OBITUARIES

Bunji Sakita 1930 – 2002

Professor Bunji Sakita, distinguished professor of physics at the City College of New York (CCNY), passed away on 31 August while in Japan, after a year-long struggle with cancer. Sakita was born in 1930 in the Toyama area of Japan. He received his first degree from Kanazawa University in 1953, and his Masters from Nagoya University in 1956 as part of Sakata's group. He was among several students recruited by Robert Marshak to come to Rochester University, and received his doctorate in 1959 under Charles Goebel. He went on to a postdoctoral position and a professorship at the University of Wisconsin. During this time, and while visiting the Argonne National Laboratory, Sakita wrote a series of influential papers on the quark model, introducing the new symmetry group SU(6), which generated considerable scientific interest among physicists as it united spin and isospin.

At Wisconsin, Sakita wrote some of the fundamental papers on the "dual resonance model", which now forms the foundation of string theory. With Goebel, he generalized the Veneziano amplitude to the many-particle case. With K Kikkawa and M Virasoro, he showed how to correct a crucial defect in the theory (unitarity) by including loop diagrams, much like Feynman diagrams. With his student C S Hsue, and with J L Gervais, he then generalized this to the functional formalism, based on Riemann surfaces, which today provides the most powerful formulation of string theory. Sakita and Virasoro also showed how ordinary field theories, in the infinite loop limit, can create fishnet diagrams which approximate string theory (which helped form

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some of the basis of the 1/N approximation). In these seminal papers, we see the foundations of string perturbation theory, the string functional formalism, and conformal field theory.

After J Schwarz, A Neveu and P Ramond introduced spin into the dual resonance model, Sakita and Gervais revealed the supersymmetry underlying the theory by writing down the first linear supersymmetric action, which today forms the basis of the superstring action. (Different versions of supersymmetry were also discovered in the Soviet Union at around this time.) B Zumino and J Wess, stimulated by the paper of Sakita and Gervais and by a seminar Sakita gave at CERN in the spring of 1973, then generalized this to a variety of quantum field theories defined in four dimensional space–time, rather than the two-dimensional world sheet. This led to the beginning of the application of supersymmetry to the physical world. (Sakita fondly remembers, in his memoirs, talking to Zumino in the CERN coffee lounge. Sakita said: "If you allow me to use anti-communting c-numbers, Gervais and I have written down a transformation of a fermi field to a bose field in the Nuclear Physics paper." Zumino replied" "It's OK to use anti-communting c-numbers. Schwinger has frequently used them.")

With the rapid expansion of the graduate physics programme at CCNY in the 1970s, Sakita followed Robert Marshak (who became president of the college) and joined the faculty at CCNY as distinguished professor in 1970. He presided over a rapid growth of the high-energy group, which developed string field theory, superconformal gravity, and research in strong coupling theory and collective co-ordinates. He received the Guggenheim Fellowship in the 1970s and was awarded the Nishina Prize in Physics in 1974. With Gervais and his student A Jevicki, he wrote a series of papers presenting the general formalism of collective co-ordinates and its full perturbation theory, allowing one to link point particle theories into those describing extended objects. This was extended to gauge theories with his student S Wadia, and Gervais. With his student J Alfaro, he applied the method of stochastic quantization to large N theories.

Sakita's interests were broad and varied, always seeking out the fundamental basis found in physical systems. In later years, he turned his attention to problems in solid-state physics, especially two-dimensional systems which exhibit W symmetry, and also physical characteristics found in high-energy physics (for example the fractional Hall Effect) with his colleagues S Iso and D Karabali.

Sakita leaves behind two children, Mariko and Taro. His warmth, leadership, modesty, and vision will be sorely missed by his students and colleagues all over the world and especially at CCNY.

Antal Jevicki, Brown University; Michio Kaku and Parameswaran Nair, CCNY; and Spenta R Wadia, Tata Institute of Fundamental Research, Mumbai.