

Anil Kumar

Prof. Anil Kumar of Physics Department, Indian Institute of Science (IISc), Bangalore died in a tragic road accident near the Institute on 2 November 2002.

Born on 10 April 1951 at Jalandhar, Panjab, Anil Kumar received his MSc (1973) and Diploma in Applied Physics (1974) both from Punjabi University, Patiala. He received the Ph D degree in physics from IISc in 1979, having worked under the guidance of E. S. Raja Gopal. Subsequently, Anil Kumar started his professional career with postdoctoral work for several years at University of Pittsburgh and University of California at Santa Clara, both in USA, and at other places. He was appointed Assistant Professor in the Physics Department, IISc in 1987, became an Associate Professor in 1993 and a full Professor of physics in 1998. I knew Anil Kumar for several decades through personal interactions and through his participation in the DAE Solid State Physics Symposia. His experimental contributions to various aspects of complex systems in condensed matter physics were of interest to me.

Phase transitions and critical phenomena in solids, liquids and multicomponent liquids have been frontier areas of research in condensed matter physics for several decades. 'Universality of description of physical systems near a critical point in seemingly dissimilar systems' manifests itself and is realized through these studies. The theoretical works of Landau, Kadanoff, Wilson, Fisher and others concerning these phenomena and renormalization group theory spurred experimental activities in this area. Anil Kumar was active in this esoteric field for nearly twenty-five years.

Anil Kumar investigated a variety of polar and non-polar binary, ternary and multicomponent liquid systems using a variety of experimental techniques involving measurements of (a) AC and DC electrical resistivity, (b) electrical conductivity fluctuations, (c) light scattering and (d) turbidity. These studies began with investigations of phase transitions and critical phenomena in simple liquid mixtures, but subsequently progressively got extended to discovery and study of systems with double, triple and quadruple critical points, re-entrant phase transitions involving special critical points and multiple re-entrant phase transitions.

Anil Kumar was leading one of the important and very few experimental

groups studying such complicated behaviour in multicomponent systems anywhere in the world. He was able to make unusual and excellent contributions to the understanding of these complex and subtle phenomena because of his skills as an outstanding experimenter who had designed and built exceptionally high-precision measurement standards in the experiments, and by an intuitive choice of proper materials that exhibit these phenomena for investigations. The ingenuity in the design and development of temperature controllers, which can be used to hold temperatures, steady to within thousandths of a degree or better over prolonged periods of time, was impressive. While temperature as a variable parameter is routinely used in the study



of critical phenomena, Anil Kumar used pressure, addition of water and/or salt as other variables effectively in several systems for probing various aspects of critical phenomena.

Specific results obtained can be garnered only by going through his long list of publications in various journals. By summarizing, injustice may be committed to his voluminous and high-quality output. However, I wish to focus attention on only a few aspects that made an impression on me:

(i) Sometime in early eighties, Anil Kumar published a detailed review in *Physics Reports*, co-authored with E. S. Raja Gopal and H. R. Krishnamurthy. This report drew heavily on the research investigations in his department itself. However, within a decade, he was invited to write a second review article by the same journal; he co-authored this with T. Narayanan and the review was based on his studies of re-entrant phase

transitions in multicomponent liquids. By any standards, publication of two *Physics Reports* articles relating to one's experimental investigations is a good measure of one's calibre and contributions.

It is because of such efforts that he had been invited to give talks at the DAE Solid State Physics Symposia first at Bhopal in 1988 and subsequently at Kolkata in 1995. I had seen his posters in the DAE Symposium at Jaipur in 1994 and it was a matter of great satisfaction to listen to him at Kolkata, presenting these and other results against a broad perspective. The last time I heard him presenting further work carried out by his group was through a review talk at the National Conference on High Pressure Physics and Technology held in Kalpakkam in 1997. His work was well-recognized internationally too; he was recently invited to give a plenary talk and chair one of the sessions at the IUPAC International Conference on Chemical and Biological Thermodynamics.

(ii) The other important notable achievement of Anil Kumar is one related to discovery of a new critical point, namely the quadruple critical point in quaternary liquid mixtures.

(iii) His paper in the *Journal of Chemical Physics* related to coexistence curve and critical double point in polymer systems, drew my attention because Anil Kumar and his coworkers were able to study the esoteric phenomenon by addition of mere water to polystyrene and acetone system.

(iv) Anil Kumar did not confine himself merely to liquid mixtures. He delved in the study of other complex systems like colloids, magnetic systems and chalcogenide glasses and perhaps even liquid crystals, exposing the underlying universality behaviour.

Anil Kumar, through his genial temperament and exuberance in discussing his work, was a role model to many young researchers; he set a high standard for youngsters. Anil Kumar was a Fellow of Indian Academy of Sciences. I join many others in paying homage to a dear friend who was pleasant and unassuming in his personal interactions. He has left behind his wife Mythili and a young daughter.

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