

### Annual Report 2000

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Printing National Capital Printing, Canberra ACT

ISSN 0155-624 X

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# **Director's Report**



Professor Erich Weigold - Director

The end of the past year also coincided with the close of a century during which physics revolutionised our society. The introduction of a simple concept one hundred years ago changed our world view for ever. When Max Planck announced his quantum assumption in Berlin on 14 December 1900, nobody realised that he was opening the door to a completely new description of nature, one that would be successful in explaining a host of phenomena – from the structure of elementary particles, nuclei, and atoms, the nature of chemical bonds and of many condensed-matter phenomena, all the way through to the physics of the early universe. The "quantum revolution" also led to an immense number of technological applications, lasers and semiconductors being just two examples. Thus the twentieth century could readily be identified as the quantum century.

However, it could just as readily be called the century of the electron, which was discovered at the end of the nineteenth century. These two discoveries have revolutionised our modern society, providing electric power and appliances at one end, wireless, wire and optical fibre communications, computers and even the internet at the other end. Physics has indeed been a wealth creating science, something which is recognised in the USA, Germany, Japan and other leading economies, but sadly not recognised by Australian governments. The past half a decade has seen a considerable reduction in the nation's capabilities in the physical sciences, both in teaching and research, and it will take a long time to recover from this setback.

What lies ahead? One thing is certain, physics will be completely different 100 years from now. The history of physics has shown that the investigation of fundamentals often gives rise to new fields. We are currently seeing the establishment of a fledgling new field of quantum information, which deals with the novel possibilities of processing information through individual and entangled quantum systems. Quantum cryptography and quantum teleportation promise exciting new possibilities. Quantum computers would give us computers of unprecedented speed. Physics is also poised to shed new light on more complex systems, systems at the nanoscale and mesoscale, and hard, soft and bio matter, multiscale functionality and complex (adaptive) matter. The School's research program is actively pursuing novel and fundamental ideas in all these areas as well as seeking applications resulting from breakthroughs in its research.

Researchers in the School have again been outstandingly successful in using their intellectual potential to attract funds from within the University, local and international industry, other government sources and granting agencies. Approximately one third of the School's total budget continues to come from external sources. An exciting development was the establishment of two spin-off companies, Acton Lasers and Acton Semiconductors, in order to commercialise some of the fruits of research in the Department of Electronic Materials Engineering (EME), in particular its laser devices.

Early in the year the Departments of Applied Mathematics and Theoretical Physics were reviewed by international committees of high repute. The research in both departments was found to be of the highest standing. The Report on the Department of Applied Mathematics strongly endorsed their research directions, their mix of theory and experiment, and in general expressed their confidence in the future of the Department. The Report on the Department of Theoretical Physics supported the exciting research in the Department and sought ways of unifying, highlighting, and strengthening the broad theory effort in the School, within and outside the Department. It also recommended the establishment of a new senior appointment in computational condensed (complex) matter, and the establishment of further joint appointments.

It has been another good year for promotions. Professor Barry Ninham was promoted to the top select (E3) group of professorships, Dr Nail Akhmediev to Professor, Drs John Howard, Wieslaw Krolikowski and Mark Ridgway to Senior Fellow, Drs Ying Chen, Mahananda Dasgupta and Mladen Petravic to Fellow, and Drs Rowena Ball, Vince Craig, Clyde Morton and Heiko Timmers to Research Fellow.

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During the year the first stage of the School architectural masterplan was undertaken by the firm Daryl Jackson and Alastair Swayn. This follows the successful major refurbishment of the office block housing the Department of Nuclear Physics in 1999. Stages 2 and 3 of the master-plan are now proceeding and will result in costed options for the staged redevelopment of the School buildings. These redevelopments will be funded through the University Capital Management Plan, and should ensure that the built environment for the School will serve us well for a further 50 years.

It was with great sorrow that the School learned of the deaths of Sir Mark Oliphant the founder of the School, Professor Trevor Ophel, Mrs Brenda Newham and Dr Tom Rhymes. All will be sorely missed and remembered with great affection.

On a happier note, Professor Rodney Baxter celebrated his 60<sup>th</sup> birthday in style. In his honour a one-week international conference entitled "The Baxter Revolution" was held in the School during February. It paid tribute to his truly revolutionary contributions to both mathematics and physics.

Finally it is important to record that despite the increasing difficulties due to funding constraints, the School has once again distinguished itself and made an increasing number of prominent contributions to the advancement of knowledge in the physical sciences and engineering. The School can enter the new century with growing confidence. I congratulate all staff and students on the efforts they have made. The results of those efforts, summarised in this report, speak for themselves.



#### http://www.maths.ann.edu.an/conferences/Baxter2000

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The workshop is an Edward Activity of The Ania Pacific Datas for Theoretical Physics (APCT9), organized by The School of Mathematical Sciences at The Assistant National University and The Assistant National University Center for Theoretical Physics.

Promotional poster for the The Baxter Revolution conference



Making good use of the quantum revolution, Professor Chennupati Jagadish and members of his quantum-well laser team, display a laser mounted on the head of a pin.

### Sir Mark Oliphant 1901 - 2000

Founder of the Research School of Physical Sciences and Engineering

