Table 2. A selection from DBT's budget estimates

(Rupees in lakhs)

Programme/scheme/project	Plan (actuals) 1998–1999	Plan (BE) 1999–2000	Plan (BE) 2000–2001
Scientific institution/professional bodies			
National Institute of Immunology	1059.00	1300.00	1400.00
National Centre for Cell Science	700.00	800.00	800.00
Center for DNA Fingerprinting and Diagnostics	576.00	650.00	600.00
National Brain Research Centre	0.00	0.00	500.00
National Centre for Plant Genome Research	0.00	0.00	350.00
Basic and product-oriented R&D			
Aquaculture and marine biotechnology	189.80	200.00	200.00
Plant biotechnology	419.70	530.00	630.00
Basic research and emerging areas	514.79	500.00	450.00
Biofertilizer	190.00	195.00	140.00
Medicinal and aromatic plants	199.88	150.00	130.00
Animal biotechnology	296.68	315.00	300.00
Seribiotechnology	149.94	150.00	125.00
Tree and woody species, application of tissue culture	650.02	555.00	600.00
Development of biological pesticides	300.00	250.00	200.00
Medical biotechnology and immunodiagnostics	602.77	950.00	700.00
Vaccine research and development	174.55	150.00	100.00
Biodiversity conservation and environment	196.46	200.00	250.00
Human genetics and genome analysis	391.00	390.00	250.00
Others			
Bio-informatics	509.07	600.00	600.00
Biotech product, process development, technology transfer	506.87	500.00	500.00
IPR and Biosafety	15.00	10.00	10.00

Source: DBT's website www.dbtindia.org
BE = Budget estimates.

redrafted on a regular basis, in consultation with industry and international experts.

Peering into what the Union Budget 2001–2002 holds for the Department of Biotechnology (DBT), there is an increase in central plan outlay budget estimates to Rs 175 crore. DBT's plan outlay and a selection of budget estimates for the past three years are presented in Table 2.

Manju Sharma, Secretary, DBT, when asked to comment on the Plan outlay for DBT, said to N.S. that she was satisfied with the outlay for her Department in the last year of the IX plan, ending on 31 March 2002. Special emphasis is being given to emerging areas by additional allocations such as for genomics (Rs 15 crore), medicinal plants (Rs 15 crore); National Bio-resource Development Board, NBDB (Rs 12 crore); pending approval by the Parliamentary Standing Committee. The NBDB, established in June 1999, is meant to carry out sustainable development and utilization of precious bio-resources of the country using biotechnology tools and techniques. Areas such as DNA fingerprinting and Brain research will also see support in this outlay.

DBT seems to be on 'quick step' to achieving its goals towards product development, technology transfer in addition to basic research using biotechnological tools for socio-economic progress of the country. More cash in the kitty would give the extra zing for just this.

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MEETING REPORTS

Solid state physics symposium*

DAE Solid State Physics Symposium (SSPS) is the largest annual event in which the latest research findings in the area of condensed matter physics in India are discussed. Invited talks by experts provide scholarly reviews on frontier topics in this field and motivation to students to pursue a research career in condensed matter physics. Special evening lectures highlight important recent developments and give possible future directions of research in condensed matter physics. In the 43rd DAE SSPS organized recently, there were ~ 300 presentations and the symposium was attended by ~ 400 delegates.

In his presidential address, R. K. Singh (Vice Chancellor, Guru Ghasidas University, Bilaspur) began his talk by drawing attention to the importance of information technology and biotechnology in the current times and mentioned that this was a culmination of the sustained efforts in condensed matter physics research. Then he proceeded to discuss the role of materials science bridging technology with solid state physics.

The symposium was inaugurated by R. Chidambaram (ex-chairman, AEC, Mumbai). His remarks dealt with the role of hydrogen bonding in organic and inorganic materials in general and in biomolecular materials in particular. He mentioned that hydrogen bond is anisotropic in nature and from the point of view of its strength, it is in between the two extremes, i.e. the covalent bond

*A report on the 43rd DAE Solid State Physics Symposium held at the Guru Ghasidas University, Bilaspur during 27–31 December 2000.

(strong and anisotropic) and the molecular bond (weak and isotropic). He emphasized that the advances in the techniques of calculations like the Monte Carlo, the molecular dynamics and the phonon and electronic band structure calculations have been exploited to learn the crystal and electronic structures of materials and make predictions about the possible changes under the action of thermodynamic variables.

Apart from 11 invited talks and 8 theses presentations, this symposium covered 4 special topics, namely News and views, Tutorials on Monte Carlo simulations, Physics in biology and Experiments using synchrotrons. Contributed papers were divided into 13 categories, namely, Phase transitions, Complex systems, Novel materials, Experimental techniques, Liquids, glasses and amorphous systems, Relaxation studies, Surface science, Phonons, Electronic structure, Superconductivity, Magnetism, Transport properties, and Semiconductor physics.

Based on his high pressure–low temperature experiments, N. Mori (Institute of Solid State Physics, Tokyo) described his recent findings in magnetite. Magnetite undergoes a discontinuous change in resistivity at 117 K and this discontinuity termed as Verwey transition has been explained in terms of valence change $Fe^{2+} \rightarrow Fe^{3+}$. Mori's experiment provides evidence that a metallic ground state is realized above 8 GPa. Y. Hayakawa (Shizuoka University, Japan) described the recent experiments on the dissolution and crystallization of InGaSb on earth (under normal gravity) and in a spacecraft (under microgravity). Under microgravity condition, Ga compositional profile was observed to be uniform in the radial direction and the interface was flat. In contrast, terrestrial experiments showed segregation and the dissolved zone broadened towards the gravitational direction. In a separate experiment done on an aeroplane, needle-type crystals were formed. Subrata Ghose (University of Washington, USA) discussed the differences in the stability and the thermodynamic properties of 3 polymorphs of Al_2SiO_5. In the unit cell, Al ions have 2 types of coordinations. He mentioned that the observed difference in the features of these polymorphs have the roots in half of their Al ions' coordinations (5-fold in andalusite, 4-fold in sillimanite and 6-fold in kyanite). Remaining half of Al ions has 6-fold coordinations and Si is in 4-fold coordination.

Study of confined organic films is an emerging area of research. Screening of electrons by optical phonons and by plasmons under the framework of an effective 2D dynamic interaction has been developed to bring forth the possibility of pairing and hence the superconductivity in layered electron-doped cuprates. R. K. Singh described the success of this approach in the prediction of superconducting properties such as T_c, energy gap, coherence length and penetration depth in Nd–Ce–CuO and other high T_c superconductors. D. Varshney (Devi Ahilya University, Indore) described his recent work on the pairing mechanism and superconductivity of alkali metal-doped fullerenes. C. V. Tomy (IIT, Mumbai) dealt with the structure of vortex lattice in borocarbides. RNi_2B_2C (R = RE, Y) adopts tetragonal structure. At very low fields, this borocarbide has a hexagonal flux line lattice which transforms to a square symmetry at fields (115 mT). Further, the London penetration depth is observed to be anisotropic in the *ab* plane. Rotation of the flux line lattice in $ErNi_2B_2C$ at the onset of the magnetic order provides an evidence of the interplay between the superconductivity and the magnetism. A. Narayanasamy (University of Madras, Chennai) discussed about the size-dependent magnetic properties of nanostructured magnetic materials.

Magnetic properties are strong functions of the microstructure. N. C. Mishra (Nuclear Science Centre, New Delhi) explained this aspect in monodispersed hematite particles. It is observed that the coercivity increases substantially with the decrease in particle size. Saibal Basu (BARC, Mumbai) talked about the neutron reflectometry studies done at *Dhruva* on Ni/Cu multilayers, Ni/Ti multilayers, Au thin films and Ni/Ti supermirrors. A. Datta (SINP, Kolkata) described the recent synchrotron radiation source results and observed that the layer thickness correlates strongly with radius of gyration in polymers and molecular dimensions in liquids, while the amplitude of density oscillations decreases with increase in the solid–liquid interface width. An ordered monolayer of metal salts of long chain fatty acids on water is a manifestation of confinement. R. V. Nandedkar (CAT, Indore) mentioned that a 450 MeV electron storage ring *INDUS-1* at CAT is now operational and the synchrotron radiation in soft X-ray to vacuum ultra violet to visible range is available. Six beamlines and experimental stations are being developed around this storage ring for performing atomic, molecular and condensed matter spectroscopy experiments. He informed that 2 beamlines have now been commissioned and showed the reflectivity and X-ray photoemission data obtained during the test runs.

In the session on 'News and views' the following developments were outlined: Installation of two cold neutron guides at *Dhruva* reactor has opened up opportunities for performing improved signal-to-background ratio neutron scattering experiments. S. L. Chaplot (BARC) mentioned that the guides serve 4 neutron spectrometers: 2 for small angle scattering (suitable for investigating length scales of 10–100 nm), a polarized neutron reflectometer (for studying surfaces, thin films and multilayers) and a spin-echo spectrometer (for quasielastic scattering) with resolution of a micro eV. A 3 MV tandem pelletron ion accelerator is operational at IOP, Bhubaneswar and B. N. Dev (IOP) reported that this accelerator has 6 beamlines and experiments such as RBS, PIXE, channelling, ion implantation, atomic spectroscopy (light and heavy ion-induced X-ray emission), surface studies and scanning ion microscopy (using a 3 micrometre beam spot) can be performed. P. Singh (BARC) gave the details of the design and development of a 6 MV folded tandem ion accelerator. This accelerator with acronym FOTIA is expected to be used in nuclear physics and condensed matter physics research. For high current isotope separation and ion implantation, recently a high current, low energy accelerator has been set up at SINP, Kolkata. T. K. Chini (SINP) reported on the basic configuration of the system and showed the test results.

Computer simulations are of special use in the study of condensed matter systems. There are several examples of complex systems wherein it is difficult or impossible to perform meaningful experiments or carry out analytical calculations. The focal theme of the tutorial on 'Computer simulation in condensed matter physics', was on the Monte Carlo simulation. The tutorial session consisted of three talks and practical demonstration of

the Monte Carlo technique for the crystal structure determination and for the study of the magnetic systems with emphasis on the phase transition. M. Ramanadham (BARC) in his talk mentioned that simulation experiments based on molecular dynamics, Monte Carlo, cellular automata, neural network, genetic algorithm, fuzzy logic, etc. are routinely performed to understand the condensed and the ill-condensed matter. Saibal Basu dealt with the application of the Monte Carlo technique in the crystal structure determination and presented the key idea behind the Metropolis sampling and reverse Monte Carlo. K. P. N. Murthy (IGCAR) explained the Markov chain Monte Carlo, taking Ising model as an example for the study of phase transition in magnetic systems. Three Monte Carlo software programs were loaded and run on about 15 PCs. Actual demonstration of the program execution for the Monte Carlo simulation was made to 60 participants in 4 batches. Methods to find out the radial distribution function in biomolecules and organic solids and the features associated with the magnetic to non-magnetic transition in 2D Ising model and the Central Limit Theorem were demonstrated to the delegates. The participants were also given the opportunity to run the programs and have a first hand experience.

Biology entered in a general session that highlighted recent advances in genomics and structural biology. The connections between the discipline were highlighted in an evening lecture by R. Chidambaram on 'Interface between Physics and Biology', was apt and a clear indication of the projected direction of future research. Going down memory lane, Chidambaram highlighted his work on hydrogen bonding in ice done in 1961 and its relevance to understand different types of biomolecular interactions. His remarks highlighted what physics has done to understand fundamentals of biology and vice-versa. He chose relevant examples to bring out the message. And the subjects included neural networks, radiation resistance of certain bacteria, bio-terrorism, DNA computing and so forth. Finally he brought out the synergy between biology and physics and highlighted its relevance. He concluded his presentation with the remark that the twentieth century belonged to physics, while the twenty-first century will belong to biology. He stressed that there is an urgent need for working towards interfacing physics with biology and to work on such cutting-edge research.

A special seminar on experiments using synchrotrons consisted of 13 presentations, namely (i–iii) pressure-induced amorphization in single-wall carbon nanotubes, electronic topological transition in $AuIn_2$ and structural transition in adamantane; (iv) melting of a quasi-2D (Langmuir–Blodgett) films, (v) resonance enhancement of X-rays in a thin polymer blend film of polystyrene and polybromostyrene; (vi–viii) SAXS studies of Nb/Si multilayer, micellar solutions and zircaloy; (ix) X-ray diffraction studies of $ZrSiO_4$, $ZrMo_2O_8$ and almandine; (x, xi) high-resolution Compton scattering studies of Mo and $CeFe_2$; (xii) beamlines for circularly polarized SR, and (xiii) heat transfer study of Be window.

The best thesis award in SSPS 2000 was presented to D. Loganathan (School of Physics, University of Hyderabad) for his work on 'Field cycling NMR studies of molecular dynamics in liquid crystals'. One of the other highlights of the 43rd SSPS was the evening lecture by T. V. Ramakrishnan (IISc, Bangalore) on 'Some strange ways of electronic matter'. He mentioned that though BCS theory could satisfactorily explain the conventional superconductors in terms of the Cooper pair formation due to the phonon mediated electron–electron interaction, the situation in high T_c superconductors is far too complex. The interplanar interactions in the latter could at best be like those in insulators and probably holon–spinon coupling is responsible for the superconductivity in the high T_c superconductors. Next he talked about 'Giant magnetic conductors' in which the polyvalency of Mn plays a dominant role in modifying significantly the magnetic and conducting characteristics.

Of the nearly 300 contributed presentations, only a few representative examples have been picked up in order to give the flavour of the symposium. Monte Carlo simulation has been carried out in charged colloids to study the glass transition as a function of pressure. B. V. R. Tata and P. S. Mohanty (IGCAR) have analysed the pair correlation function and mean square displacement and claim that the liquid-to-glass transition is accompanied with a pressure crunch. Priya Vashista (Louisiana State University, USA) has used multi-resolution molecular dynamics approach to multimillion-atom simulation for investigating the structure–property correlation in nanostructured materials. Mechanical failure, atomic-level stresses, crack propagation, fracture and phase transition have been predicted and the simulation data have been compared with the observed values in SiC, GaAs and nanophase ceramics. Two non-mesonic compounds like sodium lauryl sulphate and ethylene glycol have been observed to exhibit mesomorphic behaviour. S. K. Naveen Kumar *et al.* (University of Mysore) have observed a temperature-dependent structural sequence ($I \rightarrow SA \rightarrow SE \rightarrow K$) as revealed by the X-ray diffraction and spectroscopic studies like UV, IR and ^1H NMR. S. L. Chaplot and N. Choudhury (BARC) have carried out molecular dynamics simulations on orthoenstatite, a geophysically important mineral. It reveals a structural phase transition at $P = 0$, $T = 1050$ K, with a 3% volume increase. The temperature-dependent variation of elastic constants shows a significant softening, prior to the transition. Using the LAPW method with GGA for exchange-correlation terms, A. K. Verma *et al.* (BARC) have studied the shock Hugoniot of Al and they observe a pressure-induced melting at ~ 0.1 TPa. P. B. V. Prasad (Research Laboratory for Studies in Crystallization Phenomena, Khammam) has used the laser light scattering technique to study the temperature effect on the small metal grains of Al, Cu and Ag and have related the observed non-uniform growth due to the defect substructure and its effect on the thermal expansion. MAl_2O_4 doped with Eu exhibits an afterglow. This material is normally synthesized at 1200–1700°C. A. Jestin Lenus *et al.* (IGCAR) have found an alternative route in that the synthesis can be done at 900°C. BaFBr doped with Eu is a versatile X-ray phosphor. It is used as X-ray intensifier (containing Eu with 2^+ and 3^+ states) and as X-ray storage phosphor (containing Eu^{2+} only). They have also shown that by treating the X-ray intensifier material with oxalic acid at ~ 600°C, it is possible to obtain the phosphor with almost 100% Eu^{2+}.

Realizing the fact that the development in the area of instrumentation and technique is the lifeline of the research, it will be better if organizers of the SSPS encourage and invite scientists involved

in the development of instrumentation for physics research, by organizing a special seminar exclusively on this aspect. In the session on 'News and views' one had the glimpses of hardware development, but all the discussions were centred on the development of the national faciities.

In summary, the 43rd SSPS was a very satisfying one, both from its scientific content and the social features. All the aspects of the symposium were taken care of in a praiseworthy manner, as a result of commendable efforts of the organizers of the symposium and local hosts.

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International rice genetics symposium*

In a matter of two decades, rice genetics has taken new strides and rice is no longer a poor cousin of maize and wheat in terms of genetic information. With the advent of International Programme on Rice Biotechnology (IPRB) sponsored by the Rockefeller Foundation, it moved to centre stage of molecular genetic research. This paradigm shift is visible in the successive International Rice Genetics Symposia (IRGS) held once in five years. It all began with the first IRGS held at International Rice Research Institute (IRRI), Philippines in 1985 at which time Rice Genetic Cooperative was also established, paving way for international collaboration in rice genetics. The same year also saw the establishment of IPRB. By the time the second IRGS was held in 1990, the impact of international collaboration in rice genetics and biotechnology was apparent. Molecular biologists made inroads into rice research. Developments in genetic transformation and DNA marker technology have advanced the cause of rice genetics, providing better insight into the rice genome. Five years later, the advances are spectacular with the ascent of rice to the top among cereals and a model among the monocots.

The 4th IRGS held recently was structured in the form of plenary sessions (7), concurrent sessions (6) and poster sessions (11), to provide room for all forms of interaction among the four hundred and odd rice scientists representing 28 countries.

Lead papers were presented in the areas of Rice genetics – Present and future, Bio-systematics and evolution, Molecular markers and QTL mapping, Comparative and structural genomics, Genetic resources for functional genomics, Gene isolation and function and transformation.

In the first plenary presentation by Gurdev Khush (IRRI), significant developments in rice genetics from Mendel to functional genomics were highlighted. J. N. Rutger (USDA) gave an account of application of Mendelian genetics that led to many breeding advances in rice. Of considerable interest was the presentation of Qifa Zhang (China) on the genetic and molecular basis of heterosis in rice, wherein he demonstrated the involvement of a large number of epistatic interactions as the genetic basis of heterosis and the relationship between gene expression and heterosis with differential display analysis.

'Quantitative evaluation of species relationship in the genus *Oryza* using molecular markers' by H. Morishima (Japan) showed that the pattern was largely agreeable to that so far conceived. Using three genes – two nuclear genes (*Adh1* and *Adh2*) and one chloroplast gene *matK* – S. Ge (Beijing, China) presented evidence to support the previous recognition of nine genome types. Nevertheless a new genome type HK was recognized for *O. schlechteri* and *Porteresia coarctata*, suggesting *P. coarctata* belongs to genus *Oryza*. Sue Wessler (Georgia, USA) presented a paper on functional genome approach to the study of miniature inverted repeat transposable elements (MITES) and their role in genome diversity. Susan McCouch (Cornell, USA) gave an update on microsatellites in rice – abundance, diversity and applications. To date, a set of 500 microsatlellite markers have been mapped onto rice genome, providing rice breeders and geneticists with an efficient and highly informative set of DNA markers that can be used for variety protection, diversity analysis, marker-assisted selection, gene isolation and QTL identification. Dave Mackill (University of California, Davis, USA) reviewed the important applications of molecular mapping for (i) determining the allelism of genes conferring identical phenotypes, (ii) selection or pyramiding of non-allelic genes in a breeding programme and positional cloning of genes, citing examples to illustrate how such tools can be integrated into breeding programmes. Zhi-Kang Li (IRRI, Philippines) made a critical analysis of QTL mapping in rice to show that epistasis and QTL × environment interaction remain the twin challenges in QTL mapping and proposed two strategies – genetic and physiological dissection and use of introgression lines to improve the power of QTL detection and integrate QTL identification in rice improvement.

When the first dense maps of cereal genomes were constructed by the application of DNA markers a decade ago, it was clear that gene content and gene order along the chromosome were remarkably similar to related species than it was thought to be. Early comparative studies of wheat, maize and rice established synteny between the major cereals. Further, studies on comparative genetics extended to related grasses and their wild relatives suggest that rice, with one of the smallest genomes (430 Mb) is providing link between species as diverse as foxtail millet, *Setaria italica* and rye grass, *Lolium perenne*. Mike Gale (John Innes Centre, UK) traced these developments in comparative genetics to show how similarities in the gene and chromosome organization and conversely the conserved differences in the form of chromosomal rearrangements are of evolutionary significance. Duplication of quite large regions of the genome, for example, as in chromosomes 11 and 12 of rice, is common and seems to be an evolutionary feature that has emerged through such studies.

Rod Wing (Clemson University, USA) presented the programme and status of CCW rice genome sequencing consortium of Clemson University Genomics Institute (CUG), Cold Spring Harbor, Washington University Genome Sequen-

*A report on the Fourth International Rice Genetics Symposium organized jointly by the International Rice Genetics Cooperative and International Rice Research Institute (IRRI) during 22–27 October 2000 at IRRI, Los Banos, Philippines.