

DAE-BRNS Theme Meeting on Quantum Structures (TMQS) : a Report

The Theme Meeting on Quantum Structures (TMQS) was jointly organized by the Bhabha Atomic Research Centre, Mumbai and Indian Association for the Cultivation of Science, Kolkata at the Multipurpose Hall, BARC Guest House, Anushaktinagar, Mumbai. This meeting was sponsored by the Board of Research in Nuclear Sciences (BRNS), Department of Atomic Energy. Prof. B. N. Dev, Prof. G. P. Das, and Dr. S. M. Yusuf were conveners for this theme meeting.

Quantum structures with man-made superlattices were launched almost four decades ago with compound semiconductor heterostructures and epitaxial growth. Later the field of quantum devices, from quantum wells to quantum dots and ultimately to nanoelectronics, took wings. In order to meet the ever increasing demand on high-performance materials and devices, the need for focused experimental-cum-theoretical research programmes on quantum structures and devices was felt. Accordingly, a Theme Meeting on "Quantum Structures" was organized in BARC during November 2-3, 2009, which coincided with the Homi Bhabha Centenary Year. The Meeting was organized to discuss and review the status of this emerging field of quantum structures, and pave the way for further developmental work and action plan in this very important area. On one hand, the deliberations are expected to help the young researchers with adequate exposure on the state-of-the-art tools such as MBE, STM, SQUID, MOKE, SAM, SEMPA, SPLEEM and various transport and optical measurement techniques. On the other hand, this meeting has helped consolidate our expertise and capabilities in utilizing these techniques in understanding various

physical properties of advanced materials. Following the deliberations and discussions in this Theme Meeting, a road map for future activities in the area of quantum structures is being prepared.

Dr. S. Banerjee, Director, BARC gave the key-note address, elucidating the importance and relevance of quantum structure research in our country. In the inaugural session of the Theme Meeting on Quantum Structures (TMQS), Dr. J.V. Yakhmi, Associate Director, Physics Group, BARC gave the welcome address, Profs. B.N. Dev and G.P. Das of IACS, Kolkata gave an introduction and genesis of the Theme Meeting. Dr. S.M. Yusuf, BARC proposed a vote of thanks.

R. Muraleedharan and S. K. Ray delivered a talk on the growth of III-V and IV-IV semiconductor quantum well and quantum dot structures using Molecular Beam Epitaxy (MBE). D. Goswami talked about manifestation of quantum capacitance in single electron tunneling phenomena. Sandip Ghosh discussed about probing semiconductor quantum structures with polarized light. B.N. Dev's presentation addressed various aspects of growth and electronic properties of quantum dot and quantum wire structures.

S.M. Yusuf talked on probing quantum structures using magnetic techniques. Ferrites and other nanostructures were discussed by N. Venkatramani and D. Bahadur. Magnetization switching in ferromagnetic resonant tunneling diodes was the topic of presentation of Swaroop Ganguly. Indranil Das talked on spin polarized transport in low dimensional systems.



A group photograph of the participants of the Theme Meeting on Quantum Structures held during November 2-3, 2009

On the computational aspects, G.P. Das talked on simulation and design of quantum nanostructures. M. Deshmukh addressed the issue of breakdown of quantum Hall effect in graphene. D.G. Kanhere discussed about the nature of metal-insulator transition from graphene to graphane. Vijay Singh talked on scaling laws for semiconductor nanostructures.

In addition, various fabrication and characterization methods were presented by G.K. Dey, Ajay Gupta,

V. Ganesan, P.V. Satyam, S. Dhamodaran, P. Chakraborty and D.C. Kothari. These methods include ion beam methods including Focused Ion beam (FIB), MOKE, SPM, TEM and SIMS.

There was a session of open forum and discussions coordinated by B.N. Dev. At the end of the meeting, a decision was taken to chalk out a road map on quantum structure research. Following this, G.P. Das gave the concluding remarks at the valedictory function.