

scientists. That our scientific activities are widely and thinly spread has very little to do with the government or the funding it provides but more to do with our compulsive need to promote *harmonious* scientists and provide them with ostentatious trappings of power. The scientific contents of national conferences are, by and large, a national disgrace and a perfect cover for public-funded jamborees.

But the government too has a responsible role to play, specially in nurturing basic science. Basic science is the mother of all science, the fountainhead of man's knowledge about nature. It is a means by which he can use nature to modify and control his environment through appropriate interactions with it. This knowledge, by common consent, is the common heritage of mankind. Such noble endeavours deserve state

patronage as they have always deserved since ancient times.

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NEWS

A report on the 35th DAE symposium on solid state physics

The Solid State Physics Symposium is an annual national symposium organized under the auspices of the Board of Research in Nuclear Sciences of the Department of Atomic Energy. This year's symposium, hosted by Sri Venkateswara University, Tirupati, had nearly 500 papers scheduled for presentation. There were also oral presentations of some 50 papers. Well over 300 papers were presented in the Poster Sessions covering a variety of topics like phonon physics, electronic properties, transport properties, magnetism, superconductivity, semiconductors, disordered materials, liquids and liquid crystals, surface and interface physics, phase transitions, resonance studies, solid state devices, techniques and instruments, etc. The seminar on 'thin films' was chosen keeping in view the interest of students and staff of the Physics Department of the host University. This was very appropriately preceded by an invited talk by Jayarama Reddy on 'thin film solar cells'.

The technical sessions started with the seminar on magnetism which was coordinated by L. Madhav Rao. In magnetic systems showing spin glass behaviour one is interested in a domain of phase diagram where ferromagnetism coexists with spin-glass behaviour. Several Indian researchers like Abhijit Mukherjee have made valuable theoretical contributions to this area. A variety of systems like intermetallic compounds, amorphous metals and insulators exhibit

anomalous magnetic behaviour at low temperatures. In his introduction to re-entrant spin glasses, Madhav Rao referred to occurrence of two transitions; one given by T_c and the other by T_x (where transverse components freeze) and how this T_c and T_x define phase diagram changes with concentration of say any one element in a binary system.

S. B. Roy gave one important message that experimenters must make as many macroscopic and microscopic measurements as possible on the same system to unravel the mystery of such complex magnetic systems. Through well-known examples, he showed how neutron scattering experiments were very crucial to decide the nature of re-entrant spin glass. He also cautioned against fitting data indiscriminately to some fashionable theoretical models without sufficient introspection.

S. N. Kaul discussed several theoretical models developed during 1975-90 and referred to results of computer simulation studies where 'spin melting' is not seen. Then he showed how small angle neutron scattering and inelastic neutron scattering were necessary to clear some of the model results.

In essence, Roy and Kaul tried to raise basic questions like whether the so-called spin-glass existed at all? and whether one can refer to observation of anomalous behaviours associated with observations related to this as phase transitions in the thermodynamic sense?

S. K. Dhar dealt with a larger variety of experimental data in heavy fermion systems carried out by him and his colleagues at TIFR. Although a large amount of experimental data exist, theoretical understanding is far from satisfactory. He also referred to measurements of correlation lengths via neutron scattering.

For experimental physicists in the field of neutron scattering, it was pleasing to see the importance of neutron scattering studies which was brought out in all these three talks by persons who have not used the technique. Obviously, there is a case for strengthening collaborative research programmes using our own reactor facilities.

Many of the invited talks were of interdisciplinary nature bordering technological applications. For example, in his lecture on thin film solar cells, Jayarama Reddy reviewed the technological status of bulk photovoltaics like Si and α -Si:H which are currently being used. He then elaborated on the currently pursued research in the areas involving thin film solar cells based on systems like CdTe and CuInSe₂ (CIS). Conversion efficiencies achieved over areas of about a cm² by a few companies in these materials are in the neighbourhood of 10% reaching out to 15% whereas theoretical maximum estimates are in the neighbourhood of 35%, which is why it is important to vigorously pursue this effort. Sri Venkates-

wara University is one of the five centres that is working on CdTe and CIS solar cells and has achieved efficiencies of 8% and 6% respectively so far.

The seminar on thin films was very well received by the participants. This seminar had three presentations. The first one was on microwave devices with HTSC thin films by R. Pinto. He reviewed the devices that have emerged in HTSC materials related to two applications (i) μ -wave devices and (ii) squid-based devices. He described the developmental efforts carried out by TIFR and Sameer group in developing HTSC thin film resonators using microstrip configuration operating at C-band and X-band frequencies using one cm^2 $\langle 100 \rangle$ MgO and $\langle 100 \rangle$ LaAlO₃ substrates, and laser ablation for depositing the YBCO films. He discussed the importance of understanding the effect of microstructure (grain size, grain orientation and grain boundaries) which essentially depend on the substrate characteristics.

The second presentation was on strained layer semiconductors by A. K. Srivastava. Generally one goes for lattice matched epitaxial thin film structure for various applications. Srivastava described an entirely new class of materials which are based on epitaxial thin films grown (*lattice mismatched*) on substrates like, InGaAs-GaAs, InGaAs/InGaAsP/InP, etc. With the help of a graph giving strain versus concentration he showed how strain can be introduced in these materials, and used as a control parameter. When strain is introduced in the material the electronic band structure gets changed and this has important implications for device applications like the mid-infrared optoelectronic devices.

The third presentation by S. Mohan dealt with optical coatings for high power laser films that can withstand laser irradiation. He discussed the role of design, substrate selection, choice of coating materials and optimization of deposition techniques and deposition parameters.

In addition to these seminar talks which related to new material synthesis which have been achieved in the country, during the poster sessions, one came across a large number of posters dealing with synthesis of other materials like new class of HTSC, new solid state reaction-based systems and, of course,

thin film developments for Squids from the NPL group. The tempo of material synthesis and characterization of new materials inclusive of C₆₀ and C₇₀ fullerenes seems to be in good shape. But efforts in the area of preparing other devices—solid state devices and sensors—have to be accentuated enormously.

Among the other invited speakers, N. V. Madhusudana talked about the electrodynamic instabilities and pattern formation in liquid crystalline systems, and explained how anisotropic properties arising from orientational order can be used to change the orientation 'director' by applying relatively weak external magnetic or electric fields, which lead to their application in display devices. He also talked about new mechanism for electroconvective processes in flexoelectric liquid crystals and how the concomitant electro-optic effects could be used for display devices.

The talk by S. V. Subramanyam related to the extensive conductivity measurements carried out at IISc in the area of organic conductors, at low temperatures and high pressures. Using examples of polypyrrole (polymerized carbon films) and several charge transfer complexes he detailed a vast amount of experimental results obtained in their laboratory. Understanding of some of these features is based on various exotic conduction mechanisms but some are still to be explained. He had also brought with him a High Pressure Clamp exhibit which enthused several young students to mill around and to talk to him on various experimental features of his work.

This year's symposium had a talk by J. V. Yakhmi on a related topic namely organic ferromagnets. The organizing committee invited him to give this review talk because it is an area in which there is a lot of potential but in which, there is hardly any work going on in the country at present. Occasionally, it is good to have a talk of this type where attention can be focused on an activity wherein it is desirable to venture. Yakhmi summarized the work that is carried out by three leading overseas groups and the nature of results obtained in this promising area.

A. Bharathi of IGCAR presented the work of her group which has made very substantial contributions to the experimental study of fullerenes C₆₀ and C₇₀

and their derivatives and to understanding the nature of structure and superconductivity in these systems. In view of the long tradition they have had in the study of type II, low T_c superconductors and high- T_c superconductors it is not surprising that they have been able to make considerable inroads in the currently fashionable material. It is also gratifying to note that the work has been carried out by a group of 15–20 people drawn from disciplines of chemistry, material science and metallurgy, which they call the Buckeyball Squad.

The invited talk by M. V. Hosur on 'virus architecture and antiviral drug design', may not fall within strict boundaries of solid state physics. Perhaps it is good we had a talk on this topic when boundaries are all collapsing in many other fields of human activity. Hosur has to be complimented for the lucid style in which he was able to present a subject like this, introducing the right amount of jargon necessary and, at the same time, not over-awing by details. Himself an experimentalist who dabbles in protein crystal growth one day, X-ray diffraction the next day, computer graphics modelling on another day and talking to doctor-immunologists yet another day, he brought to bear in his talk the single but important message of how crystal structure can play a crucial role in designing drugs for combating viruses, as simple and as common as the 'common cold virus' at one end to fairly complex and I hope not-so-common a virus as AIDS virus.

A. P. Roy who delivered a talk on 'multichannel Raman spectroscopy at short notice', dealt with design and development of an indigenous Raman spectrometer, including the argon ion laser, triple monochromator system and data acquisition systems. The only major component which is not indigenously manufactured is the diode array in this system. He discussed the experiments carried out in the area of resonant Raman scattering in ternary semiconductors. But this instrument has many other important applications in the study of phase transitions and kinetics.

The 'theses session' intended for encouraging the young researchers had nearly 30 theses slated for presentation. While the response for oral theses presentations was good, barely a third of the poster theses were actually

presented. This year's 'Indian Physics Association Best Thesis Presentation Award' goes to Vasudeva Siriguri of the School of Physics, University of Hyderabad, for his thesis entitled 'Magnetic properties of amorphous Fe-rich $Fe_{100-m}Zr_m$ and $Fe_{90-y}CO_yZr_{10}$ alloys'.

On the whole the symposium has once again fulfilled its objectives of

serving as a national forum for discussing solid state physics research in the country as pointed out by P. K. Iyengar during the inauguration. As Jayarama Reddy put it in his inaugural address, the symposium has vindicated the strength, perseverance and abundance of solid state physics and also served to bring about 'a cultural communion of

its elite and intellectual fraternity of its savants'. It also vindicated the words of Chidambaram during the inaugural function, that 'solid state physics has matured in the country'.

A. Sequeira, Bhabha Atomic Research Centre, Bombay.



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