The Department during 2003 continued its long tradition of research into the broad areas of condensed matter and surface science. This includes much experimental work as well as theory and simulation of these systems. The research interests in condensed matter can be broadly classified into three main areas: (a) soft matter systems (polymers, liquid crystals, surfactants); (b) surface science – particularly systems involving colloidal and soft materials; (c) porous and disordered materials. Although condensed matter and materials research dominates the Department’s efforts, there are also theoretical program areas as diverse as networks and analysis of economic data.

A large part of the Department’s effort intermeshes strongly with the ARC Cooperative Research Centre, SmartPrint, which focuses mainly on paper research (Kackstedt, Senden and Craig). It involves in particular, use of the X-ray computed tomography facility, which enables 3D imaging of small samples of material at a resolution of 2 microns. This facility is a crucial part of much of the Department’s experimental efforts and is also used to image rock samples for the petroleum industry and bone samples for applications in biotechnology.

The department is very large, comprising over 50 people, and in terms of academic staff is the largest in the Research School. It continues to grow, thanks mainly to inputs of money from industry and from the ARC in terms of fellowships, the CRC and grants. It is also very diverse, encompassing researchers with very different backgrounds and often very different approaches to research. Research ranges from the very esoteric through to highly applied work on petroleum extraction and papermaking. This is its great strength. In reality it is much like a physics, chemistry, biology, mathematics, materials and chemical engineering department all rolled into one. It also has a strong experimental component as well as theory and computer simulation. The Department has a very broad funding base amounting to over $2M per annum. More than 60% of its budget comes from outside sources. This of course creates a very complicated budgetary situation.

During 2003 the research of the Department continued much as in recent years. The group led by Professor Steve Hyde developed its work on laboratory manufactured “fossils” which has garnered significant academic praise and media attention – as well as derision–from the significant number of academics who have been upset by having the truth revealed. On the theoretical front work–continued on the self assembly of polymer toroids (Williams, Cooke and Hernandez-Zapata).

Another important area of research is experimental surface forces, either using the surface forces apparatus or one of the atomic force microscopes (Craig and Senden).

As can be seen from this brief and rather selective description, the Department is an applied mathematics department in name only, but thus far the name has been retained for historical reasons.

**Department Staff**

**Head of Department**
David Williams, BSc Sydney, PhD Cambridge
(ARC Fellowship)

**Professors**
Stephen Hyde, BSc PhD Monash

**Senior Fellow**
Vassili Yaminsky, DipHons PhD Moscow
Andrew Stewart, MA ScD Cambridge, AM Harvard, EE Col, DIC PhD London, FAIP (attached from Theory Cluster)

**Fellows**
Tomaso Aste, DipHons Genova, PhD Milan (EU, Marie Curie Fellow)
Mark Knackstedt, BSc Columbia, PhD Rice (ARC QEII Fellowship)
Tiziana Di Matteo, BSc (Hons) PhD Salerno (ARC QEII Fellowship)

**Research Fellows**
Christoph Arns, Dipl-Phys Aachen, PhD UNSW
Vince Craig, BSc PhD ANU (ARC Fellowship)
Satomi Ohnishi, BSc SUT Tokyo, PhD Saitama (ARC QEII Fellowship)
Tim Senden, BSc PhD ANU (ARC Fellowship)
Adrian Sheppard, BSc Adel, PhD ANU
Rob Sok, BSc PhD Groningen
Postdoctoral Fellows
Armin Bauer, Dipl-Chem
Dr.Rer.Nat Regensburg
Fabrice Bauguet, PhD Paris XI
Ernesto Hernandez-Zapata, BSc PhD UNA Mexico
Mika Kohonen, BSc PhD ANU
Christian Kugge, PhD KTH Stockholm (STINT Scholarship)
Ann-Kristin Larsson, Ma Sc Lic PhD Lund, Doc Stockholm
Chiara Neto, BSc(Hons), PhD Florence
Vanessa Robins, BSc ANU, PhD Colorado
Arthur Sakellariou, BSc PhD Melbourne

Computational & Visualisation Consultants
Stuart Ramsden, GradDip Film & Television Swinburne
Ray Roberts, BSc(For) CRC Administrator
Holger Averdunk, BSc(Hons) Biochemistry, BSc Computer Science

Visiting Fellows
Anna Carnerup, BSc Malmo (until February)
Arthur Davies, BSc ANU
Eugene Gamaly, PhD DSc Moscow (jointly with LPC)
Bruce Hyde, BSc Bristol, PhD DSc
Stjepan Marcelja, Dip.Eng Zagreb, PhD Roch, FAA
Yoshinori Nagai, DScWaseda
Barry Ninham, MSc WA PhD Maryland, DTech (hon causa) KTH Stockholm, D Phil (hon causa) Lund, FAA
Ewa Radlinska, MSc Warsaw, PhD ANU (until January)

Senior Technical Officers
Anthony Hyde, Assoc IE Aust
Tim Sawkins

Departmental Administrator
Cindy Bradley (Part-time)

Departmental Publications

Legend: *External to the University, †Member of another area of this University other than this School, ‡Author having a joint appointment across departments within the School

Publications in Refereed Journals

Anderson, S.* and Ninham, B.W.
Why Ice Floats on Water.

Arns, C., Sakellariou, A., Senden, T.J., Sheppard, A.P., Sok, R.M., Pinczewski, W.V.* and Knackstedt, M.A.
 Petrophysical Properties Derived from X-ray CT Images.

Arns, C., Knackstedt, M.A. and Mecke, K.*
Reconstructing Complex Materials via Effective Grain Shapes.

Arns, J.-Y.W., Arns, C., Sheppard, A.P., Sok, R.M., Knackstedt, M.A. and Pinczewski, V.*
Relative Permeability from Tomographic Image: Effect of Correlated Heterogeneity.

Aste, T. and Coniglio, A.*
Cell Approach to Grain Transition.

Aste, T. and Coniglio, A.*
Glasses and Local Packings.

Atkin, R., Craig, V., Wanless, E.* and Biggs, S.*
Adsorption of 12- and 12 Gemini Surfactants at the Silica-aqueous Solution Interface.

Atkin, R.*, Craig, V., Hartley, P.*, Wanless, E* and Biggs, S.*
Adsorption of Ionic Surfactants to a Plasma Polymer Substrate.

Atkin, R.*, Craig, V., Wanless, E* and Biggs, S.*
Mechanism of Cationic Surfactant Adsorption at the Solid-aqueous Interface.
Advances in Colloid and Interface Science 103 (2003) 219-304

Atkin, R.*, Craig, V., Wanless, E* and Biggs, S.*
The Influence of Chain Length and Electrolyte on the Adsorption Kinetics of Cationic Surfactants at the Silica-aqueous Solution Interface.
Journal of Colloid and Interface Science 266 (2003) 236-244

Becheri, A.*, Lo Nostro, P.*, Ninham, B.W. and Baglioni, P.*
The Curious World of Polyplexes: Canas. - Cyclodextrins as Probes of Water Structure.

Berbenni, V.*, Marini, A.*, Velhâm, N. and Galinneto, P.* and Mozatti, M.*

Bonaccurso, E.*, Butt, H.-J.*, and Craig, V.
Surface Roughness and Hydrodynamic Boundary Slip of a Newtonian Fluid in a Completely Wetting System.

Boström, M., Williams, D.R.M., Stewart, P.R. and Ninham, B.W.
Hofmeister Effects in Membrane Biology: The Role of Ionic Dispersion Potentials.

Boström, M., Craig, V., Albion, R., Williams, D.R.M. and Ninham, B.W.
Hofmeister Effects in pH Measurements: Role of Added Salt and Co-ions.

Boström, M.
Longdell, J.J., Mitchell, D.J. and Ninham, B.W.
Resonance Interaction Between One Excited and One Ground State Atom.
The European Physical Journal D 22 (2003) 47-52

Boström, M.
Williams, D.R.M. and Ninham, B.W.
Specific Ion Effects: The Role of Co-ions in Biology.
Europhysics Letters 63 (2003) 610-615

Boström, M., Williams, D.R.M. and Ninham, B.W.
Specific Ion Effects: Why the Properties of Lysozyme in Salt Solutions Follow a Hofmeister Series.

Chan, A.*, Rode, A.V., Gamaly, E.G., Luther-Davies, B., Taylor, B.*, Dawes, J.*, Lowe, M.* and Hannaford, P.*
Ablation of Dental Enamel Using Subpicosecond Pulsed Lasers.

Craig, V. and Plunkett, M.*
Cruz, S.A.*, Gamaly, E.G.*, Chadderton, L.T. and Fink, D.*
A Simple Model for Latent Track Formation Due to Cluster Ion Stopping and Fragmentation in Solids
Radiation Measurements 36 (2003) 145-149

Di Matteo, T., Adte, T. and Dacorogna, M.*
Scaling Behaviors in Differently Developed Markets
Physica A 324 (2003) 183-188

Garcia-Garcia, F.J.*, Larson, A.-K. and Furusethe, S.*
The Crystal Structure of Ni, Sr2P* Elucidated from HREM

Self-assembled Silica-carbonate Structures and Detection of Ancient Microfossils
Science 302 (2003) 1194-1197

Golberg, D.*, Rode, A.V., Bando, Y.*, Mitome, M.*, Gamaly, E.G.* and Luther-Davies, B.
Boron Nitride Nanostructures Formed by Ultra-high-repetition Rate Laser Ablation

Ab-initio Construction of Some Crystalline 3D Euclidean Networks

Hyde, S.T. and Schröder, G.
Novel Surfactant Mesotopological Topologies: Between Lamellae and Columnar (Hexagonal) Forms
Current Opinion in Colloid and Interface Science 8 (2003) 5-14

Hyde, S.T. and Ramdern, S.J.
Some Novel Three-dimensional Euclidean Crystalline Networks Derived from Two-dimensional Hyperbolic Tori

Juodkazis, S.*, Rode, A.V., Gamaly, E.G.*, Matsumo, S.* and Mizawa, H.*
Recording and Reading of Three-dimensional Optical Memory in Glasses

Thickness Decrease of a Grafted Polyelectrolyte Membrane Exposed to Shear Flow

Knackstedt, M.A., Arms, C. and Pinczewski, W.V.*
Velocity-porosity Relationships, 1: Accurate Velocity Model for Clean Consolidated Sandstones
Geophysics 68 (2003) 1822-1834

Lo Nostro, P.*
Ninham, B.W., Fratoni, L.*, Palma, S.*, Manzo, R.*, Allemandi, D.* and Baglioni, P.*
Effect of Water Structure on the Formation of Coagels from Ascorbyl-Alkanoates

Neto, C.*, Craig, V. and Williams, D.R.M.
Evidence of Shear-dependent Boundary Slip in Newtonian Liquids
European Physical Journal E 12 (2003) 571-574

Ninham, B.W.
The Confederacy in Retreat: An Appreciation of Sten Andersson

Notley, S.*, Biggs, S.* and Craig, V.
Application of a Dynamic Atomic Force Microscope for the Measurement of Lubrication Forces and Hydrodynamic Thickness Between Surfaces Bearing Absorbed Polyelectrolyte Layers

Notley, S.*, Biggs, S.* and Craig, V.
Calibration of Colloid Probe Cantilevers Using Dynamic Viscous Response of a Confined Liquid

Oguey, C.*, Rivier, N.* and Ade, T.
Stratifications of Cellular Patterns: Hysteresis and Convergence

Roberts, R., Senden, T.J., Knackstedt, M.A. and Lyne, M.B.*
Spreading of Aqueous Liquids in Unsized Papers is by Film Flow

Precision Ablation of Dental Enamel Using a Subpicosecondpulsed Laser
Australian Dental Journal 48 (2003) 233-239

Schröder, G., Ramdern, S.J., Christy, A.G. and Hyde, S.T.
Medial Surfaces of Hyperbolic Structures

Senatore, C.*, Polichetti, M.*, Zola, D.*, Di Matteo, T., Giunchi, G.* and Pace, S.*
Harmonic Susceptibilities and Pinning Properties of Mg2Bulk Superconductors

Study of the Vortex Dynamic in Mg2 by Harmonic Susceptibility Measurements

Senatore, C.*, Polichetti, M.*, Zola, D.*, Di Matteo, T., Giunchi, G.* and Pace, S.*
Vortex Dynamics and Pinning Properties Analysis of Mg2Bulk Samples by ac Susceptibility Measurements
Superconductor Science and Technology 16 (2003) 183-187

Stewart, A.M.
Vector Potential of the Coulomb Gauge

Stewart, A.M.
Wave Mechanics without Gauge Fixing

Tuohimaa, A.*, Paasi, J.*, De Luca, R.* and Di Matteo, T.
Three-dimensional Josephson Junction Networks with Coupling Inhomogeities in Magnetic Fields
Physica C - Superconductivity and its applications 398 (2003) 41-48

Yaminsky, V.V. and Stewart, A.M.
Interaction of Glass Surfaces in Air: Dispersion Forces in the Retarded Regime

Yaminsky, V.V. and Ohnishi, S.
Physics of Hydrophobic Cavities

A Comparative Schlieren Imaging Study Between ns and sub-ps Laser Forward Transfer of Cs
Applied Surface Science 208-209 (2003) 177-180 (also listed under Laser Physics Centre)

Refereed Conference Proceedings

Roberts, R., Senden, T.J. and Knackstedt, M.A.
3D Imaging of the Spreading and Penetration of Aqueous Liquids into Unsized and Sized Papers
5th International Paper and Coating Chemistry Symposium 2003, Montreal, Canada (2003) 303-311

Sakellariou, A., Sawkins, T., Senden, T.J., Arnns, C., Limaye, A.*, Sheppard, A.P., Sok, R.M., Knackstedt, M.A., Pinczewski, W.V.*, Inge BERGE, L* and Oran, P.*
Micro-CT Facility for Imaging Reservoir Rocks at Pore Scales
SEG, International Exposition and Seventy-Third Annual Meeting, Dallas, USA (2003) 1-4

Stewart, A.M.
Caponite Dilatometry in a Surface Force Apparatus

Studies on Ultra-short Laser Micro Structuring
Atomic, Molecular, and Optical (AMO) Physics is both a fundamental and enabling science that supports many other important areas of science and technology. Staff of these Laboratories pursue a broad spectrum of experimental and theoretical research into the structure of atoms, molecules, and solids, and their interactions with electrons, positrons, and photons.

As recognised by the Division of Atomic, Molecular, and Optical Physics of the American Physical Society, “AMO physics is an enabling science that supports many other important areas of science and technology”. Indeed, students graduating in AMO physics acquire a breadth of knowledge and skills, enabling them to contribute to many areas of science, technology, and society. AMO physicists have also appeared prominently among Nobel laureates in recent times. The Atomic and Molecular Physics Laboratories are engaged in a broad range of experimental and theoretical studies of the interaction of electrons, positrons, and photons with atoms, molecules, and solids, in order both to further our knowledge of fundamental physical and chemical processes, and to provide essential information that is critical to applications in other scientific disciplines, technology, and the environment.

During the year, the Department bade farewell to Radmila Panajotovic and Vladimir Sashin: we thank them for their contributions and wish them well in their new positions. Conversely, we welcomed Frank Mills (jointly with CRES), Jun Matsumoto, Michael Lange, and Robert Dall to new appointments, together with two new PhD research students, Cheng Chen and Cameron Bowles, and three Honours students. In addition, we hosted five international visiting scholars, two third-year students, and two summer scholars who were involved in brief research projects. Congratulations are in order for Robert Robson, who was appointed as an Adjunct Professor, and Andrew Truscott, who was promoted to Fellow. Finally, construction was completed this year of the new building wing (The Erich Weigold Building) which now houses most of the Department’s experimental laboratories. Together with the refurbishment of the East Cockcroft wing, due for completion in 2004, this important development has served to consolidate Departmental staff and activities, currently in disparate locations, into a single area, and should lead to operational efficiencies and improved intra-Departmental interactions.

Members of the Department were again successful in winning grants, awards, and other marks of distinction during the year. The Department won four grants in the ARC Discovery round, resulting in funding on the order of $400K p.a. (Weigold, Gibson, Sullivan and Kheifets). In addition a successful LIEF application for a National Positron Facility brought in funding of over $800K (Buckman) and $30K seed funding to assist the preparation of a full application for an ARC research network in Optical and Quantum Science was secured (Baldwin). Brenton Lewis won DEST and Victorian Government funding of $77K as sponsorship for the Fourteenth International Conference on Vacuum Ultraviolet Radiation Physics that he is chairing in Cairns next July. $140K from the Major Equipment Committee to further efforts in photodetachment and photofragment spectroscopy was also won (Gibson and Cavanagh). Finally, we congratulate Andrew Truscott, who won the Australian Academy of Sciences Early-Career Researcher Award, and Thomas Hanna, who won the General Sir John Monash Award which will enable his DPhil studies at Oxford University.

The international research profile of the Department remains strong, as evidenced, not only by invitations to speak at international conferences, but also by an ongoing commitment to 48 collaborative projects, most involving international collaborators. Of approximately 50 refereed Departmental publications this year, over two-thirds have international coauthors.

Department Staff

Professor and Head of Laboratories
Brenton Lewis, PhD DSc Adel, C Phys, FlinstP, FAPS, FOSA, FAIP

Professors
Stephen Buckman, BSc PhD Flind, FAPS, FAIP
Erich Weigold, BSc Adel, PhD ANU, FAA, FTSE, FAPS, FAIP

Adjunct Professors
Lewis Chadderton, DSc Dur, MA PhD Camb, C Phys, FlinstP, FAIP
Robert McEachran, MSc PhD UWO, C Phys, FlinstP
Robert Robson, BSc Qld, DipMet PhD, FRMS, FAPS, FAIP  (from October)

Senior Fellows
Ken Baldwin, MSc ANU, DIC PhD Lond, FAIP, FOSA (joint project with Laser Physics Centre)
Anatoli Kheifets, BSc PhD St Pet. (jointly with Theoretical Physics)
Maarten Vos, MSc PhD Gron
Departmental Reports

Research School of Physical Sciences & Engineering 2003

Departmental Reports

Research School of Physical Sciences & Engineering 2003 in Excitation Cross Sections

Brunger, M.*, Buckman, S.J. and Elford, M.T.

Books and Book Chapters across departments within the School

 Springer-Verlag, Germany (2003) 6.118-6.201

Legend: * External to the University, † Member of another area of this University other than this School, ‡ Author having a joint appointment across departments within the School

Books and Book Chapters


Research Fellows

Mitsuhiko Kono, MS Kyoto IT, PhD Grad U Adv Sci (from September)
Franklin Mills, BSE Princ, MS PhD Caltech (from July) (jointly with CRES)
Andrew Truscott, BSc PhD Qld. (ARC Centre for Quantum Atom Optics)

Postdoctoral Fellows

Steven Cavanagh, BSc PhD Griff (ARC Fellowship)
Robert Dall, BSc CQld (from November)
Michael Lange, Dip. Phys Dr rer nat Heid (ARC Linkage) (from March)
Radmila Panajotovic, MSc PhD Belgr (until December)
Vladimir Sashin, BSc Mosc, PhD Flind (until May)

Visiting Fellows

John Carver, MSc Syd, PhD ScD Camb, AM, FAA, FTS, FAIP (Emeritus Professor)
Robert Crompton, BSc PhD Adel, AM, FAA, FInstP, FAPS, HonFAIP (Emeritus Professor)
Malcolm Elford, BSc PhD Adel
Harald Friedrich, DipPhys Freib, Dr rer nat M.unst, (jointly with Theoretical Physics) (until March)
Robert Robson, BSc Qld, DipMet, PhD, FRMS, FAPS, FAIP (jointly with Theoretical Physics) (until November)
Theodore Stepinski, BE Qld, ME NSW, FTSE, FIE Aust (from November)

Senior Technical Officers

Stephen Battisson, AssocDipMechEng CIT
Graeme Cornish, AssocDipMechEng CIT
Colin Dedman, AssocDipSciInst Bdgo CAE
Kevin Roberts, MechTechCert SAIT

Technical Officer

Gary Picker, AssocDipMechEng CIT

Departmental Administrator

Alice Duncanson

Department Publications

Buckman, S.J., Brunger, M.*, and Elford, M.T. Integral Elastic Cross Sections in Photon and Electron Interactions with Atoms, Molecules and Ions, Springer-Verlag, Germany (2003) 6.52-6.84


Publications in Refereed Journals


Electronic Materials Engineering

The Electronic Materials Engineering (EME) Department undertakes internationally competitive research into the growth, structure, properties, processing and applications of electronic materials and related structures and devices, and plays an important role in the training of undergraduates, postgraduates and other early career researchers.

This year saw two significant staff changes resulting from restructuring of the Department’s technical resources and the redeployment of the Department’s administrative assistant. Specifically, Renee Vercoe was appointed as Departmental Administrator, and Fred Johnson as the general staff member responsible for the Department’s high-profile accelerator laboratories. As an experimental department with an extensive suite of experimental facilities EME relies very heavily on the dedication and expertise of its technical staff (Michael Aggett, Tom Halstead, Fred Johnson and Bernie King) as well as that of the School workshop (mechanical and electronic) and service staff.

The Department also acknowledges the increasingly important role played by its technical assistants (Martin Conway, Yu Jun, David Llewellyn and Bettina Wolpensinger).

Department Staff

Professor and Head of Department
Rob Elliman, BAppSci, MAppSci RMIT, PhD, DSc Salf, FAIP, FIP

Professors
C. Jagadish, BSc Nagarjuna, MSc (Tech) Andhra, MPhil PhD Delhi, FAIP, FIP, FIoN, FIEEE, FTSE, FAPS
Jim Williams, BSc PhD NSW, FAA, FTSE, FAIP, FiEAust

Senior Fellows
Mark Ridgway, BSc MCM MSc PhD Queen’s

Fellow
Ying Chen, BSc CAS MSc Tsinghua, PhD Paris (ARC Fellowship)
Mladen Petravic, MSc Zagreb, PhD ANU
Hoe Tan, BE Melb, PhD ANU (ARC QEII Fellowship)

Research Fellows
Manuela Buda, PhD Eindhoven
Sanju Deenapanray, BEng MSc Pretoria, PhD ANU (ARC Fellowship)
Jenny Wong-Leung, BSc Bristol, PhD ANU (ARC QEII Fellowship)
Postdoctoral Fellow
Jodie Bradby, BApSc RMIT, PhD ANU (ARC Fellowship)
Lan Fu, MSc UTSC, PhD ANU (ARC Fellowship)
Chris Glover, BSc Newcastle, PhD ANU (ARC Fellowship)
Patrick Kluth, PhD Juelich (Humboldt Fellowship)
Susan Kluth, BSc BEng PhD Leuven (ARC Fellowship)
Tessa Weijers, BSc QUT, PhD ANU (ARC Fellowship) (from October)

Visiting Fellows
Stuart Campbell, BSc Aberd, MSc Salf, PhD Mon, FAIP
Neville Fletcher, PhD Harv, DSc Syd, FIP, FAIP, FAAS, FTAE, FAA, AM
Jeff McCullam, BSc PhD Melbourne
Michael Swain, BSc PhD UNSW (from December)
Heiko Timmers, Dipl Phys Munich, PhD ANU
Peter Zory, BSc Syracuse, PhD Carnegie-Mellon (January to February)
Tessa Weijers, PhD ANU (until October)

Research Assistants
David Llewellyn (jointly with Electron Microscopy Unit, RSBS)
Jun Yu (Assistant to Ying Chen)
Bettina Wolpensinger (Assistant to Robert Elliman, Ying Chen and Jim Williams)

Head Technical Officer
Tom Halstead, ElectCommCert Canb TAFE

Senior Technical Officers
Michael Aggett, AssocDipMechEng CIT
Bernie King, ONC UK
Fred Johnson

Laboratory Technicians
Martin Conway

Departmental Administrator
Renee Vercoe

Department Publications

Legend: * External to the University, # Member of another area of this University other than this School, † Author having a joint appointment across departments within the School

Publications in Refereed Journals

Azevedo, G.M., de, Glover, C.J.*, Yu, K.M.*, and Foran, G.J.*
Direct Evidence of Defect Annihilation During Structural Relaxation of Amorphous Indium Phosphide

Azevedo, G.M., de, Ridgway, M.C., Betlehem, J., Yu, K.M.*, Glover, C.J.* and Foran, G.J.*
EXAFS Measurements of Metal-decorated Nanocavities in Si

Boudinov, H.*, Coelho, A.V.P.*, Tan, H.H. and Jagadish, C.
Characterization of Deep-Level Traps Responsible for Isolation of Proton Implanted GaAs

Brady, J.E., Williams, J.S. and Swain, M.V.*
In Situ Electrical Characterization of Phase Transformations in Si During Indentation

Brett, D.A., Azevedo, G.M. de, Llewellyn, D.J. and Ridgway, M.C.
Gettering of Pt to Implantation-induced Nanocavities in Si

Buda, M., Hay, J., Tan, H.H., Fu, L., Jagadish, C., Reece, P.* and Gal, M.*
Effects of Zn Doping on Intermixing in InGaAs/AlGaAs Lasers Diode Structures

Buda, M., Tan, H.H., Fu, L., Josyula, L.* and Jagadish, C.
Improvement of the Kink-free Operation in Ridge-waveguide Lasers Diodes Due to Coupling of the Optical Field to the Metal Layers Outside the Ridge

Carmon, C., Tan, H.H. and Jagadish, C.
Electrical Isolation of n- and p-implanted InGaAs Epilayers Using Ion Irradiation

Carmony, C., Tan, H.H. and Jagadish, C.
Influence of Cap Layer on Implantation Induced Interdiffusion in InP/InGaAs Quantum Wells

Carmony, C., Tan, H.H. and Jagadish, C.
Ion-implanted InGaAs Quantum Wells

Carmony, C., Tan, H.H. and Jagadish, C., Gaarder, A.* and Marcinkevicius, S.*
Ultrafast Carrier Trapping and Recombination in Highly Resistive Ion Implanted InP

Chen, Y., Conway, M.J. and Fitzgerald, J.D.*
Carbon Nanotubes Formed in Graphite After Ball Milling and Annealing

Chen, Y., Conway, M.J. and Fitzgerald, J.D.*
Carbon Nanotubes Formed in Graphite After Mechanical Grinding and Thermal Annealing

Deenapanray, P.N.K., Svensson, B.G.*, Tan, H.H. and Jagadish, C.
A Comparison of Low-energy As Ion Implantation and Impurity-free Disordering Induced Defects in N-type GaAs Epitaxial Layers

Deenapanray, P.N.K., Petracic, M., Kim, K.J.*, Kim, B.* and Li, G.*
Composite Changes on GaN Surfaces under Low-energy Ion Bombardment Studied by Synchrotron-based Spectroscopies

Deenapanray, P.N.K. and Danie Auret, F.D.*
Deep Level Transient Spectroscopy of Defects Introduced in Si and SiGe by Low Energy Particles
Deenapanray, P.N.K., Coleman, V.A. and Jagadish, C. 
Electrical Characterization of Impurity-free Disordered p-type GaAs 

Deenapanray, P.N.K., Tan, H.H. and Jagadish, C. 
Electrical Characterization of Impurity-free Disorder-induced Defects in n-GaAs Using Native Oxide Layers 

Electron Emission Properties of a Defect at ~(-0.23eV) in Impurity-free Disordered p-GaAs 

Deenapanray, P.N.K., Gao, Q. and Jagadish, C. 
Implant Isolation of Zn-doped GaAs Epilayers: Effects of Ion Species, Doping Concentration, and Implantation Temperature 

Doshi, S., Deenapanray, P.N.K., Tan, H.H. and Jagadish, C. 
Towards a Better Understanding of the Operative Mechanisms Underlying Impurity-free Disorder of GaAs: Effect of Stress 

Elliman, R.G., Lederer, M.J., Smith, N. and Luther-Davies, B. 
The Fabrication and Properties of Silicon-nanocrystal-based Devices and Structures Produced by Ion Implantation – The Search for Gain 

Fletcher, J.D.*, Chen, Y. and Conway, M.J. 
Nanotube Growth During Annealing of Mechanically Milled Boron 

Fletcher, N.H. 
Aboriginal Musical Instruments: The Didjeridu, the Bullroarer and the Gumleaf 
Australian Aboriginal Musical Instruments: The Didjeridu, the Bullroarer and the Gumleaf (2003) 51-54

Fu, L., Lever, P., Tan, H.H., Jagadish, C., Reece, P.* and Gal, M.* 
Suppression of Interdiffusion in InGaAs/GaAs Quantum Dots Using Delocated Layer of Titanium Dioxide 

Gao, Q., Tan, H.H., Jagadish, C. and Deenapanray, P.N.K. 
Defect Evolution in Annealed p-type GaAsN Epilayers Grown by Metalorganic Chemical Vapour Deposition 

Gao, Q., Deenapanray, P.N.K., Tan, H.H. and Jagadish, C. 
Implantation-induced Electrical Isolation of GaAsN Epilayers Grown by Metalorganic Chemical Vapour Deposition 

Glover, C.J., Foran, G.J.* and Ridgway, M.C. 
Structure of Amorphous Silicon Investigated by EXAFS 

Hydrogen Incorporation, Diffusivity and Evolution in Bulk ZnO 

ICP Dry Etching of ZnO and Effects of Hydrogen 

Kucheyev, S.O., Jagadish, C., Williams, J.S., Deenapanray, P.N.K., Yano, M.*, Kolke, K.*, Sasa, S.*, Inoue, M.* and Ogata, K.* 
Implant Isolation of ZnO 

Ion-beam-produced Structural Defects in ZnO 

Kuznetsov, A.Yu.*, Wong-Leung, J., Hallen, A.*, Jagadish, C. and Svensson, B.G.* 
Dynamic Annealing in Ion Implanted SiC: Flux Versus Temperature Dependence 

Lay, M.D.A.*, McCallum, J.C.* and Jagadish, C. 
Implantation Angle Dependent Study of Vacancy Related Defect Profiles in Ion-Implanted Silicon 

Identification of Hydrogen Related Defects in Proton Implanted Float-zone Silicon 

Vacancy and Interstitial Depth Profiles in Ion-implanted Silicon 

Determination of Carrier-transfer Length from Side-wall Quantum Well to Quantum Wire by Micro-photoluminescence Scanning 

Solubility Limits of Dopants in 4H-SiC 

Liu, A.C.Y.*, McCallum, J.C.* and Deenapanray, P.N.K. 
Detective Crystal Recovered from the Crystallization of Potassium-doped Amorphous Silicon Films 

Carrier Lifetime Studies of Deeply Penetrating Defects in Self-Imnplaned Silicon 

Petravic, M., Deenapanray, P.N.K., Ushier, B.F.*, Kim, K.J.* and Kim, B.* 
High-resolution Photoemission Study of Hydrogen Interaction with Polar and Nonpolar GaAs Surfaces 

Athermal Annealing of Si-implanted GaAs and InP 

Ridgway, M.C., Azevedo, G.M. de, Glover, C.J.*, Yu, K.M.* and Foran, G.J.* 
Common Structure in Amorphised Compound Semiconductors 

Ruault, M.D.*, Ridgway, M.C., Fortuna, F.*, Bernas, H.* and Williams, J.S. 
In-situ Microscopy Study of Nanocravity Shrinkage in Si Under Ion Beam Irradiation 

Ruault, M.D.*, Ridgway, M.C., Fortuna, F.*, Bernas, H.* and Williams, J.S. 
Shrinkage Mechanism of Nanocravities in Amorphous Si Under Ion Irradiation: An in situ Study 

Ferromagnetic GaAs Produced by Ion Implantation and Pulsed-laser Melting 

Stewart, K., Buda, M., Wong-Leung, J., Fu, L., Jagadish, C., Stiff-Roberts, A.* and Bhattacharya, P.* 
Influence of Rapid Thermal Annealing on a 30 Stack InAs/GaAs Quantum Dot Infrared Photodetector 

Epitaxially Grown GaAsN Random Laser 
Research within the Centre covers many of the most exciting aspects of contemporary laser-based research. The activities within the Centre can be broadly divided into seven areas: laser-matter interactions, nonlinear optical phenomena, nonlinear optical materials, solid-state spectroscopy, UV spectroscopy, atom manipulation, and photonics. Research in photonics is partly supported by the Australian Photonics Cooperative Research Centre. Research highlights for 2003 include the first demonstration of two-qubit quantum logic operations in solid state impurity sites (Longdell, Sellars, Manson); the successful demonstration of femtosecond laser writing and reading of 3D optical memory involving collaboration with Professors Mizawa and Juodkazis from Tokushima University (Gamaly, Rode); the successful completion of a 50 W mode-locked laser system for ultrafast laser deposition involving collaboration with Malte During and Joachim Giesekus from Fraunhofer ILT in Aachen (Kolev, Luther-Davies); and demonstration of the production of optically-induced lattices in nonlinear optical materials (Krolikowski, Neshev); and development of a low chirp (<10 MHz), Fourier transform-limited, long pulse (25 ns) optical parametric oscillator for high resolution spectroscopy (Baldwin, Orr).

2003 was a good year for new competitive funding. Activities started within the two new Centres of Excellence funded by the Australian Research Council announced at the end of 2002. We play a major role in the Centre for Ultra-high Bandwidth Devices for Optical Systems (CUDOS) which brings around $800K of additional funding each year to activities in the School. CUDOS involves collaboration with groups at the University of Sydney, The University of Technology, Sydney, Macquarie University, Swinburne University and the CSIRO and aims to develop new all-optical technologies for advanced photonic “chips”. We have a smaller involvement in the Australian Centre for Quantum-Atom Optics, (ACQAO) whose partners are the University of Queensland and Swinburne University. ACQAO focuses on fundamental research, but has a long-term goal to underpin and develop the next generation quantum technology.

A number of other ARC grants were won during the year. Barry Luther-Davies was awarded a prestigious Federation Fellowship commencing in October. This fellowship is for the creation of novel photonic and nanomaterials by ablation of solids with ultra-fast lasers. Work started on two Discovery grants awarded in 2002, the storage of non-classical light, and the development of a quantum computer. Two new ARC Discovery grants were won in the 2003 round for work on integrated magneto-optic devices (Jarvis, Luther-Davies) and solitons in non-local media (Krolikowski). An ARC Linkage grant to develop a sodium laser guide star in collaboration with Electro Optic Systems Pty Ltd of Queanbeyan was also received (Kolev, Luther-Davies). Ken Baldwin was Initiative Coordinator on a successful bid for an ARC Special Research Initiatives Seed Funding Grant for the “Network for Optical and Quantum Science and Technology”. Several members of staff continue to work as consultants at RPO Pty Ltd whose activities stemmed from work on inorganic polymer glasses funded by the Australian Photonics CRC, and a new contract was signed with the company during 2003.

The Centre congratulates Wieslaw Krolikowski on his promotion to Professor and Matt Sellars on his promotion to academic level C. Congratulations also go to Snjezana Tonjénovic-Haníc and Jevon Longell who were awarded their PhDs during the year. We were pleased to welcome new students Annabel Alexander, Brendon Hanna, Darren Freeman, Nathan Madsen, Roger MCMurtrie and Khu Vu. Jochen Schröder and Malte During spend lengthy periods in the Centre as visiting scholars.

Centre Staff

Professor and Head of Department
Barry Luther-Davies, BSc PhD S’ton, SIEE, FAIP (ARC Federation Fellow)

Professor
Neil Manson, MSc PhD Aberd

Senior Fellows
Ken Baldwin, MSc ANU, DIC PhD Lond, FAIP, FOSA (joint project with Atomic and Molecular Physics Laboratories)
Wieslaw Krolikowski, MSc PhD Wars
Centre Publications

Legend: * External to the University, † Member of another area of this University other than this School, # Author having a joint appointment across departments within the School.

Publications in Refereed Journals

Chan, A.*, Rode, A.V., Gamaly, E.G.*, Luther-Davies, B., Taylor, B.*, Dawes, J.T., Lowe, M.* and Hannaford, P.*
Ablation of Dental Enamel Using Subpicosecond Pulsed Lasers

Charge Carrier Mobility in an Organic-inorganic Hybrid Non-
compositem

Cruz, S.A.*, Gamaly, E.G.*, Chadderton, L.T. and Fink, D.*
A Simple Model for Latent Track Formation Due to Cluster Ion Stopping and Fragmentation in Solids
Radiation Measurements 36 (2003) 145-149


Synthesis and Third-order Nonlinear Optical Properties of [Mo3(3-5)(2-5)]4# Clusters with Maleonitriledithiolate, Oxalate and Thiocyanate Ligands
Dalton Transactions 23 (2003) 4546-4551

Goldberg, D.*, Rode, A.V., Bando, Y.*, Mlomite, M.*, Gamaly, E.G.* and Luther-Davies, B.

Halliwell, X.W., Friedrich, H., Gibson, S.T. and Baldwin, K.G.H.*
Quantum Reflection of Metastable Helium 23S Atoms in Hollow Optical Fibres
Optics Communications 224 (2003) 89-95

Organometallic Complexes for Nonlinear Optics. Part 29. Quadratic and Cubic Hyperpolarizabilities of Stilbenylethynyl-gold and Ruthenium Complexes

Hurst, S.K.*, Humphrey, M.G.*, Morrall, J.P.*, Cifuentes, M.P.*, Samoc, M., Luther-Davies, B., Heath, G.W.* and Willis, A.C.*
Organometallic Complexes for Nonlinear Optics. Part 31. Cubic Hyperpolarizabilities of Ferrocenyl-linked Gold and Ruthenium Complexes

Juodkazis, S.*, Rode, A.V., Gamaly, E.G.*, Matsumoto, S.* and Mizawa, H.*
Recording and Reading of Three-dimensional Optical Memory in Glasses

Kolev, V.Z., Lederer, M.J., Luther-Davies, B. and Rode, A.V.*
Passive Mode Locking of a Nd:YVO4 Laser with an Extra-long Optical Resonator
Optics Letters 28 (2003) 1275-1277

Kono, M., Lewis, B.R., Baldwin, K.G.H.* and Gibson, S.T.
Experimental Verification of Line- and Band-shape Asymmetry in the Schumann-Runge System of O2
Journal of Chemical Physics 118 (2003) 10924-10928 (also listed under Atomic & Molecular Physics Laboratories)

Krolkowski, W., Bang, O.*, Wyller, J.* and Rasmussen, J.J.*
Optical Beams in Nonlocal Nonlinear Media

Krolkowski, W., Luther-Davies, B. and Denz, C.*
Photorefractive Solitons

Andrei Rode, MSc PhD Mosc
Marek Samoc, PhD DSc Wroc

Fellows
Anna Samoc, MSc PhD Wrocl

Research Fellow
Matthew Sellars, BSc PhD ANU

Postdoctoral Fellows
Ruth Jarvis, BE BSc ANU (Australian Photonics CRC)
Douglas Bulla, MSc PhD USP Brazil (Australian Photonics CRC)
Wetang Li, MSc China, PhD Sydney (Australian Photonics CRC)
Congji Zha, BE Jingdezheng, ME WUT, PhD Sydney (from September)

Visiting Fellows
Graham Atkins, BSc PhD Sydney
Robbie Charters, BSc Nott, PhD Cranfield
Ben Cornish, BSc ANU
Eugene Gamaly, PhD DSc Mosc (from August) (jointly with AM)
Graeme Gordon
Mark Humphrey, BSc PhD Adelaide (until September)
Dax Kukulj, BSc PhD UNSW (until May and from October)
Jevon Longdell, BSc Waikato, MSc Auck, PhD ANU (from December)
David Pulford, BSc PhD
John Wyller, MSc PhD Tromsø (jointly with DU) (from August)
Congji Zha, BE Jingdezheng, ME WUT, PhD Syd (until August)
Guo Zhen, PhD Shanghai

Research Assistants
Mr Vessel Kolev, Eng-Phys Uni of Ploddiv
Mr Darren Freeman, BEng (EE) (Hons) Flinders

Head Technical Officer
Ian McRae

Senior Technical Officers
Craig Macleod, AssocDipMechEng CIT
Mike Pennington, AssocDipAppSciInst CIT
Anita Smith, BSc Flinders

Technical Officers
John Bottega
Maryla Krolikowska

Departmental Administrators
Sharon Lopez (to May)
Belinda Barbour
Scattering of Dipole-mode Vector Solitons: Theory and Experiment

Li, W.T., Bulla, D.A.P.*, Love, J.D., Luther-Davies, B., Charles, C. and Boswell, R.W.*
Hydrogen Contamination in Ge-doped SiO2 Thin Films Prepared by Helicon Activated Reactive Evaporation
Journal of Vacuum Science and Technology A 21 (2003) 792-796

Mutual Spatial-soliton Trapping in Photorefractive Media: Experiment Versus Theory

Neshev, D., Ostrovskaya, E.A., Kivshar, Yu.S. and Krolkowski, W.
Spatial Solitons in Optically Induced Gratings

Nikolov, N.I., Neshev, D., Bang, O.* and Krolkowski, W.
Quadratic Solitons as Nonlocal Solitons

Organonetallic Complexes for Nonlinear Optics. 30. Electrochromic Linear and Nonlinear Optical Properties of Alkynylbis(diphosphine)ruthenium Complexes
Journal of the American Chemical Society 125 (2003) 602-610

Organonetallic Complexes for Nonlinear Optics. 33. Electrochemical Switching of the Third-order Nonlinearity Observed by Simultaneous Femtosecond Degenerate Four-wave Mixing and Pump-probe Measurements

Precision Ablation of Dental Enamel Using a Subpicosecond-pulsed Laser
Australian Dental Journal 48 (2003) 233-239

Samoc, A.
Dispersion of Refractive Properties of Solvents: Chlorosulfonic Acid, Benzene and Carbon Disulfide in Ultra-violet, Visible and Near-infrared

Samoc, A., Samoc, M., Luther-Davies, B., Freydank, A.C. and Lucas, N.T.*
Investigations into Nonlinear Optical Chromophores with Femtosecond Degenerate Four-wave Mixing in Solutions

Samoc, M., Samoc, A. and Luther-Davies, B.
Third Harmonic Autocorrelation and Wave Mixing in a Thin Film of Poly(p-phenylethylenvinylene)
Optics Express 11 (2003) 1787-1792

Samoc, M., Samoc, A., Luther-Davies, B., Humphrey, M.G.* and Wong, M.-S.*
Third-order Optical Nonlinearities of Oligomers, Dendrimers and Polymers Derived from Solution Z-scan Studies

Extreme Ultra-violet Laser Excitation of Isotopic Molecular Nitrogen: The Dipole-allowed Spectrum of 15N2 and 14N15N

Tanaumang, H.*, Herman, H.*, Tija, M.O.* and Samoc, M.
Electric Field Induced Second Harmonic Generation in Vacuum Evaporated Disperse Red 1 Films
Optica Acta 41 (1994) 715-728

Optical Materials 22 (2003) 289-294

Tomljenovic-Hanic, S. and Krolkowski, W.
New Design for a Variable Optical Attenuator Based on a Bent Channel Waveguide
Applied Physics B Lasers and Optics 77 (2003) 19-23

White, R.T.*, He, Y.*, Orr, B.J.*, Kono, M. and Baldwin, K.G.H.*
Pulsed Injection-seeded Optical Parametric Oscillator with Low Frequency Chirp for High-resolution Spectroscopy
Optics Letters 28 (2003) 1248-1250

Wilson, E., Manson, N. and Wei, C.
Perturbing an Electromagnetic Induced Transparency within an Inhomogeneously Broadened Transition
Physical Review A 67 (2003) 023812-1-10

Zakery, A.*, Ruan, Y., Rode, A.V., Samoc, M. and Luther-Davies, B.
Low-loss Waveguides in Ultrastable Laser-deposited As253 Chalcogenide Films

A Comparative Schlieren Imaging Study Between ns and Sub-ps Laser Forward Transfer of Cr
Applied Surface Science 208-209 (2003) 177-180

Refereed Conference Proceedings
Geometry Effects upon the Transmission Loss in Optical Rib Waveguides Fabricated Using Chemical Etching

Jarvis, R. and Boswell, R.W.
Expansion of Germanium Doped Silica Films under UV Irradiation

Lucas, N.T.*, Notaras, E.G., Humphrey, M.G.*, Samoc, M. and Luther-Davies, B.

Luo, X., Zha, C. and Luther-Davies, B.
Synthesis of Low-Oh Photosensitive Osmosil Polymers Via Anhydroly Sol-gel Process for Integrated Optics

Luo, X., Zha, C. and Luther-Davies, B.
Synthesis of Photosensitive Organic-inorganic Hybrid Polymers Via Anhydroly Sol-gel Process for Integrated Optics

Luther-Davies, B., Kolev, V.Z., Yelinan, R., Samoc, M., Jarvis, R., Rode, A.V., Giesekus, J.*, Du, K.-M.*, Duering, M.* and Zakery, N.*
Low Chalcogenide Glass Waveguides Produced by Pulsed Laser Deposition

Luther-Davies, B., Kolev, V.Z., Leverer, M.J., Ruan, Y., Samoc, M., Jarvis, R., Rode, A.V., Giesekus, J.*, Du, K.-M.*, and Duering, M.*
Ultrastable Laser Deposition of Chalcogenide Glass Films for Low-loss Optical Waveguides
Advanced Optical Processing of Materials Symposium, San Francisco, USA (2003) 131-142

Spatial-soliton Interactions: Experiment versus Theory

Neshev, D., Ostrovskaya, E.A., Kivshar, Yu.S. and Krolkowski, W.
Localization of Light in Optically-induced Gratings

Sukhorukov, A.A., Neshev, D., Kivshar, Yu.S. and Krolkowski, W.
Nonlinear Bio-wave Spectroscopy of Opticaly-induced Gratings

A Laser Cooled Metastable Helium Facility for Atomic Collision Research
21st Summer School and International Symposium on the Physics of Ionized Gases (21st SPIG), Sokoabanja, Yugoslavia (2003) 19-33

Studies on Ultra-short Laser Micro Structuring
The Nonlinear Physics Centre is engaged in fundamental research on nonlinear phenomena and the dynamics of nonlinear localised waves and solitons in different branches of physics.

Professor Yuri Kivshar

The interdisciplinary research of the Centre covers several topics such as nonlinear optics and all-optical switching devices, nanooptics and photonic crystals, self-trapping effects and energy transfer in condensed matter physics and biopolymers, nonlinear atom optics and dynamics of Bose-Einstein condensates, and more recently, linear and nonlinear effects in left-handed metamaterials. Other research covered is linear and nonlinear optics, quantum optics, parametric effects and frequency conversion, dissipative solitons, nonlinear materials, etc.

Research highlights for 2003 include the demonstration of the production of optically-induced lattices in nonlinear optical materials (Neshev); the first experimental generation of discrete vortices (Neshev, Alexander, Ostrovskaya and Kivshar); experimental and theoretical studies of spatial gap solitons in optically-induced lattices (Sukhorukov, Neshev, Krolikowski and Kivshar); the first prediction of gap vortices in optical lattices (Ostrovskaya); the development of the comprehensive theory of nonlinear effects in left-handed materials (Shadrivov and Kivshar); the theoretical demonstration of giant Lamb shift in photonic crystals (Wang); and the theory of nonlinear switching in periodic structures with negative refraction (Feise and Shadrivov). Added to our important milestones for 2003 was the publication of a book on optical solitons (Agrawal and Kivshar) and a comprehensive review paper on parametric processes for Progress in Optics (Saltiel, Sukhorukov and Kivshar). Overall, in 2003 the members of the Group published seven papers in Physical Review Letters, the top-ranked journal in physics, the largest number ever published annually by a single department in the School.

This was a good year for new competitive funding. Our major activities are supported by the two new Centres of Excellence funded by the Australian Research Council announced at the end of 2002. We play a major role in the Centre for Ultra-high Bandwidth Devices for Optical Systems (CUDOS) which brings around $800K of additional funding each year to activities in the School. We also have a strong involvement in the Australian Centre for Quantum-Atom Optics, (ACQAO). In view of our earlier success with the ARC funding, we have had limited eligibility to apply for new funding from the ARC. Nevertheless, a new ARC Discovery grant ($750K) was won in the 2003 round for work on optically-induced lattices (Neshev, Sukhorukov).

The Centre congratulates both Andrey Sukhorukov and Elena Ostrovskaya on their promotion to level B. Congratulations also go to Tristram Alexander who submitted his thesis in 2003 and has already been awarded his PhD this year. We were pleased to welcome new PhD student Beata Dabrowska. During 2003, the Group hosted a number of visiting scholars and visiting fellows, including Alex Zharov (Russia), Solomon Saltiel (Bulgaria), John Wyller (Norway), Dmitry Pelinovsky (Canada), Jean Guy Caputo (France), Nina Zharova (Russia), Jose Salgueiro (Spain) and Kristian Motzek (Germany).

Centre Staff

Professor and Head of Centre
Yuri Kivshar, PhD USSR Acad Sci

Professor
Solomon Saltiel, MSc PhD Mosc, DSc Sofia (from June)

Research Fellows
Michael Feise, MSc PhD Pullman
Dragomir Neshev, MSc PhD Sofia
Elena Ostrovskaya, MSc Mosc, PhD ANU
Xue-Hua Wang, PhD China

Postdoctoral Fellows
Tristram Alexander PhD ANU (from August)
Andrey Sukhorukov, PhD ANU

Visiting Fellows
Jean Caputo, MSc PhD Grenoble (June to August)
Dmitry Pelinovsky, MSc PhD Monash
Sergei Kun, MSc PhD Kiev (jointly with TP) (from June)
Kristian Motzek, MSc Darmstadt (October to December)
Jose Ramon Salgueiro, MS PhD Santiago de Compostela
John Wyller, MSc PhD Tromsø (jointly with LPC)(from August)
Alexander Zharov, BSc Gorky, PhD USSR AcadSci, DSc NIRFI, Russia (February to April, October to December)
Nina Zharova, BSc Gorky, PhD USSR AcadSci (Oct. to December)

Departmental Administrator
Wendy Quinn, BA

Centre Publications

Books and Book Chapters
Mingaleev, S.F. and Kivshar, Yu.S.

Publications in Refered Journals

Branki, F.*, Neshev, D. and Ubachs, W.*
High-order Harmonic Generation Yielding Tunable Extreme-ultraviolet Radiation of High Spectral Purity

Soliton "Molecules": Robust Clusters of Spatiotemporal Optical Solitons

Desyatnikov, A.S., Ostrovskaya, E.A., Kivshar, Yu.S. and Denz, C.*
Composite Band-gap Solitons in Nonlinear Optically Induced Lattices

Shadrivov, I.V.*, Kivshar, Yu.S. and Kovaliev, A.S.*
Instabilities and Bifurcations of Nonlinear Impurity Modes

Kivshar, Yu.S. and Flach, S.*
Nonlinear Localized Modes

Kivshar, Yu.S., Kevrekidis, P.G.* and Takeno, S.*
Nonlinear Localized Modes in Waveguide Bends

Krolikowski, W., McCarthy, G., Kivshar, Yu.S., Wellinau, C., Denz, C.*, Garcia-Ripoll, J. and Perez-Garcia, V.M.*
Scattering of Dipole-mode Vector Solitons: Theory and Experiment

Louis, P.J.Y., Ostrovskaya, E.A., Savage, C. and Kivshar, Yu.S.
Bose-Einstein Condensates in Optical Lattices: Band-gap Structure and Solitons

Mutual Spatial-soliton Trapping in Photorefractive Media: Experiment Versus Theory

Neshev, D., Ostrovskaya, E.A., Kivshar, Yu.S. and Krolikowski, W.
Spatial Solitons in Optically Induced Gratings
Optics Letters 28 (2003) 710-712

Nikolov, N.I., Neshev, D., Bang, O.* and Krolikowski, W.
Quadratic Solitons as Nonlocal Solitons

Ostrovskaya, E.A. and Kivshar, Yu.S.
Multiwave Gap Solitons in Atomic Band-gap Structures

Experimental Test of Spontaneous Correlation and Anomalous Sensitivity in Finite Highly Excited Many-body Systems

Salgueiro, J.R., Shadrivov, I.V., Kivshar, Yu.S. and Saltiel, S.M.*
Parametric Vector Solitons in Tetragonal Crystals
Optics Letters 28 (2003) 826-830

Salgueiro, J.R., Sukhorukov, A.A. and Kivshar, Yu.S.
Spatial Optical Solitons Supported by Mutual Focusing
Optics Letters 28 (2003) 1457-1459

Shadrivov, I.V., Sukhorukov, A.A. and Kivshar, Yu.S.
Beam Shaping by a Periodic Structure with Negative Refraction

Shadrivov, I.V., Zharov, A.A. and Kivshar, Yu.S.
Giant Gouss-Hanchen Effect at the Reflection from Left-handed Metamaterials

Shadrivov, I.V., Sukhorukov, A.A. and Kivshar, Yu.S.
Guided Modes in Negative-refractive-index Waveguides

Shadrivov, I.V. and Zharov, A.A.
Interaction of Vector Solitons with a Nonlinear Interface
Optics Communications 216 (2003) 47-54

Sukhorukov, A.A. and Kivshar, Yu.S.
Generation and Stability of Discrete Gap Solitons
Optics Letters 28 (2003) 2345-2347

Sukhorukov, A.A. and Kivshar, Yu.S.
Multigap Discrete Vector Solitons

Sukhorukov, A.A. and Akhmediev, N.N.
Multiport Soliton Devices with Controllable Transmission

Sukhorukov, A.A., Kivshar, Yu.S., Eisenberg, H. and Silberberg, Y.
Spatial Optical Solitons in Waveguide Arrays

Theocharis, G.*, Frantzeskakis, D.J.*, Kevrekidis, P.G.*, Malomed, B.A.* and Kivshar, Yu.S.
Ring Dark Solitons and Vortex Necklaces in Bose-Einstein Condensates

Vinencio, R.A.*, Molina, M.J.* and Kivshar, Yu.S.
Controlled Switching of Discrete Solitons in Waveguide Arrays

Zharov, A.A., Shadrivov, I.V. and Kivshar, Yu.S.
Nonlinear Properties of Left-handed Metamaterials
Physical Review Letters 91 (2003) 057401-1-4

Refereed Conference Proceedings

Desyatnikov, A.M.*, Denz, C.* and Kivshar, Yu.S.
Composite Bound States of Spatial Optical Solitons
CLEO/Europe - EQEC 2003, Munich, Germany (2003) EE5-4-THU

Kivshar, Yu.S. and Mingaleev, S.F.
Nonlinear Photonic Crystals: All-optical Switching and Gap Solitons
IEEE LEOS Summer Topical Meeting, Vancouver, Canada (2003) 21-22

Kivshar, Yu.S.
Nonlinear Photonic Crystals
87th OSA Annual Meeting, Tucson, USA (2003) MF1-1

Louis, P.J.Y., Ostrovskaya, E.A., Kivshar, Yu.S. and Savage, C.*
Bose-Einstein Condensates in One-dimensional Optical Lattices: Bandgap Structure and Solitons

Spatial-soliton Interactions: Experiment Versus Theory

Neshev, D., Ostrovskaya, E.A., Kivshar, Yu.S. and Krolikowski, W.
Localization of Light in Optically-induced Gratings

Shadrivov, I.V., Sukhorukov, A.A. and Kivshar, Yu.S.
Beam Shaping by a Periodic Structure of Left-handed Slabs

Shadrivov, I.V., Sukhorukov, A.A. and Kivshar, Yu.S.
Guided Modes in Negative Refractive Index Waveguides

Shadrivov, I.V., Sukhorukov, A.A., Kivshar, Yu.S., Boardman, A.D.* and Zharov, A.A.*
Surface Polaritons of Nonlinear Left-handed Materials
CLEO/Europe - EQEC 2003, Munich, Germany (2003) EE2-6-Mon

Sukhorukov, A.A. and Kivshar, Yu.S.
Controlled Generation and Steering of Spatial Gap Solitons in Waveguide Arrays
CLEO/Europe - EQEC 2003, Munich, Germany (2003) EE3-4-WED

Sukhorukov, A.A., Neshev, D., Kivshar, Yu.S. and Krolikowski, W.
Nonlinear Bloch-wave Spectroscopy of Optically-induced Gratings

Sukhorukov, A.A. and Kivshar, Yu.S.
Stability and Excitation of Gap Solitons in Binary Waveguide Arrays
The Department operates the premier laboratory in Australia for accelerator-based research in nuclear physics, providing and developing facilities for local staff and national and international outside users. The facilities are used for postgraduate and postdoctoral training over a wide range of research, from basic to applied.

The Department had a productive year in terms of both the research carried out by staff and in the development and operation of the Heavy Ion Accelerator Facility, the premier laboratory in Australia for accelerator-based research in nuclear physics, providing and developing facilities for local staff and national and international outside users.

Approximately 40 papers were published in major peer-reviewed journals and Department members contributed to about 20 conferences and workshops, 14 of them international, including nine invited papers.

Research highlights range from basic research in nuclear structure to climate change. The successful observation of linking transitions connecting the superdeformed structures to normal states in the neutron-deficient nucleus Pb-192 by a local team led by Anna Wilson and including collaborators at the Lawrence Berkeley National Laboratory has led to renewed interest in tunneling in nuclear systems. In contrast, the application of Accelerator Mass Spectrometry dating techniques to the extraction of the history of Ice Age glaciers in Australia has provided new information on historical mean temperatures with profound implications for the adaptation to such conditions and subsequent changes by Australian Aborigines.

External funding was obtained to support the main areas of research including the following ARC Discovery grants: “Characterising Nuclei Far From Stability with a Novel Recoil Spectrometer (2004-2006)” (Dracoulis, Lane and Kibedi); “Development of Advanced Detection Systems for Accelerator Mass Spectrometry” (Mortona) and “Superdeformed Nuclei and their Decay” (Wilson).

The Department was also successful in obtaining a major ARC LIEF grant with the support of collaborators from the Department of Electronic Materials Engineering, the Department of Physics in the Faculties, Macquarie University, the University of Newcastle and the University of New South Wales. The main objectives of the proposal entitled “National Heavy Ion Accelerator” are to enhance the capabilities of the Heavy Ion Facility by extending both the energy range and the range of beam species. The variety of beams provided by the facility are already used for an extensive range of research in basic science, applications and research training. In 2003 alone there were nearly 50 international users of the facility including 18 postgraduate students.

Awards this year include the 2003 Lyle Medal, a senior award of the Australian Academy of Science, to George Dracoulis. The award recognised both his individual contributions to nuclear structure and the international standing of the laboratory. Annette Berriman won the 2002 Australian Institute Bragg Gold Medal for her PhD thesis on “Entrance-Channel Effects in Fission-Fusion Dynamics”, and Centenary Medals were awarded to George Dracoulis and John Newton.

Greg Lane was promoted to level C, Tim Barrows to level B and both David Hinde and Aidan Byrne were promoted to Professor.

Department Staff

Professor and Head of Department
George Dracoulis, BSc PhD Melb, FAIP, FAPS, Hon. FRSNZ, FAA

Senior Fellows
Tezer Esat, MSc Queens, PhD ANU (jointly with Research School of Earth Sciences)
David Hinde, BSc Manc, PhD ANU, FAIP
Keith Fifield, MSc Auck, PhD Penn, FAIP
Andrew Stuchbery, BSc PhD Melb, FAIP

Reader
Aidan Byrne, MSc Auck, PhD ANU, FAIP
(jointly with Department of Physics, The Faculties)

Fellow
Mahananda Dasgupta, BSc MSc Rajasthan, PhD Bombay (from June; ARC QEII Fellowship until June)
Tibor Kibédi, PhD Debrecen

Research Fellows
Greg Lane, BSc PhD ANU (ARC Fellowship)
Stephen Tims, BSc PhD Melb
Anna Wilson, BSc Bristol, PhD Liverpool
Post Doctoral Fellows
Timothy Barrows, BSc PhD ANU
Clyde Morton, BSc Sydney, PhD ANU (ARC Fellowship)

Visiting Fellows
Bruce Barrett, BSc Kansas, MSc PhD Stanford (May to June)
Igor Gontchar, Dip Omsk, PhD Tomsk, DSc Dubna (July to September)
John Newton, MA PhD Camb, DSc Manc, FAA (Emeritus Professor)
Susanne Olivier, Dipl Chem Berne (until March)
Ray Spear, PhD DSc Melb, FAPS, FAIP (Emeritus Professor)
Martin Suter, PhD ETH, Zurich (July to August)
Heiko Timmers, Dipl Phys Munich, PhD ANU (jointly with EME)
Katrien Vyve, BSc MSc PhD Leuven (January to July)

Research Officers
Paul Davidson, BSc MSc Auck, PhD ANU
Gordon Foote, BSc Lond, PhD ANU
Vladimir Levchenko, MSc PhD St Petersburg

Engineer
Nikolai Lobanov, BSc Moscow, PhD St Petersburg

Technical Officers
John Bockwinkel, AssocDipMechEng
Alan Cooper, AssocDipMechEng
Alan Harding
Justin Heighway, AssocDipAppSci
John Kennedy
Lorenzo Lariosa
Alistair Muirhead
Andy Rawlinson (June to August)
Bob Turkentine
Howard Wallace

Departmental Administrator
Marj O'Neill

Department Publications

**Books and Book Chapters**


Lane, G.J., Byrne, A.P. and Dracoulis, G.D. High-spin Isomers, Residual Interactions and Octupole Correlations in the N=128 Isotones: 211Bi, 212Po and 213At in *Frontiers of Nuclear Structure*, American Institute of Physics, USA (2003) 386-393

**Publications in Refereed Journals**


Plasma Research Laboratory

Plasmas — ionised gases — comprise most of the visible universe and are also at the core of development of energy, space, materials, and optical and wireless communications technologies for the future. The Plasma Research Laboratory (PRL) conducts research in all these areas, in close collaboration with other laboratory and industry groups around the world.

The Laboratory’s research attracts over $1M per year in external funding, from the ARC Discovery and Linkage programs, DEST and ACT research grants, Euratom and international industrial contracts. The Laboratory is comprised of six academic and six general staff members, two post-dc, around 12 post graduate students, and 5-10 undergraduate students.

Research in toroidal plasma confinement is carried out by the Toroidal Physics Group, and centers around the H-1 Heliac Major National Research Facility. H-1 is a toroidal stellarator magnetic plasma confinement experiment for the study of the plasma physics important in developing fusion energy: that is, to provide renewable electricity generation using light-atom fusion reactions like those that power the Sun and stars.

In 2003, studies of the plasma turbulence in the heliac by Michael Shats and his colleagues demonstrated the role of zonal flows and self-organisation in regulating the outward transport of particles and achieving enhanced confinement regimes.

Heliac experiments carried out by Boyd Blackwell, Jeffrey Harris and their colleagues demonstrated the sensitivity of confinement and fluctuations in the heliac to resonant effects in the magnetic configuration, and a related collaborative experiment on the D3D tokamak in the USA demonstrated the use of spatially-resonant magnetic fields to control the stability of the plasma edge.

John Howard and his colleagues have used heliac experiments to develop a series of novel imaging spectrometers that use electro-optic technology to determine temperatures and flows in radiating media. These techniques are in use on fusion experiments in Europe and the USA, and are being developed for use in defence and steel production.

The Space Physics and Plasma Processing (SP3) Group led by Rod Boswell and Christine Charles have continued to develop the helicon plasma source. The robustness of the concept has led to a large range of applications: basic plasma physics experiments to electronic and optical materials processing and plasma thrusters for space travel. This work is being carried out in collaboration with French and US space scientists.

Other applications of helicon sources include a high brightness ion sources for semiconductor device fabrication (with FEI, Inc, USA) and the fabrication of nano-titre plate technology for drug testing.

Our interest in rf technology has led to the development of the Bush Local Area Network (BushLAN) project, headed by Gerard Borg, which is developing digital VHF (Very High Frequency) wireless technology for use in a novel scheme to provide long-distance (~50 km) Internet connections to regional Australia.

Department Staff

Professor and Head of Department
Jeffrey Harris, MS MIT, PhD Wisc, FAPS, FAIP

Professor
Roderick Boswell, BSc Adel, PhD Flin, FAPS, FTSE, FATS

Senior Fellows
Boyd Blackwell, BSc PhD Syd
John Howard, BSc PhD Syd
Michael Shats, MSc Kiev Poly Inst, PhD Gen Phys Inst Mosc

Fellows
Gerard Borg, BSc PhD Syd
Christine Charles, Ingénieur INSA Rennes, PhD Orléans (Australian Photonics CRC)

Post-doctoral Fellows
Douglas Bulla, PhD Sao Paulo (Australian Photonics CRC)
Wei Tang Li, MSc China, PhD Syd (Australian Photonics CRC)

Adjunct Fellows
Mr Scott Collis, BSc Syd
Mr Fenton Glass, BSc Qld
Mr Clive Michael, BSc
Mr Horst Punzmann, BSc Polytech Regensburg
Visiting Fellows
Joe Baker, MSc PhD Qld, OBE, FTSE
Lise Cailault, DEA Orsay, PhD ONERA
Andrew Cheetham, BSc PhD Flinders (until February)
Braulio de la Fuente  (from August)
Roger Gammon, Btech PhD Brunel, FinstP, Cphys, MIE Aust, CP
Eng, FAIE, FAIM
Sydney Hamberger, PhD DSc Lond, FAIP  (Emeritus Professor)
John Keller, PhD Rensselaer Polytechnic
Mike Lieberman, PhD Elect Eng, Berkeley
Dennis Mather, BSc PhD UNSW, Dip Ed STC
Kazunobo Nagasaki, MSc PhD Kyoto
John O’Connor, BSc PhD Dsc ANU
Alexander Samarin, BSc Moscow, PhD Protvino  (jointly with TP) (February to March)
Anthony Sproule, ME UT Syd, GradDipOR NSW IT
Chang-Fei Wang (from August)
Wei-Rong Wu (from August)

Head Technical Officer
Clinton Davies

Senior Technical Officers
Peter Alexander
Ray Kimlin
John Wach, BAppSci CAE Ball, GradDipEl CCAE

Technical Officer
Costanzo Costa

Departmental Administrator
Helen Hawes, BA

Department Publications

Legend: * External to the University, # Member of another area of this University other than this School, † Author having a joint appointment across departments within the School

Publications in Refereed Journals

Aanesland, A.*, Charles, C., Boswell, R.W. and Frederickson, A.*
Sputtering Effects in a Helicon Plasma with an Additional Immersed Antenna
Plasma Sources Science and Technology 12 (2003) 85-88

Boswell, R.W.
Cosmic Waves in the Lab

Charles, C. and Boswell, R.W.
Current-Free Double-layer Formation in a High-density Helicon Discharge

Charles, C., Boswell, R.W. and Lieberman, M.
Energy Balance in a Low Pressure Capacitive Discharge Driven by a Double-saddle Antenna
Physics of Plasmas 10 (2003) 891-899

Charles, C.
Wall Effects on the Chemistry in a Pulsed Oxygen/Silane Radiofrequency Helicon Plasma

Studies of Resonantly Produced Plasmas in the H-1NF Heliac Using a Far-infrared Scanning Interferometer

Dubost, L.*, Bellinger, A.*, Perrin, J.* and Boswell, R.W.
Low Temperature Pulsed Etching of Large Glass Substrates

Herrick, A., Perry, A.J. and Boswell, R.W.
Etching Silicon by SF6 in a Continuous and Pulsed Power Helicon Reactor

Howard, J., Michael, C.A., Glass, F. and Danielsson, A.*
Time-resolved Two-dimensional Plasma Spectroscopy Using Coherence-imaging Techniques

Li, W.T., Bulla, D.A.P.*, Love, J.D., Luther-Davies, B., Charles, C. and Boswell, R.W.
Hydrogen Contamination in Ge-doped SiO2 Thin Films Prepared by Helicon-activated Reactive Evaporation
Journal of Vacuum Science and Technology A 21 (2003) 792-796

Punzmann, H., Shats, M.G., Solomon, W.M. and Xia, H.
Multichannel Visible Spectroscopy Diagnostic for Particle Transport Studies in the H–1 Heliac

Shats, M.G., Punzmann, H., Xia, H. and Solomon, W.M.
Measurements of Poloidal Rotation Velocity Using Cross-correlation Spectroscopy in the H–1 Heliac

Shats, M.G., Solomon, W.M. and Xia, H.
Turbulent Transport Reduction and Randomization of Coherent Fluctuations by Zonal Flows in Toroidal Plasma

Smith, H.B., Charles, C. and Boswell, R.W.
Breakdown Behavior in Radio-frequency Argon Discharges
Physics of Plasmas 10 (2003) 875-881

Progress in Experimental Research of the VASIMR Engine
Fusion Engineering and Design 43 (2003) 111-117

Xia, H. and Shats, M.G.
Inverse Energy Cascade Correlated with Turbulent-structure Generation in Toroidal Plasma

Refereed Conference Proceedings

Geometry Effects upon the Transmission Loss in Optical Rib Waveguides Fabricated Using Chemical Etching

Jarvis, R. and Boswell, R.W.
Expansion of Germanium Doped Silicon Films under UV Irradiation
Department of Theoretical Physics

Research within the Department covers fundamental aspects of atomic and molecular physics, biophysics, condensed matter physics, nuclear physics, plasma physics, statistical mechanics and quantum field theory.

Professor Vladimir Bazhanov

Research highlights for 2003 include the detailed examination of cylindrical plasmas and their connection to quantum chaos theory; the creation of a model describing the observed properties of key ion channels; a quantum kinetic derivation of the Landauer formula in electron transport; clarification of the interplay between localised moments and conduction electrons in strongly correlated electron systems; new analytical results for the thermodynamics of the Coqblin-Schrieffer model for magnetic impurities and the application of exactly solved models to the physics of strongly coupled ladder compounds.

In 2003 the Department continued its strong success in competitive funding. In addition to the $675K in ARC Discovery grants held for 2003, major new Discovery grants awarded from 2004 totalled $650K. The new projects were for research on toroidal plasmas (Dewar), ion channels (Kuyucak) and protein interactions (Kuyucak, Bastug). Professor Dewar was Coordinator of a successful bid for an ARC Special Research Initiatives Seed Funding Grant on Energetically Open Systems. Success was also obtained in Linkage International with a Fellowship awarded to Dr Benedicte Ponsot from France (Bazhanov). Professor Batchelor took up his Australian Professorial Fellowship from 1 January. New members of staff, also supported by the ARC, were Dr Sergeev, Dr Guan and Dr. Mangazeav.

During the year Professors Bazhanov and Dewar made extended visits to Japan under the Outside Studies and Professional Development Program. Dr Das was elected as a Fellow of the American Physical Society. Other highlights included the selection of Ben Corry’s PhD thesis on ion channels as the best thesis from the ACT region for entry in the 2002 Bragg Medal for Excellence in Physics.

The Department is host to the Centre for Complex Systems (CCS). The Centre’s activities are highlighted elsewhere.

Department Staff

Professor and Head of Department
Vladimir Bazhanov, PhD Serpukhov

Professors
Nail Akhmediev, DSc USSR Acad Sci
Murray Batchelor, BSc UNSW, PhD ANU, FAIP, FaustMS (ARC Fellowship) (jointly with Mathematical Sciences Institute)
Robert Dewar, MSc Melb, PhD Princ, FAIP, FAPS, FAA

Senior Fellows
Shin-Ho Chung, PhD Harv (NHMRC Professorial Fellow)
Mukunda Das, MSc Utkal, PhD Roorkee, FAPS, FAIP, CPhys, FlnstP
Miklos Gulacsi, BSc MSc Cluj, PhD Trieste
Anatoli Kheifets, Msc PhD St Petersburg (jointly with Atomic and Molecular Physics Laboratories)
Serdar Kuyucak, BSc Ankara, PhD Yale

Fellows
Miklos Gulacsi, BSc MSc Cluj, PhD Trieste
Wen Xu, BSc, MSc, PhD Antwerp

Research Fellows
Rowena Ball, BSc, PhD Macquarie (ARC Fellowship)
Xi-Wen Guan, BSc Qufu, MSc Sichuan, PhD Jilin (jointly with Igor Ivahov, MSc MPTI, PhD Isan (jointly with AMPL)
Mathematical Sciences Institute) (from February)
Sudip Sen, MSc, PhD UMIST (until December)
Sergei Sergeev, MSc Moscow, PhD Serpukhov, 2nd PhD St Petersburg (from June)

Post-doctoral Fellow
Turgut Bastug, BSc Ankara, PhD Kassel (until December)
Matthew Hoyles, BSc ANU

Visiting Fellows
Fred Barker, MSc Melb, PhD Birm (Emeritus Professor)
Conrad Burden, BSc Qld, PhD ANU
Fricke Burkhard, DiplPhys Darmstadt, PhD Frankfurt (from December)
Jorgen Frederiksen, BSc Adelaide, PhD ANU, DSc Adelaide (from October)
Harald Friedrich, DiplPhys Freib, Dr rer nat Munst (jointly with Atomic and Molecular Physics Laboratories) (until March)
Michael Hall, MSc PhD ANU
Graeme Honner, BSc LaTrobe
Kailash Kumar, BSc Agra, MSc Alld, PhD M cm, FAIP
Sergei Kun, M S PhD Kiev

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Department of Theoretical Physics

Mihajlo Mudrinic, BSc MSc PhD Belgrade
Jinlan Nie, BSc Sichuan China
Benedicte Ponsot, BSc Paris VI, PhD Montpellier II (March)
Brian Robson, MSc PhD DSc Melb, FAIP
Robert Robson, BSc Qld, DipMet, PhD, FRMS, FAPS, FAIP (until October)
(jointly with Atomic and Molecular Physics Laboratories)
Alexander Samarin, BSc Moscow, PhD Protvino (jointly with PRL) (February to March)
Harold Schranz, BSc PhD USyd (until August)
Susan Scott, BSc Monash, PhD Adel
Michael Simpson, BSc Adel, PhD Newcastle
Irina Talanina, MSc PhD GPI Moscow
Lindsay Tassie, MSc PhD Melb, FAIP
Guy White, BScSyd, PhD Oxford, DSc Woolongong
William Woolcock, BSc Qld, PhD Camb, FAIP

Departmental Administrators
Mrs Sharon Lopez
(part time, until March)
Mrs Trina Merrell (part time, from April)

Department Publications

Legend: * = External to the University, † = Author having a joint appointment across departments within the School

Books and Book Chapters

Akhmediev, N.N. and Ankiewicz, A.
Solitons Around Us.
Integrable, Hamiltonian and Dissipative Systems in Optical Solitons: Theoretical and Experimental Challenges. Springer-Verlag, Germany (2003) 105-126


Bail, R., Dewar, R.L. and Sugama, H.*

Das, M.P. and Green, F.

Green, F. and Das, M.P.

McMillan, B.F., Dewar, R.L. and Storer, R.G.*

Town, G.E.*, Akhmediev, N.N. and Soto-Crespo, J.M.*

Xu, W., Lewis, R.A.*, Koenraad, P.M.*, Waumans, L.R.* and Langerak, C.J.*

Publications in Refereed Journals

Akhmediev, N.N. and Soto-Crespo, J.M.*

Allen, T.W.*, Bastug, T., Kuyucak, S. and Chung, S.-H.*
Gronahm’s a Channel as a Test Ground for Molecular Dynamics Force Fields in Biophysical Journal 84 (2003) 2159-2168

Akhmediev, A., Maruno, K.-I. and Akhmediev, N.N.*

Akhmediev, A. and Akhmediev, N.N.*

Barker, F.C.*

Barker, F.C.*

Bastug, T. and Kuyucak, S.
Role of the Dielectric Constants of Membrane Proteins and Channel Water in Ion Permeation in Biophysical Journal 84 (2003) 2871-2882

Batchelor, M.T., Guan, X.-W., Oelkers, N., Sakai, K.*, Tsuibo, Z.* and Foerster, A.*
Exact Results for the Thermal and Magnetic Properties of Strong Coupling Ladder Compounds in Physical Review Letters 91 (2003) 217202-1-4

Batchelor, M.T., Burne, R.V.*, Henry, B.I.* and Watt, S.D.*
Mathematical and Image Analysis of Stromatolite Morphogenesis in Mathematical Geology 35 (2003) 789-803

Batchelor, M.T., Guan, X.-W., Foerster, A.* and Zhou, H.-Q.*

Batchelor, M.T., Guan, X.-W., Foerster, A.*, Tonel, A.* and Zhou, H.-Q.*

Bazhanov, V.V., Lukyanov, S.L.* and Tselik, A.M.*

Bazhanov, V.V., Lukyanov, S.L.* and Zamoctodchikov, A.B.*
Higher-level Eigenvalues of O-operators and Schrödinger Equation Advances in Theoretical and Mathematical Physics 7 (2003) 711-725

Brosche, P.*, Lentes, F.* and Tassie, L.J.*

Brown, B.A.* and Barker, F.C.*
Di-Proton Decay of 45Sc in Physical Review C: Nuclear Physics 67 (2003) 041304-1-3

Corry, B., Kuyucak, S. and Chung, S.-H.*

Das, M.P. and Green, F.

Dewar, R.L.
Spectrum of Global Ideal-magnetohydrodynamic Three-dimensional Ballooning Modes in Space Science Reviews 107 (2003) 349-352 (also listed under Plasma Research Laboratory)

Structure of the Unbound11N Nucleus by the (3He, 6He) Reaction in Physical Review C: Nuclear Physics 67 (2003) 064601-1-8


Hall, M J.W., Kumar, K. and Regginato, M.*
Random Walks on Finite Lattices

Jacob, T., Anton, J.,* Sarpe-Tudoran, C.,* Sepp, W.* and Bastug, T.
Embedded Cluster Approach to Simulate Single Atom Adsorption on Surfaces: Cu on Cu Surfourt
Surface Science 556 (2003) 45-54

Kendl, A.*, Scott, B.D.*, Ball, R. and Dewar, R.L.
Turbulent Edge Structure Formation in Complex Configurations
Physics of Plasmas 10 (2003) 3684-3691

Krishnamurthy, V.* and Chung, S.-H.
IEEE Transactions on Nanobioscience 2 (2003) 266-278

Kun, S.Y.,* Benet, L.*, Chadderton, L.T., Greiner, W.* and Haas, F.*
Macroscopic Quantum Superpositions in Highly Excited Strongly Interacting Many-body Systems
Physical Review C: Nuclear Physics 67 (2003) 011604-1-4

Kuyucak, S. and Bastug, T.
Physics of Ion Channels

Maruno, K.-I., Anikiewicz, A. and Akhmediev, N.N.
Exact Localized and Periodic Solutions of the Discrete Complex Ginzburg-Landau Equation
Optics Communications 221 (2003) 199-209

Maruno, K.-I., Anikiewicz, A. and Akhmediev, N.N.
Exact Soliton Solutions of the One-dimensional Complex Swift-Hohenberg Equation

Maslen, M.*
Batchelor, M.T. and de Gier, J.*
Magnetization Plateaux in Bethe Ansatz Solvable Spin-S Ladders

Meister, C.* and Friedrich, H.*
Quenching of Curve Crossing Probabilities by Quantum Radiation
Physics and Chemistry 68 (2003) 211-214 (also listed under Atomic & Molecular Physics Laboratories)

Nie, J.,* Xu, W. and Lin, L.B.*
Binding Energies of Hydrogen-like Impurities in a Semiconductor in Intense Terahertz Laser fields

O’Mara, M., Barry, P.H.* and Chung, S.-H.
A Model of the Glycine Receptor Deduced from Brownian Dynamics Studies
Proceedings of the National Academy of Sciences of the United States of America 100 (2003) 4310-4315

Pakuliak, S.* and Sergeev, S.M.
Spectral Curves and Parameterization of a Discrete Integrable Three-dimensional Model
Theoretical and Mathematical Physics 136 (2003) 917-935

Experimental Test of Spontaneous Correlation and Anomalous Sensitivity in Finite Highly Excited Many-body Systems

Robson, R.E.*, White, R.W.* and Morrison, M.A.*
Some Fundamental Questions Concerning the Kinetic Theory of Electrons in Molecular Gases and the e-H2 Vibrational Cross Section Controversy
Journal of Physics B: Atomic, Molecular and Optical Physics 36 (2003) 4127-4143 (also listed under Atomic & Molecular Physics Laboratories)

Sen, S.
On Stabilizing Role of Parallel Inhomogeneous Flow on Low-frequency Space Fluctuations
Space Science Reviews 107 (2003) 373-381

Signeuger, F.*, Winkler, R.* and Rosbon, R.E.*
What Really Happens with the Electron Gas in the Famous Franck-Hertz Experiment
Contributions to Plasma Physics 43 (2003) 178-197

Soto-Crespo, J. M.*, Akhmediev, N.N. and Anikiewicz, A.
Model and Stability Properties of Solitons in Discrete Dissipative Structures

Soto-Crespo, J. M.*, Akhmediev, N.N., Grelu, Ph.* and Belhache, F.*
Quantized Separations of Phase-locked Soliton Pairs in Fibre Lasers
Optics Letters 28 (2003) 1757-1759

Sukhorukov, A.A. and Akhmediev, N.N.
Multipot SolitonDevices with Controllable Transmission

MDH Equilibrium of a Low-shear Helical Axis Heliotion

Takahashi, T.* and Kuyucak, S.
Functional Properties of Threefold and Fourfold Channels in Ferritin Deducedd from Electrostatic Calculations
Biophysical Journal 84 (2003) 2256-2263

Uchida, M.*, Sen, S., Fukuyama, A.* and McCarthy, D.R.*
Stability of the Ion-temperature-gradient-driven Mode with Negative Magnetic Shear
Physics of Plasmas 10 (2003) 4758-4762

von Gehlen, G.*, Pakuliak, S.* and Sergeev, S.M.
Theta-function Parametrization and Fusion for 3D Integrable Boltzmann Weights

White, R.D.*, Robson, R.E., Schmidt, B. and Morrison, M.A.*
Is the Classical Two-term Approximation of Electron Kinetic Theory Satisfactory for Swarms and Plasmas?

Xu, W., Lin, L.B.*, and Tang, C.S.*
Absorption of Surface Acoustic Waves by a Two-dimensional Electron Gas in the Presence of Spin-orbit Interaction

Xu, W., Das, M.P. and Lin, L.B.*
Coupled Plasmon-phonon Modes in a Two-dimensional Electron Gas in the Presence of the Rashba Effect

Xu, W.
Hypersonic Acoustic-phonon Emission from Two-dimensional Electron Gases in the Presence of Spin-orbit Interaction

Xu, W.
Plasmons of a Two-dimensional Electron Gas in the Presence of Spin Orbit Interaction

Referred Conference Proceedings

Akhmediev, N.N. and Soto-Crespo, J.*
Composite Soliton Generation in Systems with Two Peak Spectral Filtering
CLEO/Pacific Rim 2003, Taipei, Taiwan (2003) W1F5(1)-2-1-3

Akhmediev, N.N., Soto-Crespo, J.* Grelu, Ph.* and Belhache, F.*
Generation of Interacting Pulse Pairs in Passively Mode-locked Fiber Lasers
CLEO/Pacific Rim 2003, Taipei, Taiwan (2003) WP-(6)-1-1-3

Akhmediev, N.N.
Nonlinear Schrödinger Equation and its Varieties: Integrable, Hamiltonian and Dissipative Systems
5th International Congress on Industrial and Applied Mathematics, Sydney (2003) ICMI03(4)V-12b

Anikiewicz, A., Maruno, K.-I. and Akhmediev, N.N.
Nonlinear Waves and Solitons in Optical Lattices with Gain and Loss

Anikiewicz, A., Soto-Crespo, J.* and Akhmediev, N.N.
Translational Invariance and Stability Properties of Solitons in Dissipative Multiple Waveguide Structures

Green, F., Das, M.P. and Thakur, J.S.*
The Conservation Laws in Messoscopic Noise, and their Observable Consequences

Maruno, K.-I., Anikiewicz, A. and Akhmediev, N.N.
Dissipative Solitons in Discrete Systems
CLEO/Pacific Rim 2003, Taipei, Taiwan (2003) WP-(5)-1-1-5
The Applied Photonics Group specialises in the design of novel planar and fibre light processing devices. The Group is strongly linked to experimental photonics groups within the School, across campus and within the Australian Photonics CRC; it provides a wealth of experience and insight into the research, modelling and design of photonic devices and photonic integrated circuits.

The Group continues to be innovative through the design and analysis of novel light-processing devices based on optical fibre and planar waveguides for optical telecommunications networks and systems in particular and for other practical applications. It also provides analytical and modelling support to several other research groups and research students within the School, including the Space Plasma and Plasma Processing Group and the Optical Sciences Centre, as well as to groupswithin the Australian Photonics CRC. Industrial research work has been undertaken for DSTO and Australian photonics companies, including Redfern Polymer Optics Pty Ltd on campus. In other areas, there is a major contribution to a wide range of outreach activities in the School, as well as to photonics schools and workshops in southeast Asia organised in collaboration with the Photonics Institute Pty Ltd at Bruce.

Another key focus by the Group is on photonics undergraduate teaching in the Department of Physics through convening, presenting and demonstrating six bachelor and masters courses, together with two distance learning courses.

**Group Staff**

**Professor and Head of Group**

John Love, MA Camb, MA DPhil DSc Oxf

**Fellow**

Adrian Ankiewicz, BSc BE UNSW, PhD ANU (Australian Photonics CRC)

**Postdoctoral Fellows**

Douglas Bulla, PhD Sao Paulo (jointly with Plasma Research Laboratory)

**Visiting Fellows**

Satis Arnold, BSc MSc NSW, Murdoch Uni

Martin Elias, ADC Australia Pty Ltd

Andrew Stevenson, Photonics Institute, BSc PhD ANU

Snjezana Tomljenovic-Hanic, PhD ANU (from June)

François Ladouceur, UNSW

Stephen Scheeler, Sydney

**Departmental Administrator**

Wendy Quinn, BA

**Group Publications**

Legend: * External to the University, # Member of another area of this University other than this School, † Author having a joint appointment across departments within the School

**Publications in Refereed Journals**

Ankiewicz, A., Maruno, K.-I. and Akhmediev, N.N.

Periodic and Optical Soliton Solutions of the Quintic Complex Swift-Hohenberg Equation


Ankiewicz, A. and Akhmediev, N.N.

Stability Analysis for Solitons in Planar Waveguides, Fibers and Couplers Using Hamiltonian Concepts


Gibson, B.C.*, Huntington, S.T.*, Love, J.D., Ryan, T.G.*, Cahill, L.W.* and Elton, D.M.*

Controlled Modification and Direct Characterization of Multimode-fiber Refractive-index Profiles

Applied Optics 42 (2003) 627-633

Li, W.T., Bulla, D.A.P.*, Love, J.D., Luther-Davies, B., Charles, C. and Boswell, R.W.

Hydrogen Contamination in Ge-doped SiO2 Thin Films Prepared by Helicon Activated Reactive Evaporation

Journal of Vacuum Science and Technology A 21 (2003) 792-796

Love, J.D. and Ankiewicz, A.

Purely Geometrical Coarse Wavelength Multiplexer/demultiplexer


Nagai, Y.*, Ankiewicz, A. and Maddess, T.*

Ternary Cellular Automata with Three Neighbors

Memoirs of the Kokushikan University Centre for Information Science 24 (2003) 8-19

Tomljenovic-Hanic, S. and Ankiewicz, A.

Analysis of Bend Loss in Waveguides Employing Photonic Band Gap Effect

Optical and Quantum Electronics 35 (2003) 1269-1279

Tomljenovic-Hanic, S., Love, J.D. and Ankiewicz, A.

Effect of Additional Layers on Bend Loss in Buried Channel Waveguides

Tomljenovic-Hanic, S. and Krolikowski, W.
New Design for a Variable Optical Attenuator Based on a Bent Channel Waveguide
Applied Physics B Lasers and Optics 77 (2003) 19-23

Tomljenovic-Hanic, S. and Love, J. D.
Planar Waveguide Add/Drop Wavelength Filters Based on Segmented Gratings
Microwave and Optical Technology Letters 37 (2003) 163-165

Referred Conference Proceedings

Ankiewicz, A., Maruno, K.-I. and Akhmediev, N.N.
Nonlinear Waves and Solitons in Optical Lattices with Gain and Loss

Ankiewicz, A., Soto-Crespo, J. M. * and Akhmediev, N.N.
Translational Invariance and Stability Properties of Solitons in Dissipative Multile Waveguide Structures

Bulla, D.A.P., Li, W.T., Charles, C., Boswell, R.W. and Love, J.D.
Geometry Effects upon the Transmission Loss in Optical Rib Waveguides Fabricated Using Chemical Etching

Criterion for Minimisation of Transition Loss in a Bent Uniform Waveguide

Transition Loss in Bent Waveguides and Fibres

Love, J. D. and Ankiewicz, A.
A Geometry-based Wavelength Multiplexer & De-multiplexer

Characterisation of Single Dopant Core Fibres

Tomljenovic-Hanic, S., Love, J. D., Ankiewicz, A. and Bailey, R.*
Bend Loss Resistant, Multiple-clad Single-mode Fibres
COIN/ACOFT 2003, Melbourne (2003) 315-318,

Tomljenovic-Hanic, S. and Ankiewicz, A.
Effect of Bend Loss on Photonic Band Gap Propagation in Waveguides

Tomljenovic-Hanic, S.
Symmetry-selecting Gratings and their Applications
5th International Conference on Transparent Optical Networks, Warsaw, Poland (2003) 196-199