Harvest Technology, Aquaculture, Biotechnology, Reliability Engineering, etc. Each departments/centre in any IIT has its own R&D culture, which does not necessarily mean publications. Thus, some departments/centres have very few publications but have a very high reputation of their R&D contributions to the industry and other public/private institutions.

Tables 1–3 list comparative statistics of recent publications from the five IITs which are readily available in our Electronic Library and have been obtained from different sources: (1) Current Contents on Disc (CCOD), (2) INSPEC and (3) IEEE/IEE. Each source refers to a group of disciplines, as explained in the captions. Of these groups, the IEEE/IEE publication data are more meaningful for comparison since all IITs have comparable (though not same size) departments in the field. The data in these tables clearly contradict the conclusions of Nagpaul and Prathap and bring out the eminent position of IIT Kharagpur among IITs. The need to do a systematic and in-depth analysis to arrive at 'impact' parameter is clear. Further, such an analysis should take into account other factors such as the number of Ph D's in engineering/technology, number of consultancy and sponsored projects and interactions with industry. Just to give a feeling of the numbers, IIT Kharagpur produces over 100 Ph D's per year, undertakes about 200 projects worth over Rs 1.00 crore as consultancy fee and over Rs 6.00 crore as sponsored R&D projects. Besides, our 30 faculty members have established enterprises, based on their work, in our Technology Park.

Finally, let me emphatically state my faith in critical assessment and accountability of any institution. Indeed, if we do ever hope to see decent standards of R&D in our country, it will be possible only after we have learned to conduct impartial, objective and ruthless peer reviews by nongovernment organizations. Some belated steps taken by UGC and AICTE for accreditation of academic institutions continue to be controversial. It is most unfortunate that our several Academies have failed to appreciate their responsibility to serve the country in this direction. What we need is fiercely independent organizations such as those existing in USA and UK to examine the credentials of each department of an educational institute. We will reach maturity only that day when such an organization will undertake comprehensive analysis to publish publicly 'grades' earned by our academic departments and institutions.

K. L. CHOPRA

Indian Institute of Technology, Kharagpur 721 302, India.

NEWS

Report on the 'International conference on symmetry methods in physics' (ICSMP-95)

The VIIth ICSMP-95, held at the Bogoliubov Laboratory for Theoretical Physics, Joint Institute for Nuclear Research, Dubna, from 10 to 16 July 1995, is the seventh conference in a series, the first five of which were organized by Yu A. Smorodinsky and the sixth was devoted to his memory. This conference was inaugurated by A. N. Sissakian (JINR), and D. V. Shirakov gave some statistical details about the Bogoliubov Laboratory of Theoretical Physics of JINR, where research is carried out in the areas of fields and particles, nuclear theory and theory of condensed matter.

The first (40 min) Invited Talk was by H. D. Doebner (Germany), who spoke on 'Infinite-dimensional symmetries and nonlinear physics'. There were in all 12 Plenary Sessions in which 44 Invited Talks were presented, and 18 Parallel Sessions, in which 85 contributions (of 30 or 20 min duration) were presented. From India, there were three invited speakers (the two authors of this report and M. Lakshmanan of the Bharathidasan University, Tiruchi).

Broadly, the topics covered included the following: dynamical symmetries and integrable models; symmetry and nonlinear phenomena; special functions and group representation theory; quantum algebras and groups; supersymmetry (SUSY) from quantum mechanics to elementary particles; gauge and conformal theories; symmetries in condensed-matter physics and statistical mechanics; geometric methods in quantum mechanics and quantum field theory; quantum optics and coherent states; and mathematical methods.

In a review of the renormalization group (RG) method introduced 40 years ago by Peterman and Stuckelberg, Gell Mann and Low, and N. N. Bogoliubov, D. V. Shirakov (JINR) pointed out that this work led K. Wilson to apply RG method to critical phenomena in the 1970s and that recent analysis identifies the RG with functional self-similarity. In his invited talk 'RG, solution symmetry and Lie group analysis', Shirakov said that Wigner's 1963 Nobel lecture traced the laws of Nature as derived from symmetry and invariance principles and these laws, in turn, explained physical phenomena. The Bogoliubov RG method adds to this scheme Lagrangian parameters and boundary parameters as inputs to the laws of Nature and the physical phenomenon respectively.

P. Winternitz (Canada) in his invited talk on 'Continuous and discrete symmetries of differential-difference equations' showed how the established Lie group analysis of ordinary differential equations (ODE) has been extended to the study of differential–difference equations. The three different approaches to the Lie point symmetries of discrete equations are beginning to converge and similar analysis of q-difference equations

are being made; algorithms, techniques and computerization of these approaches are emerging. M. Lakshmanan (India) in his invited talk on 'Lie symmetries of certain (2 + 1)-dimensional soliton systems' showed how the methodology of similarity reductions applied earlier to (1 + 1)-dimensional problems has been extended to several (2 + 1)-dimensional systems and that all the five cases considered have ∞-dimensional Lie algebras but not all are of the Virasoro type. One of us (A.K.) in an invited talk on 'Singular solutions of KdV and MKdV equations' discussed the construction and properties of the positon and negaton solutions. Just like soliton solutions, these solutions also do not change their shape after scattering and in some cases there is not even a phase change. That the positon solutions are intimately related to 'bound states in continuum' was discovered in 1929 by von Neumann and Wigner. T. A. Weber (USA) in his contribution on 'An extended Gel'fand–Levitan method' presented a study of the resonances of perturbed von Neumann–Wigner potentials.

A. J. Macfarlane's (UK) contribution was on 'Odd-dimensional fermionic phase space and SUSY'. He discussed the algebra of Dirac and Majorana fermions, and showed that fermionic SUSY on a manifold can be constructed. He discussed the case of SUSY with one real supercharge and the problem of a nonrelativistic particle with spin ~ 1/2 in a monopole field. S. Duran (Canada) discussed the generalization to 'Fractional SUSY and quantum mechanics', wherein the Hamiltonian is expressed as $H = Q^F$ ($F = 2, 3, \ldots$), where Q is the supercharge. G. Junker (Germany) discussed Witten's model of SUSY quantum mechanics in his contribution on 'SUSY and its quasiclassical approximation'. The lowest-order quasiclassical approximation is exact for shape-invariant potentials, and for others the resulting approximate spectra are sometimes better than the WKB approximation. M. Zonjil (Czechoslovakia) presented 'Two numerical aspects of SUSY in quantum mechanics', establishing the numerical efficiency of using the Pade approximated superpotentials and the consequences of employing the superpotentials in certain nonvariational treatments like the Hill determinant method. J. Casahorran (Spain) in his contribution on 'Obtaining solvable potentials in the framework of SUSY quantum mechanics' discussed the consequences of SUSY in the context of singular potentials. B. N. Zakhariev (JINR) discussed 'New situation in quantum mechanics (inverse problem and SUSY approach)', wherein he pointed out analytic methods to obtain new potentials whose spectrum and S-matrix are identical to a given potential except for the bound-state energy of one state. L. M. Tomilchik (Belarus) in his contribution on 'SUSY Dirac oscillator: Quantum and classical aspects' discussed the connection between the properties of the Dirac and the classical oscillator in the nonrelativistic and ultrarelativistic limits. A. M. Shirakov (Russia) discussed in his contribution on 'Accidental degeneracy' a situation when there is a degeneracy of levels in the quantum system that does not seem to correspond to any symmetry of the Hamiltonian. As an illustration he offered examples from the spectra of nonrigid spherical molecules.

V. S. Varadarajan (USA) pointed out in his invited talk on 'Quantum semiclassical groups' that corresponding to each method of describing a Lie group a type of deformation is associated and that the Drinfeld–Jimbo deformations are topological algebras. He focused his attention on arithmetic deformations in which real numbers are replaced by p-adic numbers, the real field is replaced by the p-adic field and Hilbert spaces are over p-adic fields. In this scheme, conventional quantum mechanics is obtained as a limit of finite quantum mechanics. In his q-quantum mechanics, p-adic oscillators and p-adic Coulomb problems arise. The hope in q-quantum mechanics is that the divergences of quantum electrodynamics and field theory will be ameliorated. However, deformation of space–time leads to violation of causality, which is troublesome. M. Arik (Turkey) in his contribution on 'Quadratic q-oscillators' gave a formalism which gives as special cases all the well-known quadratic oscillators and, in particular, he constructed homographic, squeezed, square root and chaotic q-oscillators.

G. Rosensteel (USA) in his invited talk on 'Galactic dynamics in the Siegel-half-plane' models the dynamics of rotating galaxies by a Hamiltonian Lax system for which the phase space is a G-manifold with the Lie group G being either the noncompact Sp(n, R) or a maximal parabolic group GCM(n). He showed that the dimensions $n = 1, 2, 3$ correspond, respectively, to breathing mode oscillations, planar rotations, and three-dimensional collective motion, and that the homogeneous GCM(3)-manifolds correspond to the Riemann ellipsoids. This work provides a group-theoretic setting for Chandrasekhar's lucid exposition on *Ellipsoidal Figures of Equilibrium* (Yale University Press, 1969). The homogeneous G-manifold Sp(n, R) / U(n), where U(n) is the maximal compact subgroup, was shown to be a classical complex domain diffeomorphic to the Siegal upper half-plane S_n. Equilibrium galactic radii were determined for S_1 systems.

J. P. Draayer (USA) in his contribution on 'Modern applications of SU(3) symmetry and its sp(3, R) extension in nuclear structure physics' pointed out that the SU(3)/sp(6, R) applications started in 1960 for light nuclei ($A < 40$), extended to the transition region ($40 < A < 100$) in the 1970s and after a lull in the 1980s picked up interest recently after the success of SU(3) applications to heavy nuclei ($A > 100$). He discussed some interesting recent work where the origin of pseudospin symmetry in heavy nuclei has been related to chiral symmetry in nuclei. Superdeformed bands have been observed in the sp(6, R) → SU(3) → $SO_L(3)$. The pseudo SU(3) scheme has been applied to the study of double β decay of nuclei. D. Benatsos (Greece) in his contribution on 'Quantum algebraic symmetries in nuclei and molecules' discussed super- and hyper-deformations in nuclei and atomic clusters in terms of anisotropic harmonic oscillators with rational ratios of frequencies. I. Pavlichenkov (Russia) in his contribution on 'Symmetrical bifurcation in quantum rotational spectra' considered bifurcation in rotational spectra as a fundamental phenomenon existing in different systems involving different energy scales. Odd nuclei ^{171}Yb and ^{169}Yb show bifurcation, and Coriolis forces tend to align the bands.

K. B. Wolf (Mexico) in his contribution on 'Conformal optical systems' pointed out that the most natural realization of conformal SO(4, 2) symmetry is found in optics. The Maxwell's fish-eye, i.e. the optical system of a transparent medium with spherically symmetric refractive index, had the SO(4, 2) Lie algebra of Poisson brackets. The 'hyperbolic' fish-eye has also been shown to be an optical system possessing conformal SO(4, 2)

symmetry. He pointed out the analogy of the spherical fish-eye to the hydrogen atom problem A. I Solomon (UK) discussed the many variations of the successful exact mathematical model of Jaynes–Cummings, which treats a two-level atomic system. In his contribution on 'Jaynes–Cummings variants', he detailed supersymmetric versions of the model and generalizations to the multilevel atomic and multiphoton systems. R. Mc Dermott (UK) in his contribution on 'Coherent and squeezed states parametrized by noncommutative variables' detailed the group-theoretic and Robertson–Schrödinger uncertainty relation approaches to coherent and squeezed states, discussed the properties of the unitary q-displacement Heisenberg–Weyl operator and that of the squeezed vacuum state and its q-generalization. V. L. Derbov (Russia) in his contribution on 'Geometric phases of the generalized polarization of coherent states in quantum optics' showed that the geometric phase provides valuable additional information on the polarization structure of quantum light related to the appropriate dynamical symmetry and suggested experimental measurement of the components of the polarization vector.

One of us (K.S.R.) in an invited talk gave a survey of the 'Quantum theory of angular momentum and generalized (ordinary and basic) hypergeometric functions'. It was shown that sets of hypergeometric functions are necessary and sufficient to account for the symmetries of the $3-j$ and the $6-j$ coefficients, that different ${}_3F_2(1)$ forms for the $3-j$ coefficient known in the literature are derivable from the Van der Waerden form using the transformation theory of hypergeometric functions, that the $9-j$ coefficient's triple sum series due to Alisauskas–Jucys–Bandzaitis can be identified with a triple hypergeometric series, that the $3-j$ and $6-j$ coefficients are related to the Hahn and Racah polynomials, respectively, and that most of these results have been q-generalized. A. Ronveaux (Belgium) in his survey talk on 'Orthogonal polynomials: Recurrence relations for connection and linearization coefficients' presented a simple approach to build recursively the connection coefficients between two families of polynomials and applied it to the classical discrete families (Charlier, Meixner, Krawtchouck, Hahn). M. Noumi (Japan) in his invited talk on 'Reflection equations, quantum-homogeneous space and q-orthogonal polynomials' classified the classical compact symmetry space into ten series and, by the method of reflection equations, he constructed a q-nonsymmetric space (G/K) and, for each (G/K), in seven of ten cases, the resulting zonal spherical functions were expressed in terms of Macdonald polynomials or multivariable Askey–Wilson polynomials of Koornwinder. E. G. Kalnins' (New Zealand) contribution on 'Separation of variables (special functions and modern developments)' detailed how this classical theory is closely related to that of integrable systems and showed how one can systematically classify certain classical mechanical systems via separation-of-variables techniques. R. M. Asherova (Russia) in her contribution on '$U_q(3)$ Weyl coefficients and $SU_q(2)$ Racah coefficients' used the projection operator approach to derive a general analytic formula for transformation brackets between U- and T-bases of $U_q(3)$ irreps. (so-called Weyl coefficients). A resummation technique of q-factorial expressions was used to prove that the Weyl coefficient coincides with the q-Racah coefficient for $su_q(2)$. L. A. Shelepin (Russia) in his contribution on 'Clebsch–Gordan coefficients in coherent and mixed basis' considered a generalized theory of angular momentum including both discrete and continuous parameters and introduced mixed Clebcsh–Gordan coefficients which relate the basis of common $|jm\rangle$ states and coherent states.

The above report presents some of the highlights of the Conference which was well organized and conducted by G. Pogosyan and his dedicated group at JINR. A welcome party, a boat excursion on the picturesque Volga river culminating in a barbecue dinner on an island in Moscow sea, a concert by a Dubna children's choir and a trip to Sergiev Posad, the Russian orthodox centre with its 500-year-old trinity monastery provided adequate relaxation during the week-long deliberations.

The conference concluded with its dedication, by Jelepov of JINR, to the memory of Yu A. Smorodinsky, who along with Pomeranchuk and Migdal was one of the outstanding active theoreticians invited to lecture at JINR soon after it was founded. He recalled with gratitude Smorodinsky's warm personality, broad interests, pioneering work on isospin theory, his new approach to high-energy nucleon–nucleon scattering with a potential including exchange forces, his book *Lectures on Theory of Atomic Nuclei*, with Landau which was translated into French and English (by Dover), and above all the importance he gave to symmetry concepts in physics, which played a big role in the development of this area. It is hoped that this series of conferences would become a permanent feature of JINR, Dubna.

The altered state of the former Soviet Union seems to have one depressing consequence in that, during the past five years, competent people are leaving the country and fewer students have enrolled for higher studies in theoretical physics and pure and applied mathematics – these of the areas in which the people belonging to the former Soviet Union have made deep and profound contributions. We sincerely hope that this is also but a temporary phase in these new nations, which are trying to become economically strong and highly competitive in this materialistic world of ours.

K. Srinivasa Rao, Institute of Mathematical Sciences, Madras, India and **A. Khare**, Institute of Physics, Bhubaneswar, India.