Raja Ramanna second scientist in V. P. Singh's ministry, but fate of Science Advisory Council unknown

A month after Prime Minister V. P. Singh appointed M. G. K. Menon his minister of state for science and technology, nuclear scientist Raja Ramanna was made minister of state for defence. While both appointments came as surprises—this is the first time scientists have held these jobs—, neither incumbent is new to matters of government. Ramanna had earlier been scientific adviser to the defence minister. He has also served as director of the Bhabha Atomic Research Centre, Bombay, and as chairman of the Atomic Energy Commission. At the time of his appointment as minister, he was director of the National Institute of Advanced Studies in Bangalore.

In a world conditioned to look for signs of political compulsions, Singh, by plumping for a nuclear scientist for the defence ministry, may have raised some eyebrows. But his appointment of well-known scientists to two key ministries is widely viewed as a positive step. Perhaps, too, Ramanna's passion for classical music—he's also a proficient player of the piano—and his interest in religion and philosophy ought to be taken note of.

Meanwhile, the fate of the Science Advisory Council to the Prime Minister (SAC-PM) which was constituted when Rajiv Gandhi was prime minister, is not known. The chairman of the council, C. N. R. Rao, is reported to have written to V. P. Singh seeking a decision on the future of the council. In November last, SAC-PM had prepared a list of priority recommendations.

SAC-PM's recommendations

A major point made by SAC-PM is that planning for and investment in S&T must show increasing relationship with investment for socioeconomic development. With the Government likely to be increasingly constrained in the matter of allocating resources, industry should fund a greater portion of R&D.

The council recommended that special attention be paid to agriculture and water management, population control, preventive and promotive health care, higher education in science and engineering, development of knowledge-based industry, energy, transport, communications and advanced materials technology. It also suggested the setting up of a national science and technology commission to oversee coordination of S&T and integration of S&T with national economic planning. While basic research must continue to be promoted by the Science and Engineering Research Council, a more effective diffusion of the benefits of S&T to the people should be ensured. The council proposed a network of S&T organizations and specifically listed application of remote sensing, energy and ecology conservation, and use of local natural resources.

Meeting on neural network modelling significant, but fails to agree on national plan

A fast-growing area of contemporary research is the multidisciplinary field of modelling parts or the whole of the brain. The exercise is an attempt to understand the basic cognitive and pattern-recognizing abilities of human beings. Researchers from diverse disciplines like neurophysiology, psychology, artificial intelligence and condensed matter physics are interested and are challenged by problems in this new field of neural network modelling (NNM). Solutions to problems in NNM have significant implications for a variety of areas, such as image processing, cognitive modelling and combinatorial optimization.

Recognizing the importance of this emerging discipline, Department of Science and Technology (DST) organized a two-day meeting in the National Institute of Mental Health and Neuro Sciences (NIMHANS) in Bangalore on 27 and 28 December. The meeting was aimed 'at bringing forth ideas and recommendations as to how our country can get into the field of NNM as fast as possible to achieve substantial progress in acquiring a viable scientific expertise and capabilities in the field'.

Of the twenty-three participants invited, twenty actually participated in the meeting. Among the participants were N. Kumar and V. Rajaraman of the Indian Institute of Science (IISc), Bangalore, K. S. Yajnik of the National Aeronautical Laboratory, Bangalore, and K. R. Sharma of DST. To begin with, multidisciplinary overview talks on neural networks were presented. T. Desiraju of NIMHANS, who chaired the first session, spoke on 'Neural systems architecture and functioning principles'. C. Dasgupta (IISc) spoke on 'Physics and mathematical aspects of neural networks', Patnaik (IISc) on 'Computations simulating neural network principles', and S. Ramani (National Centre for Software Technology, Pune) on 'Software and neural net models'. Notable among the other presentations were those of M. Vidyasagar (Centre for Artificial Intelligence and Robotics, Bangalore), P. R. K. Rao (Indian Institute of Technology, Kanpur) and M. A. L. Thathachar (IISc). Representatives from the Advanced Numeric Research and Analysis Group (ANURAG), Hyderabad, and the Centre for Development of Advanced Computing (C-DAC), Pune, also spoke about their interest in NNM in addition to their development work in parallel computing.

Despite an entire morning's discussion on various aspects of NNM and on the identification of areas for a national programme of action, no coherent and strong viewpoint emerged and preparation of a 'draft outline of national programme' could not be undertaken immediately. The lack of any convergent viewpoint on the action programme is not surprising considering the fact that the field is very young, though rapidly

evolving, and the meeting itself was the first of its kind in the field of NNM. The meeting did agree that four experts, drawn from among the participants of the meeting, would work out the required draft outline of the national programme on NNM and submit it to DST.

In the background of major developments in the area of parallel computing, the neural network approach has much to offer as it is an inherently parallel approach to problem solving. Neural network-based algorithms could contribute significantly to application areas like picture processing, VLSI design and constrained optimization. In fact, realizing the importance of this work, the European Economic Community (EEC) has launched a programme called BRAIN (Basic Research in Adaptive Intelligence and Neuro Computing) to promote cooperation among researchers in mathematics, computer science, biology and condensed matter physics interested in neural networks.

G. Athithan, ANURAG, Hyderabad

Esoteric physics and delicate experiments

Dipankar Home

Quantum mechanics is now more than sixty years old. It is a strange theory. Despite tremendous empirical success covering a wide range of areas from nuclear reactors to liquid helium, worrying doubts continue to persist about its intriguing interpretational aspects. For the last sixty years physicists have been busy examining if this weird theory can interpret all the facts emerging from a comprehensive probing of the atomic and subatomic world. Now that the working rules have been vindicated to a great extent, physicists have become more concerned with the conceptual problems. The proliferation of literature and conferences on this topic reflect this new mood.

In recent years there has been a resurgence of interest in this subject owing to the emerging interface between experimental studies and foundational problems. Thanks to technological advances it is now possible to perform some incredibly delicate experiments seeking to probe recondite conceptual issues. An impressive testimony to this is that the Central Research Laboratory of Hitachi, Japan, in collaboration with the Physical Society of Japan, organize, once in three years, an International Symposium on Foundations of Quantum Mechanics*.

In the words of Y. Takeda, director of the Central Research Laboratory, Hitachi: 'Like the Renaissance, going back to basics must be the driving force towards the next significant step. This is why it is inevitably valuable for physicists, mathematicians and industrial researchers to get together and discuss their dreams and problems. . . .It is now time for industry to return a great favour to quantum mechanics, hoping for its further advancement.' In fact, this series of ISQM were motivated by Akira Tonomura's fascinating experiment performed at the Hitachi Laboratory to unambiguously prove a striking quantum-mechanical effect (known as the Aharonov–Bohm effect) that produces a physically observable quantum effect (due to vector potential) on charged particles in a magnetic field-free region. Tonomura used electron holography and a toroidal magnet of micron dimension.

The interplay between quantum mechanics and technology is a two-way process. From the perspective of technology, the microfabrication technique has reached the stage where one really needs quantum mechanics to design, for example, integrated circuits on a scale approaching microscopic dimensions, or superconducting transistors using the overlap of Cooper-pair wave functions penetrating into a semiconductor substrate. Similarly, reduction of noise, for instance, in the case of superconducting quantum interference devices (SQUIDs) has reached the level where one needs to be concerned with quantum-mechanical zero-point fluctuations instead of ordinary thermal noise.

From the perspective of quantum mechanics developments in fields like electron holography, neutron interferometry and quantum optics have enabled realization of many 'thought experiments' conceived to discover new facets of quantum theory. For instance, H. Rauch (Wien, Austria) reported results of some fascinating experiments performed with neutron interferometry. To quote Rauch himself, 'Particle and wave properties appear simultaneously if a partially absorbing neutron detector is inserted to obtain a certain degree of beam path detection, although the interference pattern remains visible up to a surprisingly high degree.' This raises thought-provoking issues related to the uncertainty relations for unsharp particle-wave behaviour and their interpretation in terms of quantum-mechanical measurement theory.

Magnetic flux quanta (fluxons) are important in both fundamental and applied superconductivity. Until recently, a fluxon was too small to be observed. Akira Tonomura reported the first observation of magnetic lines of force of a single fluxon using electron interference. He also indicated some tantalizing future prospects of the electron holography technique. A. Garuccio (Bari, Italy) emphasized that the experiments related to the Einstein–Podolsky–Rosen (EPR) paradox using correlated photons have not yet provided an unambiguous verdict on the much-debated question of quantum mechanics versus local realism, owing to low efficiency of the photomultiplier detectors for visible photons, which is at most about 20%. He discussed the plan for a new type of experiment on the EPR paradox where one can vary the correlation between two photons in an EPR state by varying the magnetic field at the

*The Third International Symposium on Foundations of Quantum Mechanics (ISQM—Tokyo '89) was held in Tokyo, 28–31 August 1989.