was born of English parents in Durban, South Africa on 6 March 1911 but the family moved to their home in Suffolk, England when he was only a few weeks old. He received his education at Thetford Grammar School, Ipswich School and Lincoln College, Oxford where he completed his D.Phil. degree (Physical Chemistry) in 1937. Thereafter he did his post-doctoral work for two years with Peter Debye at the Kaiser Wilhelm Institut für Physik, Berlin. The fluency in German that he acquired during this period proved to be of immense value in the military intelligence work later. On his return to Britain in 1939 Frank worked in the Colloid Science Laboratory, Cambridge (1939–40), then joined the Scientific Civil Service (1940) and continued as its member for the next six years. During this period, after a brief stay at the Chemical Defence Research Establishment, Porton (1940), he was associated with his life long friend R. V. Jones in the Air Ministry Intelligence. He displayed uncanny skill in interpreting correctly, from fragmentary data, the development of V-weapons by the Germans. The book by R. V. Jones – *Most Secret War* – is replete with tributes to Frank on war time scientific intelligence work.

When the war was over, Frank started his regular research activities at the H.H. Wills Physics Laboratory, University of Bristol with which he had a very long association holding different academic positions – Research Fellow in Theoretical Physics (1948–51), Reader (1951–54), Professor of Physics (1954–69), Henry Overton Wills Professor of Physics and Director of the Lab. (1969–76), Emeritus Professor (1976–98).

In 1947 he published the theoretical idea of muonic atoms. Owing to the mass of muon being 200 times that of the electron, the orbit size of such atoms will be very small. Thus muonic atoms can come much closer and lead to fusion. In the context of cold fusion claims from 1989 onwards, many variants of this idea have been invoked. In a solid matrix the effective mass of an electron or a pair of electrons, in the presence of dislocation or other defects, can be very large. Such electron pairs give rise to local charged bosons and one can visualize the formation of bosonic atoms or molecules. In



deuterated palladium, the bosonic molecule D_2 can undergo cold fusion.

It is the formulation of the theory of crystal growth by Frank and collaborators in 1949, that established him as one of the leading scientists of the world. Crystal growth processes would be extremely slow without the role of defects, particularly screw dislocations. This idea of the enhancing role of screw dislocations in crystal growth is one of the landmarks in crystal physics and led to crystal growth researches by hundreds of scientists all over the world.

When I joined H.H. Wills Physics Laboratory in 1957 on British Council Fellowship, I came in closer contact with him. The Laboratory had a galaxy of great physicists – C. F. Powell, M. H. L. Pryce, F. C. Frank, David Bohm and many others to interact with. It was during the coffee and tea breaks when professors and research scholars assembled everyday that Frank was at his scintillating best. As soon as he took his seat, he would take over the topic of discussion showing deep knowledge on diverse subjects. At this time of his life he was developing his theory of liquid crystals. This was apparent from his notions of the geometrical features of complex systems such as liquid crystals. These involved affine connections, linear faults (disclinations) – Frank director of oriented molecules and the faults contributing to the Frank elastic energy density by 'splay', 'twist' and 'bend'. Developed in 1957–58 this work on liquid crystals has guided the growth of the field since then.

Next he entered the field of polymer science. The motivating drive was his curiosity to understand the growth of small crystals by the folding up and packing of long chain polymer molecules where each strand was longer than the crystal dimension. He created an active group in polymer physics in the laboratory which has made many outstanding discoveries.

In geophysics, his two-phase picture of the Earth's mantle consisting of not only the solid, but liquid channels between the solid grains is now considered the central concept for volcanism and large-scale flow of the mantle.

In September 1977, I went to H.H. Wills Physics Laboratory again as a Visiting Professor for a year. Frank had retired in 1976 but continued to visit the Lab. as Emeritus Professor. Knowing that I would be there, S. Ramaseshan asked me to persuade Frank to come to Bangalore as Raman Visiting Professor of the Indian Academy of Sciences. When I met him in this connection, he said that if I could remove the apprehensions of Lady Frank, their visit to Bangalore may be possible. We all met at dinner at his home. By the time I left their house, their fears were allayed and the best time to visit was worked out. Both Charles and Lady Frank stayed at Raman Research Institute from December 1979