



Dr David Williams

Applied Mathematics

The Department of Applied Mathematics performs research on fundamental and applied topics in novel materials and disordered systems. These include both soft matter systems such as polymers and colloids and hard systems such as rocks and sand.

The Department during 2004 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) porous and disordered materials; (b) soft matter systems (polymers, liquid crystals, surfactants); and (c) surface science. 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 the 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 about 60 people. 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 2004 the research of the Department continued much as in recent years. A highlight was the award of a prestigious Federation Fellowship to Steve Hyde for both his theoretical and experimental work across a diverse range of disciplines. Much was also achieved on the traditional theoretical, colloid front (Ninham, Williams and Edwards). 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).

The group led by Mark Knackstedt continued advanced simulation and experiments on porous media including rocks, and bone, with particular applications to oil recovery. Tomaso Aste made several advances in network theory as applied to both granular matter and economic modelling.

Staff List

Head of Department

David Williams, BSc Sydney, PhD Cambridge (ARC Senior Fellow)

Professors

Stephen Hyde, BSc PhD Monash (ARC Federation Fellow, from November)

Senior Fellows

Tomaso Aste, DipHons Genova, PhD Milan
Tiziana Di Matteo, BSc (Hons) PhD Salerno (ARC QEII Fellow)

Mark Knackstedt, BSc Columbia, PhD Rice (ARC QEII Fellow)

Vassili Yaminsky, DipHons PhD Moscow (until June)

Fellow

Tim Senden, BSc PhD ANU (ARC Fellow)

Vince Craig, BSc PhD ANU (ARC Fellow)

Research Fellows

Christoph Arns, Dipl-Phys Aachen, PhD UNSW

Satomi Ohnishi, BSc SUT Tokyo, PhD Saitama (ARC QEII Fellow, until June)

Arthur Sakellariou, BSc PhD Melbourne

Adrian Sheppard, BSc Adelaide, PhD ANU

Rob Sok, BSc PhD Groningen

Postdoctoral Fellows

Armin Bauer, Dipl-Chem Dr.Rer.Nat Regensburg (until November)

Fabrice Bauguet, PhD Paris XI

Amit Goel, B.Eng. Roorkee, PhD Minnesota

Ernesto Hernandez, BSc PhD Mexico

Shio Inagaki, BSc Tokyo I.T., MSc Ibaraki, PhD Tokyo

Alexandre Kabla, PhD Paris VI (until November)

Mika Kohonen, BSc PhD ANU

Christian Kugge, PhD KTH Stockholm (STINT Scholarship)

Ann-Kristin Larsson, MaSc Lic PhD Lund, Doc Stockholm

Chiara Neto, BSc(Hons) PhD Florence

Shannon Notley, BSc(Hons) PhD Newcastle (from November)

Drew Parsons, BSc(Hons) PhD Karpov IPC Moscow, DipEd UNSW

Vanessa Robins, BSc ANU, PhD Colorado

Computational & Visualisation Consultants

Holger Averdunk, BSc(Hons) Biochemistry, BSc Computer Science

Richard Corby (CRC) (from November)

Stuart Ramsden, GradDip Film & Television Swinburne

Professor Emeritus

Barry Ninham, MSc WA, PhD Maryland, DTech (hon causa) KTH Stockholm, D Phil (hon causa) Lund, FAA (Visiting Professor, University Florence, Italy 15 April – 10 December 2004) Humboldt Foundation distinguished Professor Regensburg Germany (February – August 2004)

Visiting Fellows

Yoshinori Nagai, DSc Waseda

Rachel Yerushalmi-Rozen, PhD Ben Gurion

Senior Technical Officers

Anthony Hyde, Assoc IE Aust

Tim Sawkins

Departmental Administrator

Cindy Bradley (Part-time)

Jan James (CRC Administrator)

Jenny Smith

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

Books and Book Chapters

Di Matteo, T., Aste, T. and Hyde, S.T.

Exchanges in Complex Networks: Income and Wealth Distributions

in *International School of Physics: Enrico Fermi*, IOS Press, The Netherlands (2004) 435–442

Publications in Refereed Journals

Ambrosi, M.*[#], Lo Nostro, P.*[#], Fratoni, L.*[#], Dei, L.*[#], Ninham, B., Palma, S.*[#], Manzo, R.H.*[#], Allemandi, D.*[#] and Baglioni, P.*[#]

Water of Hydration in Coagels
Physical Chemistry Chemical Physics 6 (2004) 1401–1407

Arns, C.H.

A Comparison of Pore Size Distributions Derived by NMR and X-ray-CT Techniques

Physica A 339 (2004) 159–165

Arns, C.H., Knackstedt, M.A. and Mecke, K.R.*

Characterisation of Irregular Spatial Structures by Parallel Sets and Integral Geometric Measures

Colloids and Surfaces A 241 (2004) 351–372

Arns, J.-Y.*[#], Robins, V., Sheppard, A.P., Sok, R.M., Pinczewski, V.* and Knackstedt, M.A.

Effect of Network Topology on Relative Permeability Transport in Porous Media 55 (2004) 21–46

Arns, C.H., Knackstedt, M.A. and Mecke, K.R.*

Euler-Poincaré Characteristics of Disordered Media: An Application in Effective Medium Theories

Microscopy and Microanalysis 10 (2004) 714–715

Arns, C.H., Knackstedt, M.A., Pinczewski, W.V.* and Martys, N.S.*

Virtual Permeability on Microtomographic Images

Journal of Petroleum Science and Engineering 45 (2004) 41–46

Aste, T. and Coniglio, A.*

Cell Theory for Liquid Solids and Glasses: From Local Packing Configurations to Global Complex Behaviors

Europhysics Letters 67 (2004) 165–171

Aste, T., Di Matteo, T. and Hyde, S.T.

Complex Networks on Hyperbolic Surfaces

Physica A 346 (2004) 20–26

Aste, T., Saadatfar, M., Sakellariou, A. and Senden, T.J.

Investigating the Geometrical Structure of Disordered Sphere Packings

Physica A 339 (2004) 16–23

Aste, T. and Valbusa, U.*

Surface Instabilities in Granular Matter and Ion-sputtered Surfaces

Physica A 332 (2004) 548–558

- Bauduin, P.*, Renoncourt, A.*, Touraud, D.*, Kunz, W.* and Ninham, B.
Hofmeister Effect on Enzymatic Catalysis and Colloidal Structures
Current Opinion in Colloid and Interface Science 9 (2004) 43-47
- Bauer, A., Woelki, S.* and Kohler, H.-H.*
Rod Formation of Ionic Surfactants: Electrostatic and Conformational Energies
Journal of Physical Chemistry B 108 (2004) 2028-2037
- Boström, M., Williams, D.R.M. and Ninham, B.
Specific Ion Effects: Why Colloid Science Has Failed to Contribute to Biology
Progress in Colloid and Polymer Science 123 (2004) 110-113
- Boström, M.* and Ninham, B.
Atomic Resonance Interaction in Dielectric Media
Physical Review A 69 (2004) 054701-1-2
- Boström, M.* and Ninham, B.
Contributions from Dispersion and Born Self-free Energies to the Solvation Energies of Salt Solutions
Journal of Physical Chemistry B 108 (2004) 12593-12595
- Boström, M.* and Ninham, B.
Dispersion Self-free Energies and Interaction Free Energies of Finite-sized Ions in Salt Solutions
Langmuir 20 (2004) 7569-7574
- Boström, M.*, Williams, D.R.M. and Ninham, B.
Specific Ion Effects: Role of Salt and Buffer in Protonation of Cytochrome c
European Physical Journal E 13 (2004) 239-245
- Boström, M.*, Williams, D.R.M. and Ninham, B.
Why the Properties of Proteins in Salt Solutions Follow a Hofmeister Series
Current Opinion in Colloid and Interface Science 9 (2004) 48-52
- Christy, A.G. and Grew, E.S.*
Synthesis of Beryllian Sapphirine in the System MgO-BeO-Al₂O₃-SiO₂-H₂O and Comparison with Naturally Occurring Beryllian Sapphirine and Khmaralite, Part 2: A Chemographic Study of Be Content as a Function of P,T, Assemblage and FeMg₁ Exchange
American Mineralogist 89 (2004) 327-338
- Cooke, I.R. and Williams, D.R.M.
Collapse of Flexible-semiflexible Copolymers in Selective Solvents: Single Chain Rods, Cages, and Networks
Macromolecules 37 (2004) 5778-5783
- Cooke, I.R. and Williams, D.R.M.
Condensed States of Semiflexible Homopolymer: Ordered Globules and Toroids
Physica A 339 (2004) 45-52
- Craig, V.S.J.
Bubble Coalescence and Specific-ion Effects
Current Opinion in Colloid and Interface Science 9 (2004) 178-184
- Di Matteo, T., Aste, T. and Mantegna, R.N.*
An Interest Rates Cluster Analysis
Physica A 339 (2004) 181-188
- Di Matteo, T., Aste, T. and Dacorogna, M.M.*
Long-term Memories of Developed and Emerging Markets: Using the Scaling Analysis to Characterize their Stage of Development
Journal of Banking and Finance 29 (2004) 827-851
- Di Matteo, T., Airolidi, M.* and Scalas, E.*
On Pricing of Interest Rate Derivatives
Physica A 339 (2004) 189-196
- Edwards, S.A. and Williams, D.R.M.
Double Layers and Interparticle Forces in Colloid Science and Biology: Analytic Results for the Effect of Ionic Dispersion Forces
Physical Review Letters 92 (2004) 248303-1-4
- Edwards, S.A. and Williams, D.R.M.
Hofmeister Effects in Colloid Science and Biology Explained by Dispersion Forces: Analytic Results for the Double Layer Interaction
Current Opinion in Colloid and Interface Science 9 (2004) 139-144
- Evans, D.R., Craig, V.S.J. and Senden, T.J.
The Hydrophobic Force: Nanobubbles or Polymeric Contaminant?
Physica A 339 (2004) 101-105
- Fortini, M.*, Berti, D.*, Baglioni, P.* and Ninham, B.
Specific Anion Effects on the Aggregation Properties of Anionic Nucleolipids
Current Opinion in Colloid and Interface Science 9 (2004) 168-172
- García-García, F.*, Larsson, A.-K., Noren, L.# and Withers, R.L.#
The Crystal Structures of Co₂Se₂ and Co₇Se₈
Solid State Sciences 6 (2004) 725-733
- Henry, C.L., Neto, C., Evans, D.R., Biggs, S.* and Craig, V.S.J.
The Effect of Surfactant Adsorption on Liquid Boundary Slippage
Physica A 339 (2004) 60-65
- Hermawan, M.*, Bushell, G.C.*, Craig, V.S.J., Teoh, W.Y.* and Amal, R.*
Floc Strength Characterization Technique. An Insight into Silica Aggregation
Langmuir 20 (2004) 6450-6457
- Hernández-Zapata, E., Cooke, I.R. and Williams, D.R.M.
Novel Conformations of Isolated Semiflexible Block Copolymers
Physica A 339 (2004) 40-44
- Hyde, S.T. and Garcia-Ruiz, J.M.*
Complex Materials from Simple Chemistry: Biomorphs and Biomaterials
Actualite Chimique 275 (2004) 4-6
- Hyde, S.T., Carnerup, A.M., Larsson, A.-K., Christy, A.G. and Garcia-Ruiz, J.M.*
Self-assembly of Carbonate-silica Colloids: Between Living and Non-living Form
Physica A 339 (2004) 24-33
- Jones, A.C., Milthorpe, B.K.*, Averdunk, H., Limaye, A.#, Senden, T.J., Sakellariou, A., Sheppard, A.P., Sok, R.M., Knackstedt, M.A., Brandwood, A.*, Rohner, D.* and Hutmacher, D.W.*
Analysis of 3D Bone Ingrowth into Polymer Scaffolds via Micro-computed Tomography Imaging
Biomaterials 25 (2004) 4947-4954
- Jones, A.C., Sakellariou, A., Limaye, A.#, Arns, C.H., Senden, T.J., Sawkins, T., Knackstedt, M.A., Rohner, D.*, Hutmacher, D.W.*, Brandwood, A.* and Milthorpe, B.K.*
Investigation of Microstructural Features in Regenerating Bone using Micro Computed Tomography
Journal of Materials Science - Materials in Medicine 15 (2004) 529-532
- Jones, A.C., Sheppard, A.P., Sok, R.M., Arns, C.H., Limaye, A.#, Averdunk, H., Brandwood, A.*, Sakellariou, A., Senden, T.J., Milthorpe, B.K.* and Knackstedt, M.A.
Three-dimensional Analysis of Cortical Bone Structure using X-ray Micro-computed Tomography
Physica A 339 (2004) 125-130
- Kohonen, M.M., Geromichalos, D.*, Scheel, M.*, Schier, C.* and Herminghaus, S.*
On Capillary Bridges in Wet Granular Materials
Physica A 339 (2004) 7-15
- Kugge, C., Craig, V.S.J. and Daicic, J.*
A Scanning Electron Microscope Study of the Surface Structure of Mineral Pigments, Lattices and Thickeners used for Paper Coating on Non-absorbent Substrates
Colloids and Surfaces A 238 (2004) 1-11

- Kunz, W.*, Belloni, L.*, Bernard, O.* and Ninham, B.
Osmotic Coefficients and Surface Tensions of Aqueous Electrolyte Solutions: Role of Dispersion Forces
Journal of Physical Chemistry B **108** (2004) 2398-2404
- Kunz, W.*, Lo Nostro, P.* and Ninham, B.
The Present State of Affairs with Hofmeister Effects
Current Opinion in Colloid and Interface Science **9** (2004) 1-18
- Kunz, W.*, Henle, J.* and Ninham, B.
Zur Lehre von der Wirkung der Salze (About the Science of the Effect of Salts): Franz Hofmeister's Historical Papers
Current Opinion in Colloid and Interface Science **9** (2004) 19-37
- Lo Nostro, P.*, Lo Nostro, A.*, Ninham, B., Pesavento, G.*, Fratoni, L.* and Baglioni, P.*
Hofmeister Specific Ion Effects in Two Biological Systems
Current Opinion in Colloid and Interface Science **9** (2004) 97-101
- Mele, S.*, Chittofrati, A.*, Ninham, B. and Monduzzi, M.*
¹⁹F NMR Investigation of Mixed Surfactants Partitioning and Kinetic Stability of Fluorinated Nanodroplets in Water
Journal of Physical Chemistry B **108** (2004) 8201-8207
- Mele, S.*, Ninham, B. and Monduzzi, M.*
Phase Behavior of Homologous Perfluoropolyether Surfactants: NMR, SAXS, and Optical Microscopy
Journal of Physical Chemistry B **108** (2004) 17751-17759
- Murgia, S.*, Monduzzi, M.* and Ninham, B.
Hofmeister Effects in Cationic Microemulsions
Current Opinion in Colloid and Interface Science **9** (2004) 102-106
- Neto, C. and Jacobs, K.*
Dynamics of Hole Growth in Dewetting Polystyrene Films
Physica A **339** (2004) 66-71
- Notley, S.M.*, Biggs, S.*, Craig, V.S.J. and Wågberg, L.*
Adsorbed Layer Structure of a Weak Polyelectrolyte Studied by Colloidal Probe Microscopy and QCM-D as a Function of pH and Ionic Strength
Physical Chemistry Chemical Physics **6** (2004) 2379-2386
- Olla, M.*, Semmler, A.*, Monduzzi, M.* and Hyde, S.T.
From Monolayers to Bilayers: Mesostructural Evolution in DDAB/water/tetradecane Microemulsions
Journal of Physical Chemistry B **108** (2004) 12833-12841
- Robins, V., Ramsden, S.J. and Hyde, S.T.
2D Hyperbolic Groups Induce Three-periodic Euclidean Reticulations
European Physical Journal B **39** (2004) 365-375
- Robins, V., Ramsden, S.J. and Hyde, S.T.
Symmetry Groups and Reticulations of the Hexagonal H Surface
Physica A **339** (2004) 173-180
- Robins, V., Rooney, N.* and Bradley, E.*
Topology-based Signal Separation
Chaos **14** (2004) 305-316
- Rode, A.V., Gamaly, E.G., Christy, A.G.#, Fitz Gerald, J.G.#, Hyde, S.T., Elliman, R.E., Luther-Davies, B., Veinger, A.*, Androulakis, J.* and Giapintzakis, J.*
Unconventional Magnetism in All-carbon Nanofoam
Physical Review B **70** (2004) 054407-1-9
- Saadatfar, M., Knackstedt, M.A., Arns, C.H., Sakellariou, A., Senden, T.J., Sheppard, A.P., Sok, R.M., Steininger, H.* and Schrof, W.*
Polymeric Foam Properties Derived from 3D Images
Physica A **339** (2004) 131-136
- Sakellariou, A., Sawkins, T., Senden, T.J. and Limaye, A.#
X-ray Tomography for Mesoscale Physics Applications
Physica A **339** (2004) 152-158
- Schröder, G.E., Ramsden, S.J., Fogden, A.* and Hyde, S.T.
A Rhombohedral Family of Minimal Surfaces as a Pathway between the P and D Cubic Mesophases
Physica A **339** (2004) 137-144
- Sheppard, A.P., Sok, R.M. and Averdunk, H.
Techniques for Image Enhancement and Segmentation of Tomographic Images of Porous Materials
Physica A **339** (2004) 145-151
- Tsotsis, T.T.*, Patel, H.*, Najafi, B.F.*, Racherla, D.*, Knackstedt, M.A. and Sahimi, M.*
Overview of Laboratory and Modeling Studies of Carbon Dioxide Sequestration in Coal Beds
Industrial and Engineering Chemistry Research **43** (2004) 2887-2901
- Turner, M.L., Knüfing, L., Arns, C.H., Sakellariou, A., Senden, T.J., Sheppard, A.P., Sok, R.M., Limaye, A.#, Pinczewski, W.V.* and Knackstedt, M.A.
Three-dimensional Imaging of Multiphase Flow in Porous Media
Physica A **339** (2004) 166-172
- Withers, R.L.#, Welberry, T.R.#, Larsson, A.-K., Liu, Y.#, Noren, L.#, Rundlöf, H.* and Brink, F.J.#
Local Crystal Chemistry, Induced Strain and Short Range Order in the Cubic Pyrochlore $(\text{Bi}_{1.5}\text{Zn}_{0.5})(\text{Zn}_{0.5}\text{Nb}_{1.5})\text{O}_{7-1.5-2.5}$ (BZN)
Journal of Solid State Chemistry **177** (2004) 231-244
- Zimin, D.*, Craig, V.S.J. and Kunz, W.*
Adsorption and Desorption of Polymer/Surfactant Mixtures at Solid-liquid Interfaces: Substitution Experiments
Langmuir **20** (2004) 8114-8123
- Zimin, D.*, Craig, V.S.J. and Kunz, W.*
Adsorption Pattern of Mixtures of Trimethylammonium-modified Hydroxyethylcellulose and Sodium Dodecyl Sulfate at Solid-liquid Interfaces
Langmuir **20** (2004) 2282-2291
- Refereed Conference Proceedings**
- Knackstedt, M.A., Arns, C.H., Holmstad, R.*, Antoine, C.* and Gregersen, Ø.*
Characterisation of 3D Structure and Transport Properties of Paper from Tomographic Images
The 2004 Progress in Paper Physics Seminar, Trondheim, Norway (2004) 64-66
- Knackstedt, M.A., Arns, C.H., Limaye, A.#, Sakellariou, A., Senden, T.J., Sheppard, A.P., Sok, R.M., Pinczewski, V.* and Bunn, G.F.*
Digital Core Laboratory: Properties of Reservoir Core Derived from 3D Images
2004 SPE Asia Pacific Conference on Integrated Modelling for Asset Management, Kuala Lumpur, Malaysia (2004) SPE 87009/1-14
- Selomulya, C.*, Hermawan, M.*, Bushell, G.C.*, Craig, V.S.J. and Amal, R.*
Characterizing the Bond Strength of Aggregates in Suspension
Chemeca - Australasian Conference on Chemical Engineering, Sydney (2004) Paper 273
- Turner, M.L., Arns, C.H., Sakellariou, A., Senden, T.J., Sheppard, A.P., Sok, R.M., Limaye, A.# and Knackstedt, M.A.
Obtaining Hydraulic Properties of Unconsolidated Porous Material
Regolith 2004, Adelaide, Perth and Canberra (2004) 370-374



Professor Brenton Lewis

Atomic and Molecular Physics Laboratories

As recognised by the Division of Atomic, Molecular, and Optical (AMO) 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 welcomed three new academic staff members, Susan Bellm, Michael Went, and Igor Ivanov, together with four Honours students, a summer scholar and a visiting scholar. Three higher degrees were conferred (Waring, Dall, Blajer), and we also congratulate Stephen Gibson on his promotion to Senior Fellow. Following completion of the East Cockroft refurbishment, the Department is now mostly co-located, resulting in a much more efficient and collegial operation. Finally, we were distressed to hear in December of the passing of John Carver, a former Director of the School and the IAS, and an active member of the Department over a long period. John was a key driver in making the School and Department what they are today, and he will be sadly missed.

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 \$400,000 p.a. (Sullivan APD, Mills, Vos, Lewis), and a UWA-led LIEF project (Vos) was commenced, leading to additional funding of around \$190,000. Ken Baldwin was successful in winning \$127,000 from the Major Equipment Committee, for the purchase of an excimer laser. Brenton Lewis won a total of an additional \$50,000 sponsorship for the VUV14 conference, held in Cairns during July, in grants from several bodies (ANU, ASRP, John Hindmarsh, Ian Potter Foundation, OSA, ONRIFO, AOARD, AROFE). Finally, congratulations are in order for Ken Baldwin, who was honoured with the award of the Eureka Prize for the promotion of the understanding of science, and Anatoli Kheifets, who was elected to Fellowship of the American Physical Society, during the year.

The international research profile of the Department remains strong, as evidenced not only by continuing receipt of international awards and learned-society fellowships, but also by invitations to speak at international conferences, and an ongoing commitment to 44 collaborative projects, most involving international collaborators. Of 41 refereed departmental publications this year, nearly 60% have international coauthors.

Staff List

Professor and Head of Laboratories

Brenton Lewis, PhD DSc Adel, C Phys, FlnstP, FAPS, FOSA, FAIP

Professors

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

Adjunct Professors

Lewis Chadderton, DSc Dur, MA PhD Camb, C Phys, FlnstP, FAIP
Robert McEachran, MSc PhD UWQ, C Phys, FlnstP
Robert Robson, BSc Qld, DipMet, PhD, FRMS, FAPS, FAIP

Senior Fellows

Ken Baldwin, MSc ANU, DIC PhD Lond, FAIP, FOSA
Anatoli Kheifets, BSc PhD St Pet (jointly with Theoretical Physics)
Maarten Vos, MSc PhD Gron

Fellows

Stephen Gibson, BSc PhD Adel
Julian Lower, BSc PhD Flind

Research Fellows

Mitsuhiko Kono, MS Kyoto IT, PhD Grad U Adv Sci
Franklin Mills, BSE Princ, MS PhD Caltech (jointly with Centre for Resource and Environmental Studies)
James Sullivan, BSc PhD ANU
Andrew Truscott, BSc PhD Qld (ARC Centre for Quantum Atom Optics)

Postdoctoral Fellows

Susan Bellm, BSc PhD Flind (from June)
Steven Cavanagh, BSc PhD Griff (ARC Fellow)
Robert Dall, BSc CQld
Igor Ivanov, BSc PhD Msk (ARC Fellow) (jointly with Theoretical Physics) (from July)
Jun Matsumoto, MSc PhD Tokyo Met
Michael Went, BSc Newcastle, PhD Griff (from June)

ARC Linkage International Fellow

Michael Lange, Dip. Phys Dr rer nat Heid

Visiting Fellows

John Carver, MSc Syd, PhD ScD Camb, AM, FAA, FTS, FAIP (Emeritus Professor)
Robert Crompton, BSc PhD Adel, AM, FAA, FlnstP, FAPS, HonFAIP (Emeritus Professor)
Malcolm Elford, BSc PhD Adel
Robert Robson, BSc Qld, DipMet, PhD, FRMS, FAPS, FAIP (jointly with Theoretical Physics)
Theodore Stapinski, BE Qld, ME NSW, FTSE, FIE Aust

Senior Technical Officers

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

Technical Officer

Gary Picker, AssocDipMechEng CIT

Departmental Administrator

Alice Duncanson

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

Books and Book Chapters

Bowles, C.M.A., Kheifets, A.S., Sashin, V.A., Vos, M., Weigold, E. and Aryasetiawan, F.*
EMS Measurements of the Valence Spectral Function of Silicon - A Test of Many-body Theory in Correlation Spectroscopy of Surfaces, Thin Films, and Nanostructures, Wiley-VCH Verlag GMBH, Germany (2004) 83-104

Publications in Refereed Journals

Berdinsky, A.S.*, Fink, D.*, Yoo, J.B.*, Chadderton, L.T., Chun, H.G.*, Han, J.H.* and Dragunov, V.P.*
Electronic Conduction Properties of Au/C₆₀/p-Si and C₆₀/Au/p-Si Sandwich Structures: I-V and Transducer Characteristics
Solid State Communications 130 (2004) 809-814

Bolognesi, P.*, Flammini, R.*, Kheifets, A.S., Bray, I.* and Avaldi, L.*
Experimental Observation of Initial-state Effects in Photo-double-ionization of Ne 2s
Physical Review A 70 (2004) 062715-1-6

Bolognesi, P.*, Avaldi, L.*, Bray, I.*, Camilloni, R.*, Coreno, M.*, Kazansky, K.*, Kheifets, A.S., Malegat, L.*, Selles, P.*, Turri, G.* and Zitnik, M.*
The Photodouble Ionisation of Helium and Heavier Rare Gases
Physica Scripta T110 (2004) 62-67

Bolorzadeh, M.A.*, Sashin, V.A.*, Kheifets, A.S. and Ford, M.J.*
Electronic Band Structure of Calcium Oxide
Journal of Electron Spectroscopy and Related Phenomena 141 (2004) 27-38

Bowles, C.M.A., Kheifets, A.S., Sashin, V.A., Vos, M. and Weigold, E.
The Direct Measurement of Spectral Momentum Densities of Silicon with High Energy (e,2e) Spectroscopy
Journal of Electron Spectroscopy and Related Phenomena 141 (2004) 95-104

Buckman, S.J., Panajotovic, R. and Jelisavcic, M.
Low Energy Electron-molecule Collision Cross Sections
Physica Scripta T110 (2004) 166-171

Campbell, L.*, Brunger, M.J.*, Petrovic, Z.Lj.*, Jelisavcic, M., Panajotovic, R. and Buckman, S.J.
Infrared Auroral Emissions Driven by Resonant Electron Impact Excitation of NO Molecules
Geophysical Research Letters 31 (2004) L10103-1-4

Chen, Y. and Chadderton, L.T.
Improved Growth of Aligned Carbon Nanotubes by Mechanical Activation
Journal of Materials Research 19 (2004) 2791-2794

Chen, Y., Conway, M.J., Fitz Gerald, J.D.#, Williams, J.S. and Chadderton, L.T.
The Nucleation and Growth of Carbon Nanotubes in a Mechano-thermal Process
Carbon 42 (2004) 1543-1548

- Cho, H.* , Park, Y.S.* , Tanaka, H.* and Buckman, S.J.
Measurements of Elastic Electron Scattering by Water Vapour Extended to Backward Angles
Journal of Physics B 37 (2004) 625-634
- Cho, H.* , McEachran, R.P., Tanaka, H.* and Buckman, S.J.
The Role of Absorption in Intermediate Energy Elastic Electron Scattering from Krypton
Journal of Physics B 37 (2004) 4639-4645
- Dedman, C.J., Nes, J., Hanna, T.M., Dall, R.G., Baldwin, K.G.H. and Truscott, A.G.
Optimum Design and Construction of a Zeeman Slower for Use with a Magneto-optic Trap
Review of Scientific Instruments 75 (2004) 5136-5142
- Fink, D.* , Petrov, A.V.* , Hoppe, K.* , Fahrner, W.R.* , Papaleo, R.M.* , Berdinsky, A.S.* , Chandra, A.* , Chemseddine, A.* , Zrineh, A.* , Biswas, A.* , Faupel, F.* and Chadderton, L.T.
Etched Ion Tracks in Silicon Oxide and Silicon Oxynitride as Charge Injection or Extraction Channels for Novel Electronic Structures
Nuclear Instruments and Methods in Physics Research B 218 (2004) 355-361
- Jelisavcic, M., Panajotovic, R., Kitajima, M.* , Hoshino, M.* , Tanaka, H.* and Buckman, S.J.
Electron Scattering from Perfluorocyclobutane ($c-C_4F_8$)
Journal of Chemical Physics 121 (2004) 5272-5280
- Khalil, A.S., Llewellyn, D.J., Ridgway, M.C., Stewart, A.M., Byrne, A.P. and Chadderton, L.T.
Swift Heavy Ion Irradiation of Single-crystal Indium Phosphide
Microscopy and Microanalysis 10 (2004) 580-581
- Kheifets, A.S. and Bray, I.*
Convergent Calculations of Double Ionization of Helium: From $(\gamma, 2e)$ to $(e, 3e)$ Processes
Physical Review A 69 (2004) 050701-1-4
- Kheifets, A.S.
Second-order Born Model for Two-electron Atomic Ionization by Fast Charged-particle Impact
Physical Review A 69 (2004) 032712-1/12
- Lower, J.C.A., Panajotovic, R. and Weigold, E.
Recent Progress in Quantum-state Resolved Ionization Experiments
Physica Scripta T110 (2004) 216-221
- McEachran, R.P., Stauffer, A.D.* , Ji, W.* and Zuo, T.*
A Relativistic Version of the Generalized Non-perturbative Polarized-orbital Method
Journal of Physics B 37 (2004) 885-904
- Milne-Brownlie, D.S.* , Cavanagh, S.J., Lohmann, B.* , Champion, C.* , Hervieux, P.A.* and Hanssen, J.*
Dynamics in Electron-impact Ionization of H_2O
Physical Review A 69 (2004) 032701-1-4
- Panajotovic, R., Jelisavcic, M., Kajita, R.* , Tanaka, T.* , Kitajima, M.* , Cho, H.* , Tanaka, H.* and Buckman, S.J.
Electron Scattering from Tetrafluoroethylene
Journal of Chemical Physics 121 (2004) 4559-4569
- Schmidt-Böcking, H.* , Dörner, R.* , Jagutzki, O.* , Jahnke, T.* , Mergel, V.* , Schmidt, L.Ph.H.* , Weber, Th.* , Czasch, A.O.* , Wimmer, Ch.* , Hattass, M.* , Knapp, A.* , Schoffler, M.* , Cocke, C.L.* , Prior, M.H.* , Kheifets, A.S., Weigold, E. and Afaneh, F.*
Many-particle Dynamics in Atomic and Molecular Physics Investigated with the COLTRIMS-technique: New Inside into e-e-Correction
Nuclear Physics A 737 (2004) 306-313
- Sprengers, J.P.* , Ubachs, W.* , Johansson, A.* , L'Huillier, A.* , Wahlström, C.-G.* , Lang, R.* , Lewis, B.R. and Gibson, S.T.
Lifetime and Predissociation Yield of $^{14}N_2$, $b^1\Pi_u(v=1)$
Journal of Chemical Physics 120 (2004) 8973-8978
- Sprengers, J.P.* , Johansson, A.* , L'Huillier, A.* , Wahlström, C.-G.* , Lewis, B.R. and Ubachs, W.*
Pump-probe Lifetime Measurements on Singlet Ungerade States in Molecular Nitrogen
Chemical Physics Letters 389 (2004) 348-351
- Stauffer, A.D.* , Parcell, L.A.* and McEachran, R.P.
Excitation of Fine-structure States of Krypton and Xenon by Positron Impact
Nuclear Instruments and Methods in Physics Research B 221 (2004) 93-96
- Swansson, J.A., Baldwin, K.G.H., Hoogerland, M.D.* , Truscott, A.G. and Buckman, S.J.
A High-flux, Liquid-helium Cooled Source of Metastable Rare Gas Atoms
Applied Physics B 79 (2004) 485-489
- Vos, M., Kheifets, A.S., Bowles, C.M.A., Chen, C., Weigold, E. and Aryasetiawan, F.*
Electronic Structure of Copper Studied by Electron Momentum Spectroscopy
Physical Review B 70 (2004) 205111-1-11
- Vos, M., Bowles, C.M.A., Kheifets, A.S., Sashin, V.A., Weigold, E. and Aryasetiawan, F.*
Measurements of the Electronic Structure of Crystalline Silicon by Electron Momentum Spectroscopy
Journal of Electron Spectroscopy and Related Phenomena 137-140 (2004) 629-632
- Vos, M., Sashin, V.A., Bowles, C.M.A., Kheifets, A.S. and Weigold, E.
Probing the Spectral Densities over the Full Three-dimensional Momentum Space
Journal of Physics and Chemistry of Solids 65 (2004) 2035-2039
- Weber, T.* , Czasch, A.O.* , Jagutzki, O.* , Müller, A.* , Mergel, V.* , Kheifets, A.S., Rotenberg, E.* , Meigs, G.* , Prior, M.H.* , Daveau, S.* , Landers, A.L.* , Cocke, C.L.* , Osipov, T.* , Diez Mu no, R.* , Schmidt-Böcking, H.* and Dörner, R.*
Complete Photo-fragmentation of the Deuterium Molecule
Nature 431 (2004) 437-440
- Weber, T.* , Czasch, A.O.* , Jagutzki, O.* , Müller, A.K.* , Mergel, V.* , Kheifets, A.S., Feagin, E.* , Rotenberg, E.* , Meigs, G.* , Prior, M.H.* , Daveau, S.* , Landers, A.L.* , Cocke, C.L.* , Osipov, T.* , Schmidt-Böcking, H.* and Dörner, R.*
Fully Differential Cross Sections for Photo-double-Ionization of D_2
Physical Review Letters 92 (2004) 163001-1-4
- Weigold, E., Kheifets, A.S., Sashin, V.A. and Vos, M.
Spectral Momentum Densities in Matter Determined by Electron Scattering¹
Acta Crystallographica A 60 (2004) 104-110
- White, R.T.* , He, Y.* , Orr, B.J.* , Kono, M. and Baldwin, K.G.H.
Control of Frequency Chirp in Nanosecond-pulsed Laser Spectroscopy. 1. Optical-heterodyne Chirp Analysis Techniques
Journal of the Optical Society of America B 21 (2004) 1577-1585
- White, R.T.* , He, Y.* , Orr, B.J.* , Kono, M. and Baldwin, K.G.H.
Control of Frequency Chirp in Nanosecond-pulsed Laser Spectroscopy. 2. A Long-pulse Optical Parametric Oscillator for Narrow Optical Bandwidth
Journal of the Optical Society of America B 21 (2004) 1586-1594
- White, R.T.* , McEachran, R.P., Robson, R.E., Elford, M.T. and Bartschat, K.*
Cross Sections and Transport Coefficients for Electrons in Zn Vapour
Journal of Physics D 37 (2004) 3185-3191

White, R.T.*, He, Y.*, Orr, B.J.*, Kono, M. and Baldwin, K.G.H.
*Transition from Single-mode to Multimode Operation of an
Injection-seeded Pulsed Optical Parametric Oscillator*
Optics Express 12 (2004) 5655-5660

Refereed Conference Proceedings

Baldwin, K.G.H., Uhlmann, L., Dall, R.G., Truscott, A.G. and
Buckman, S.J.
*A High Density Metastable Helium MOT for Electron-atom
Collision Studies*
CLEO/IQEC 2004, San Francisco, USA (2004) ITuA3-1-2

Baldwin, K.G.H., Sprengers, J.*, Ubachs, W.*, Lewis, B.R. and
Gibson, S.T.
*Ultrahigh Resolution Pulsed XUV Laser Applications: Lifetimes
for the Excited ${}^1\Pi$ States of Molecular Nitrogen*
CLEO/IQEC 2004, San Francisco, USA (2004) 001-002

Khalil, A.S., Stewart, A.M., Ridgway, M.C., Chadderton, L.T.,
Llewellyn, D.J. and Byrne, A.P.
*Formation of Ion Tracks in Single-crystal Indium Phosphide
Irradiated by Swift Heavy Ions*
28th Annual Condensed Matter and Materials Meeting,
Wagga Wagga (2004) WP40-1-3

White, R.T.*, He, Y.*, Orr, B.J.*, Kono, M. and Baldwin, K.G.H.
*Chirp Characterization of a High Resolution, Low-chirp, ns-
pulsed Optical Parametric Oscillator/Amplifier System*
CLEO/IQEC 2004, San Francisco, USA (2004) CThT31-1-2



Professor Rob Elliman

Electronic Materials Engineering

The Electronic Materials Engineering (EME) Department undertakes world-class interdisciplinary research into the growth, structure, properties and applications of semiconductors and related materials and trains early career researchers for future employment in industry, academia and government. It also plays a leading role in electronic materials research within the broader national and international research communities, and integrates its research, wherever possible, with the needs and demands of Australian industry. These activities are underpinned by the Department's comprehensive suite of state-of-the-art equipment and facilities and its strong national and international collaborative networks.

Key measures of the Department's success include the number and quality of its publications, success in competitive research funding schemes, and the ability to attract and train high-quality early career researchers. In 2004, EME staff and students published over 50 papers in high-quality peer-reviewed journals and conference proceedings, and presented 17 invited or keynote talks at national or international conferences. The Department also continued its success in the ARC Discovery round, with two new grants awarded in the 2003/2004 round (the majority of senior academic staff in the Department already hold two grants).

A highlight of the year was the award of a Federation Fellowship to Chennupati Jagadish. This was complemented by the success of the Department's early-career researchers in the 2004 academic promotion round, with Tessica Weijers, Jodie Bradby, Lan Fu, Susan Kluth and Chris Glover all being promoted to level B. In addition, two graduate students, Penny Lever and Qiang Gao, were awarded PhD degrees. Other awards of significance include the School's John Carver Prize which was awarded to Kallista Stuart for the best student research presentation, a best poster prize awarded to Patrick Kluth at the 14th International Conference on Ion Beam Modification of Materials, and the ANU Centre for the Science and Engineering of Materials (CSEM) best honours project awarded to Wilson Pok.

In addition to their impressive research performance, EME staff and students continued to contribute their time in support of the School, the University and professional bodies. This included service on School and University committees, and to professional societies, national and international conference series, granting agencies and journals. It also included significant contributions to undergraduate teaching, the supervision of honours students, and participation in outreach activities such as summer schools and related activities.

The Department's general staff also continued to play a critical role in its success. Indeed, their contribution cannot be overstated. As an experimental department with an extensive suite of complex experimental equipment and infrastructure EME relies very heavily on the dedication and expertise of its technical staff (Michael Aggett, Martin Conway, Tom Halstead, Fred Johnson, Bernie King, and David Llewellyn). The smooth running of the Department, and its social ambience, also depend critically on the administrative and social skills of its departmental

administrator (Renee Vercoe). (EME also received administrative assistance from Frances Smyth and Belinda Barbour). The important role played by other general staff in the School, including both workshop and administrative staff, is also acknowledged.

Staff List

Professor and Head of Department

Rob Elliman, BAppSci, MAppSci RMIT, PhD DSc Salf, FAIP, FIP

Professors

Chennupati Jagadish, BSc MSc (Tech) MPhil PhD, FAIP, FIP, FloN, FIEEE, FTSE, FAPS, FOSA (ARC Federation Fellow)

Jim Williams, BSc PhD NSW, FAIP, FIEAust, FTSE

Senior Fellows

Mark Ridgway, BSc McM, MSc PhD Queen's
Ying Chen, BSc CAS MSc Tsinghua PhD Paris

Fellows

Mladen Petracic, MSc Zagreb PhD ANU
Hoe Tan, BE Melb, PhD ANU (ARC QEII Fellow)

Research Fellow

Manuela Buda, PhD Eindhoven
Jenny Wong-Leung, BSc Bristol, PhD ANU (ARC QEII Fellow)

Postdoctoral Fellows

Jodie Bradby, BAppSci RMIT, PhD ANU (ARC Fellow)
Yong Jun Chen, MSc USTB, PhD Tsinghua (from July)
Tessica Dall, BSc QUT, PhD ANU (ARC Fellow)
Rakesh Dogra, BSc, MSc, PhD Panjab (from April)
Manuel Forcales, PhD Amsterdam (from May)
Lan Fu, MSc UTSC, PhD ANU (ARC Fellow)
Qiang Gao, MS BSc Northeastern China, PhD ANU (from April)
Chris Glover, BSc Newcastle, PhD ANU (ARC Fellow)
Patrick Kluth, PhD Julich (Humboldt Fellow)
Susan Kluth, BSc BEng, PhD Leuven (ARC Fellow)
Penelope McGowan, PhD ANU (from June)

Visiting Fellows

Stuart Campbell, BSc Aberd, MSc Salf, PhD Mon, FAIP
Neville Fletcher, PhD Harv, DSc Syd, FIP, FAIP, FAAS, FTSE, FAA, AM (Professor)
Michael Swain, BSc PhD UNSW
Heiko Timmers, Dipl Phys Munich, PhD ANU (jointly with Nuclear Physics)
Peter Zory, BSc Syracuse, PhD Carnegie-Mellon

Senior Technical Officers

Tom Halstead, ElectCommCert Canb TAFE
Michael Aggett, AssocDipMechEng CIT
Bernie King, ONC UK
Fred Johnson, MechEngCertCanbTAFE, DipAppSciCCEA

Laboratory Technician

Martin Conway

Research Assistants

David Llewellyn (Electron Microscopy Unit, RSBS)
Jun Yu
Bettina Wolpensinger (January to October)
Hua Chen

Departmental Administrators

Renee Vercoe (January to July)
Frances Smyth (July to November)
Belinda Barbour (November to December)

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

Books and Book Chapters

Chen, Y.
New Synthesis Method of Carbon and Boron Nitride Nanotubes: Mechano-thermal Process in *Advances in Nanoscience and Nanotechnology*, National Institute of Science Communication and Information Resources, New Delhi, India (2004) 253-258

Fletcher, N.H.
Science Education for the Twenty-first Century in Education and the Ideal, New Frontier Publishing, Australia (2004) 151-173

Publications in Refereed Journals

Agâker, M.*, Söderström, J.*, Käämbre, T.*, Glover, C.J., Gridneva, L.*, Schmitt, T.*, Augustsson, A.*, Mattesini, M.*, Ahuja, R.* and Rubensson, J.-E.*
Resonant Inelastic Soft X-ray Scattering at Hollow Lithium States in Solid LiCl
Physical Review Letters 93 (2004) 016404-1-4

Bell, A.# and Fletcher, N.H.
The Cochlear Amplifier as a Standing Wave: Squirting Waves between Rows of Outer Hair Cells?
Journal of the Acoustical Society of America 116 (2004) 1016-1024

Berky, W.*, Balogh, A.G.* and Elliman, R.G.
Heavy Ion Induced Intermixing at Ta/Si and Ta/SiO₂ Interfaces
Nuclear Instruments and Methods in Physics Research B 226 (2004) 309-319

Bogaart, E.W.*, Haverkort, J.E.M.*, Mano, T.*, Nötzel, R.*, Wolter, J.H.*, Lever, P., Tan, H.H. and Jagadish, C.
Picosecond Time-resolved Bleaching Dynamics of Self-assembled Quantum Dots
IEEE Transactions on Nanotechnology 3 (2004) 348-352

Boudreault, G.*, Elliman, R.G., Grötzschel, R.*, Gujrathi, S.C.*, Jaynes, C.*, Lennard, W.N.*, Rauhala, E.*, Sajavaara, T.*, Timmers, H.†, Wang, Y.Q. and Dall (nee Weijers), T.D.M.†
Round Robin: Measurement of H Implantation Distributions in Si by Elastic Recoil Detection
Nuclear Instruments and Methods in Physics Research B 222 (2004) 547-566

Bradby, J.E., Williams, J.S. and Swain, M.V.*
Pop-in Events Induced by Spherical Indentation in Compound Semiconductors
Journal of Materials Research 19 (2004) 380-386

- Butcher, K.S.A.*, Afifuddin, A.*, Tansley, T.L.*, Brack, N.*, Pigram, P.J.*, Timmers, H.*, Prince, K.E.* and Elliman, R.G.
Gallium and Oxygen Accumulations on Gallium Nitride Surfaces Following Argon Ion Milling in Ultra-high Vacuum Conditions
Applied Surface Science 230 (2004) 18-23
- Butcher, K.S.A.*, Wintrebert-Fouquet, M.*, Chen, P.P.-T.*, Tansley, T.L.*, Dou, H.*, Shrestha, S.K.*, Timmers, H.*, Kuball, M.*, Prince, K.E.* and Bradby, J.E.
Nitrogen-rich Indium Nitride
Journal of Applied Physics 95 (2004) 6124-6128
- Carmody, C., Tan, H.H., Jagadish, C., Douheret, O.*, Maknys, K.*, Anand, S.*, Zou, J.*, Dao, L.* and Gal, M.*
Structural, Electrical, and Optical Analysis of Ion Implanted Semi-insulating InP
Journal of Applied Physics 95 (2004) 477-482
- Chen, Y., Zou, J.*, Campbell, S.* and Le Caer, G.*
Boron Nitride Nanotubes: Pronounced Resistance to Oxidation
Applied Physics Letters 84 (2004) 2430-2432
- Chen, Y. and Chadderton, L.T.
Improved Growth of Aligned Carbon Nanotubes by Mechanical Activation
Journal of Materials Research 19 (2004) 2791-2794
- Chen, Y., Conway, M.J., Fitz Gerald, J.D.#, Williams, J.S. and Chadderton, L.T.
The Nucleation and Growth of Carbon Nanotubes in a Mechano-thermal Process
Carbon 42 (2004) 1543-1548
- Cheung, A., Azevedo, G. de M., Glover, C.J., Llewellyn, D.J., Elliman, R.G., Foran, G.J.* and Ridgway, M.C.
Structural Perturbations within Ge Nanocrystals in Silica
Applied Physics Letters 84 (2004) 278-280
- Coelho, A.V.*, Boudinov, H.*, Lippen, von T.*, Tan, H.H. and Jagadish, C.
Implant Isolation of AlGaAs Multilayer DBR
Nuclear Instruments and Methods in Physics Research B 218 (2004) 381-385
- Cohen, M.I.* and Jagadish, C.
It's All About Speed
IEEE Circuits and Devices 20 (2004) 38-43
- Dall (nee Weijers), T.D.M.†, Duck, B.C.* and O'Connor, D.J.*
The Development of a Stopping Power Predictor for Ions with Energies of 0.1 - 1.0 MeV/u in Elemental Targets
Nuclear Instruments and Methods in Physics Research B 215 (2004) 35-47
- Dall (nee Weijers), T.D.M.†, Elliman, R.G. and Timmers, H.*
Heavy Ion Elastic Recoil Detection Analysis of Silicon-rich Silica Films
Nuclear Instruments and Methods in Physics Research B 219-220 (2004) 680-685
- Elliman, R.G., Timmers, H.† and Dall (nee Weijers), T.D.M.†
Hydrogen Detection with a Gas Ionization Elastic Recoil Detector
Nuclear Instruments and Methods in Physics Research B 219-220 (2004) 410-414
- Elliman, R.G., Wilkinson, A.R., Smith, N., Spooner, M.G., Dall (nee Weijers), T.D.M.†, Lederer, M.J., Luther-Davies, B. and Samoc, M.
Light Emission from Silicon Nanocrystals - Size does Matter!
Journal of the Korean Physical Society 45 (2004) S656-S660
- Fletcher, N.H.
A Simple Frequency-scaling Rule for Animal Communication
Journal of the Acoustical Society of America 115 (2004) 2334-2338
- Fletcher, N.H.
Adam and Eve and the Collapse of the Moral Wave Function
The Physicist 41 (2004) 192-193
- Fletcher, N.H.
Designing and Making a Ceremonial Dinner Gong
Acoustics Australia 32 (2004) 65-68
- Fletcher, N.H.
Hyperhelices: A Classical Analog for Strings and Hidden Dimensions
American Journal of Physics 72 (2004) 701-703
- Fletcher, N.H., Riede, T.*, Beckers, G.J.L.* and Suthers, R.A.*
Vocal Tract Filtering and the Coo of Doves
Journal of the Acoustical Society of America 116 (2004) 3750-3756
- Gao, Q., Tan, H.H., Fu, L. and Jagadish, C.
Effects of Thermal Stress on Interdiffusion in InGaAsN/GaAs Quantum Dots
Applied Physics Letters 84 (2004) 4950-4952
- Gao, Q., Tan, H.H., Jagadish, C., Sun, B.Q.*, Gal, M.*, Ouyang, L.* and Zou, J.*
Enhanced Optical Properties of the GaAsN/GaAs Quantum-well Structure by the Insertion of InAs Monolayers
Applied Physics Letters 84 (2004) 2536-2538
- Gao, Q., Tan, H.H., Jagadish, C., Sun, B.Q.*, Gal, M.*, Ouyang, L.* and Zou, J.*
Metalorganic Chemical Vapor Deposition of GaAsN Epilayers: Microstructures and Optical Properties
Journal of Crystal Growth 264 (2004) 92-97
- Gareso, P.L., Buda, M., Fu, L., Tan, H.H. and Jagadish, C.
Suppression of Thermal Atomic Interdiffusion in C-doped InGaAs/AlGaAs Quantum Well Laser Structures using TiO₂ Dielectric Layers
Applied Physics Letters 85 (2004) 5583-5585
- Haberl, B., Bradby, J.E., Swain, M.V., Williams, J.S. and Munroe, P.*
Phase Transformations Induced in Relaxed Amorphous Silicon by Indentation at Room Temperature
Applied Physics Letters 85 (2004) 5559-5561
- Khalil, A.S., Llewellyn, D.J., Ridgway, M.C., Stewart, A.M., Byrne, A.P. and Chadderton, L.T.
Swift Heavy Ion Irradiation of Single-crystal Indium Phosphide
Microscopy and Microanalysis 10 (2004) 580-581
- Kluth, P., Johanessen, B., Giraud, V., Cheung, A., Glover, C.J., Azevedo, G. de M., Foran, G.J.* and Ridgway, M.C.
Bond Length Contraction in Au Nanocrystals Formed by Ion Implantation into Thin SiO₂
Applied Physics Letters 85 (2004) 3561-3563
- Kucheyev, S.O.*, Felter, T.E.*, Anthamatten, M.* and Bradby, J.E.
Deformation Behavior of Ion-irradiated Polyimide
Applied Physics Letters 85 (2004) 733-735
- Kucheyev, S.O., Williams, J.S., Zou, J.* and Jagadish, C.
Dynamic Annealing in III-Nitrides under Ion Bombardment
Journal of Applied Physics 95 (2004) 3048-3054
- Kucheyev, S.O.*, Williams, J.S. and Jagadish, C.
Ion-beam-defect Processes in Group-III Nitrides and ZnO
Vacuum 73 (2004) 93-104
- Kucheyev, S.O.*, Timmers, H.*, Zou, J.*, Williams, J.S., Jagadish, C. and Li, G.*
Lattice Damage Produced in GaN by Swift Heavy Ions
Journal of Applied Physics 95 (2004) 5360-5365
- Leech, P.W.*, Reeves, G.K.*, Holland, A.* and Ridgway, M.C.
The Effect of Au and O Implantation on the Etch Rate of CVD Diamond
Applied Surface Science 221 (2004) 302-307

- Lever, P., Buda, M., Tan, H.H. and Jagadish, C.
Characteristics of MOCVD-grown Thin p-clad InGaAs Quantum-dot Lasers
IEEE Photonics Technology Letters 16 (2004) 2589-2591
- Lever, P., Tan, H.H. and Jagadish, C.
Impurity Free Vacancy Disordering of InGaAs Quantum Dots
Journal of Applied Physics 96 (2004) 7544-7548
- Lever, P., Tan, H.H. and Jagadish, C.
InGaAs Quantum Dots Grown with GaP Strain Compensation Layers
Journal of Applied Physics 95 (2004) 5710-5714
- Lever, P., Buda, M., Tan, H.H. and Jagadish, C.
Investigation of the Blueshift in Electroluminescence Spectra from MOCVD Grown InGaAs Quantum Dots
IEEE Journal of Quantum Electronics 40 (2004) 1410-1416
- Li, X.*, Li, N.*, Demiguel, S.*, Zheng, X.*, Campbell, J.C.*, Tan, H.H. and Jagadish, C.
A Partially Depleted Absorber Photodiode with Graded Doping Injection Regions
IEEE Photonics Technology Letters 16 (2004) 2326-2328
- Lloyd-Hughes, J.*, Castro-Camus, E.*, Fraser, M.D., Jagadish, C. and Johnston, M.B.*
Carrier Dynamics in Ion-implanted GaAs Studied by Simulation and Observation of Terahertz Emission
Physical Review B 70 (2004) 235330-1-6
- Orbons, S.M., Spooner, M.G. and Elliman, R.G.
Effect of Material Structure on Photoluminescence Spectra from Silicon Nanocrystals
Journal of Applied Physics 96 (2004) 4650-4652
- Park, C.J.*, Kwon, Y.H.*, Lee, Y.H.*, Kang, T.W.*, Cho, H.Y.*, Kim, S.*, Choi, S.-H.* and Elliman, R.G.
Origin of Luminescence from Si-implanted (1102) Al₂O₃
Applied Physics Letters 84 (2004) 2667-2669
- Petravic, M., Deenapanray, P.N.K., Coleman, V.A., Kim, K.*, Kim, B.* and Li, G.*
Core-level Photoemission and Near-edge X-ray Absorption Fine-structure Studies of GaN Surface under Low-energy Ion Bombardment
Journal of Applied Physics 95 (2004) 5487-5493
- Presenti, G.C.*, Boudinov, H.*, Carmody, C. and Jagadish, C.
Variable Temperature Hall-effect Measurements in Ion Bombarded InP
Nuclear Instruments and Methods in Physics Research B 218 (2004) 386-390
- Quadri, S.B.*, Yousuf, M.*, Kendziora, C.A.*, Nachumi, B.*, Fischer, R.*, Grun, J.*, Rao, M.V.*, Tucker, J.*, Siddiqui, S.* and Ridgway, M.C.
Structural Modifications of Silicon-implanted GaAs Induced by the Athermal Annealing Technique
Applied Physics A 79 (2004) 1971-1977
- Reece, P.J.*, Gal, M.*, Tan, H.H. and Jagadish, C.
Optical Properties of Erbium-implanted Porous Silicon Microcavities
Applied Physics Letters 85 (2004) 3363-3365
- Ridgway, M.C., Azevedo, G. de M., Glover, C.J., Elliman, R.G., Llewellyn, D.J., Cheung, A., Johanessen, B., Brett, D.A. and Foran, G.J.*
EXAFS Characterisation of Ge Nanocrystals in Silica
Nuclear Instruments and Methods in Physics Research B 218 (2004) 421-426
- Rode, A.V., Gamaly, E.G., Christy, A.G., Fitz Gerald, J.G.†, Hyde, S.T., Elliman, R.G., Luther-Davies, B., Veinger, A.I.*, Androulakis, J.* and Giapintzakis, J.*
Unconventional Magnetism in All-carbon Nanofoam
Physical Review B 70 (2004) 054407-1-9
- Shrestha, S.K.*, Timmers, H.†, Butcher, K.S.A.* and Wintrebert-Fouquet, M.*
Accurate Stoichiometric Analysis of Polycrystalline Indium Nitride Films with Elastic Recoil Detection
Current Applied Physics 4 (2004) 237-240
- Shrestha, S.K.*, Butcher, K.S.A.*, Wintrebert-Fouquet, M.* and Timmers, H.†
Reliable ERD Analysis of Group-III Nitrides Despite Severe Nitrogen Depletion
Nuclear Instruments and Methods in Physics Research B 219-20 (2004) 686-692
- Titov, A.I.*, Karasev, P.A.* and Kucheyev, S.O.
A Model of Electrical Isolation in GaN and ZnO Bombarded with Light Ions
Semiconductors 38 (2004) 1179-1186
- Valenta, J.*, Ostatnicky, T.*, Pelant, I.*, Elliman, R.G., Linnros, J.* and Honerlage, B.*
Microcavity-like Leaky Mode Emission from a Planar Optical Waveguide Made of Luminescent Silicon Nanocrystals
Journal of Applied Physics 96 (2004) 5222-5225
- Veryovkin, I.*, Calaway, W.*, Moore, J.*, Pellin, M.*, Lewellen, J.*, Li, Y.*, Milton, S.*, King, B.* and Petravic, M.
A New Horizon in Secondary Neutral Mass Spectrometry: Post-ionization using a VUV Free Electron Laser
Applied Surface Science 231-232 (2004) 962-966
- Virwani, K.R.*, Malshe, A.P.*, Sood, D.K.* and Elliman, R.G.
Modification of Mechanical Properties of Silicon Nanocantilevers by Self-ion Implantation
Applied Physics Letters 84 (2004) 3148-3150
- Wesch, W. and Ridgway, M.C.
The Rapid Amorphisation of In_{0.53}Ga_{0.47}As Relative to Both InAs and GaAs
Materials Science in Semiconductor Processing 7 (2004) 35-38
- Wilkinson, A.R. and Elliman, R.G.
The Effect of Annealing Environment on the Luminescence of Silicon Nanocrystals in Silica
Journal of Applied Physics 96 (2004) 4018-4020

Refereed Conference Proceedings

- Deenapanray, P.N.K., Krispin, M.*, Meyer, W.E.*, Tan, H.H., Jagadish, C. and Auret, F.D.*
Defect Engineering and Atomic Relocation Processes in Impurity-free Disordered GaAs and AlGaAs
Materials Research Society Meeting, Boston, USA (2004)
- Fletcher, N.H. and Tarnopolsky, A.Z.*
The Leaf-reed: The Simplest Woodwind Instrument?
International Symposium on Musical Acoustics, Nara, Japan (2004) 116-119
- Khalil, A.S., Stewart, A.M., Ridgway, M.C., Chadderton, L.T., Llewellyn, D.J. and Byrne, A.P.
Formation of Ion Tracks in Single-crystal Indium Phosphide Irradiated by Swift Heavy Ions
28th Annual Condensed Matter and Materials Meeting, Wagga Wagga (2004) WP40-1-3



Professor Barry Luther-Davies

Laser Physics Centre

Research within the Centre covers many of the most exciting aspects of contemporary laser physics. The activities within the Centre can be broadly divided into the following areas: Laser Matter Interaction Physics, Nonlinear Optical Phenomena, Nonlinear Optical Materials, Solid State Spectroscopy and Photonics. Research in photonics is partly supported by the ARC Centre of Excellence for Ultrahigh Bandwidth Devices for Optical Systems (CUDOS). Research highlights for 2004 included the production of longest lived coherent excitation ever observed in a solid (Fraval, Longdell, Sellars and Manson); the production of the first nano-scale photonic crystals in free-standing chalcogenide glass films using a focused ion beam mill (Freeman, Luther-Davies, Krolikowska and Madden); the production of the dry etched low loss nonlinear chalcogenide glass waveguides (Ruan, Luther-Davies and Li); and the first experimental study of wavelength dispersion of the complex cubic nonlinear optical susceptibility carried out on an organometallic dendrimer indicating the presence of competition between two-photon absorption and saturation of one-photon absorption (Morrall, Samoc, Humphrey, Notaras and co-workers at the Department of Chemistry, ANU).

During 2004 the Department benefited from strong levels of funding from the Australian Research Council with major grants supporting CUDOS; Professor Luther-Davies' Federation Fellowship; four Discovery grants and one Linkage grant. In addition significant funding was provided by DARPA (USA) and DSTO. Two new Discovery grants were awarded for commencement in 2005 for work on "Nanoclusters with Extraordinary Properties Made out of Ordinary Materials" (Rode, Luther-Davies and Christy) and to develop "Polymer Optical Fibres with Controlled Molecular Orientation for Photonic Applications" (A. Samoc and M. Samoc).

The Centre congratulates Vesselin Kolev and Kylie Waring on the award of their PhDs and Darryl Scott for his Masters degree. New staff appointed in 2004 included Steve Madden and Duk Choi who will work on the fabrication of chalcogenide waveguide devices and Rongping Wang who will work on pulsed laser deposition. Malte During rejoined the Centre in December as a Visiting Scholar to continue our collaboration with Fraunhofer ILT in Aachen on the development of high power picosecond laser sources.

Staff List

Professor and Head of Department

Barry Luther-Davies, BSc PhD S'ton, SIEE, FAIP (ARC Federation Fellow)

Professors

Neil Manson, MSc PhD Aberd

Wieslaw Krolikowski, MSc PhD Wars

Senior Fellows

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

Fellows

Anna Samoc, MSc PhD Wroc

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)
Weitang Li, MSc China, PhD Sydney (Australian Photonics CRC)
Congji Zha, BE Jingdezhen, ME WUT, PhD Sydney

Visiting Fellows

Graham Atkins, BSc PhD Sydney
Robbie Charters, BSc Nott, PhD Cranfield
Eugene Gamaly, PhD DSc Mosc
Dax Kukulj, BSc PhD UNSW
David Pulford, BSc PhD ANU
Mark Humphrey, BSc PhD ANU
Graham Gordon, BSc PhD ANU
Maureen Brauers, BSc ANU
Ben Cornish, BSc ANU

Research Assistants

Mr Vesselin Kolev, Eng-Phys Uni of Plovdiv GSS
Mr Darren Freeman, BEng (EE) (Hons) Flinders
Mr Khu Vu

Head Technical Officer

Ian McRae

Senior Technical Officers

Craig Macleod, AssocDipMechEng CIT
Mike Pennington, AssocDipAppSci&Inst CIT
Anita Smith, BSc Flinders

Technical Officers

John Bottega
Maryla Krolikowska

Departmental Administrators

Belinda Barbour
Cindy Bradley (August to October)

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

Adams, C.J.*, Bowen, L.E.*, Humphrey, M.G.#, Morrall, J.P.#, Samoc, M. and Yellowlees, L.J.*
Ruthenium Bipyridyl Compounds with two Terminal Alkynyl Ligands
Dalton Transactions 2004 (2004) 4130-4138

Bulla, D.A.P.†, Li, W.T., Charles, C., Boswell, R., Ankiewicz, A. and Love, J.D.
Deposition and Characterization of Silica-based Films by Helicon-activated Reactive Evaporation Applied to Optical Waveguide Fabrication
Applied Optics 43 (2004) 2978-2985

Choudhury, K.R.*, Samoc, M., Patra, A.* and Prasad, P.N.*
Charge Carrier Transport in Poly(N-vinylcarbazole): CdS Quantum Dot Hybrid Nanocomposite
Journal of Physical Chemistry B 108 (2004) 1556-1562

Elliman, R.G., Wilkinson, A.R., Smith, N., Spooner, M.G., Dall (nee Weijers), T.D.M.†, Lederer, M.J., Luther-Davies, B. and Samoc, M.
Light Emission from Silicon Nanocrystals - Size Does Matter!
Journal of the Korean Physical Society 45 (2004) S656-S660

Fraval, E., Sellars, M. and Longdell, J.
Method of Extending Hyperfine Coherence Times in Pr³⁺:Y₂SiO₅
Physical Review Letters 92 (2004) 077601-1-4

Fraval, E., Sellars, M., Morrison, A.# and Ferris, A.#
Pr-y Interaction in Pr³⁺:Y₂SiO₅
Journal of Luminescence 107 (2004) 347-350

Gamaly, E.G., Rode, A.V., Uteza, O.*, Kolev, V.Z., Luther-Davies, B., Bauer, T.*, Koch, J.*, Korte, F.* and Chichkov, B.N.*
Control over a Phase State of the Laser Plume Ablated by Femtosecond Laser: Spatial Pulse Shaping
Journal of Applied Physics 95 (2004) 2250-2257

Harrison, J.P., Sellars, M. and Manson, N.
Optical Spin Polarisation of the N-V Centre in Diamond
Journal of Luminescence 107 (2004) 245-248

Humphrey, M.G.#, Powell, C.E.#, Cifuentes, M.P.#, Morrall, J.P. and Samoc, M.
Synthesis and Nonlinear Optical Properties of alkynylruthenium Dendrimers
Polymer preprints 45 (2004) 367-368

Krolikowski, W., Bang, O.*, Nikolov, N.I.*, Neshev, D., Wyller, J., Rasmussen, J.J.* and Edmundson, D.#
Modulational Instability, Solitons and Beam Propagation in Spatially Nonlocal Nonlinear Media
Journal of Optics B: Quantum and Semiclassical Optics 6 (2004) S288-S294

Krolikowski, W., Bang, O.* and Wyller, J.
Nonlocal Incoherent Solitons
Physical Review E 70 (2004) 1-5

Li, W.T., Charters, R.B., Luther-Davies, B. and Mar, L.*
Significant Improvement of Adhesion between Gold Thin Films and a Polymer
Applied Surface Science 233 (2004) 227-233

Lim, O.-K.*, Boland, B.*, Saffman, M.* and Krolikowski, W.
Creation, Doubling and Splitting of Vortices in Intracavity Second Harmonic Generation
Journal of Optics A 6 (2004) 486-489

Longdell, J., Sellars, M. and Manson, N.
Demonstration of Conditional Quantum Phase Shift between Ions in a Solid
Physical Review Letters 93 (2004) 130503-1-4

Longdell, J. and Sellars, M.
Experimental Demonstration of Quantum-state Tomography and Qubit-qubit Interactions for Rare-earth-metal-ion-based Solid-state Qubits
Physical Review A 69 (2004) 032307-1-5

Luo, X., Zha, C. and Luther-Davies, B.
Anhydrous Sol-gel Synthesis of Titania-doped Siloxane Polymer for Integrated Optics
Journal of Sol-Gel Science and Technology 32 (2004) 297-301

- Luther-Davies, B., Kolev, V.Z., Lederer, M.J., Madsen, N., Rode, A.V., Giesekus, J.*, Du, K.* and Duering, M.
Table-top 50-W Laser System for Ultra-fast Laser Ablation
Applied Physics A 79 (2004) 1051-1055
- Markowicz, P.P.*, Samoc, M., Cerne, J.*, Prasad, P.N.*, Pucci, A.* and Ruggeri, G.*
Modified Z-scan Techniques for Investigations of Nonlinear Chiroptical Effects
Optics Express 12 (2004) 5209-5214
- Moss, D.J.*, Ta'eed, V.G.*, Eggleton, B.J.*, Freeman, D., Madden, S., Samoc, M., Luther-Davies, B., Janz, S.* and Xu, D.-X.*
Bragg Gratings in Silicon-on-insulator Waveguides by Focused Ion Beam Milling
Applied Physics Letters 85 (2004) 4860-4862
- Neshev, D., Sukhorukov, A.A., Hanna, B., Krolikowski, W. and Kivshar, Y.S.
Controlled Generation and Steering of Spatial Gap Solitons
Physical Review Letters 93 (2004) 083905-1-4
- Neshev, D., Sukhorukov, A.A., Kivshar, Y.S. and Krolikowski, W.
Observation of Transverse Instabilities in Optically Induced Lattices
Optics Letters 29 (2004) 259-261
- Nikolov, N.I.*, Krolikowski, W., Neshev, D., Bang, O.*, Rasmussen, J.J.* and Christiansen, P.L.*
Attraction of Nonlocal Dark Optical Solitons
Optics Letters 29 (2004) 286-288
- Powell, C.E.#, Morrall, J.P., Ward, S.A.#, Cifuentes, M.P.#, Notaras, E.G., Samoc, M. and Humphrey, M.G.#
Dispersion of the Third-order Nonlinear Optical Properties of an Organometallic Dendrimer
Journal of the American Chemical Society 126 (2004) 12334-12335
- Pryde, G., Sellars, M. and Manson, N.
Phase-dependent Decoherence of Optical Transitions in Pr³⁺:LaF₃ in the Presence of a Driving Field
Physical Review B 69 (2004) 075107-1-4
- Rode, A.V., Gamaly, E.G., Christy, A.G., Fitz Gerald, J.G.#, Hyde, S.T., Elliman, R.G., Luther-Davies, B., Veinger, A.I.*, Androulakis, J.* and Giapintzakis, J.*
Unconventional Magnetism in All-carbon Nanofoam
Physical Review B 70 (2004) 054407-1-9
- Ruan, Y., Li, W.T., Jarvis, R., Madsen, N., Rode, A.V. and Luther-Davies, B.
Fabrication and Characterization of Low Loss Rib Chalcogenide Waveguides Made by Dry Etching
Optics Express 12 (2004) 5140-5145
- Saffman, M.*, Krolikowski, W. and McCarthy, G.
Two-dimensional Modulational Instability in Photorefractive Media
Journal of Optics B 6 (2004) S397-S403
- Samoc, A., Samoc, M., Luther-Davies, B., Kelly, J.F.#, Krausz, E.R.# and Willis, A.C.#
New Second-order Nonlinear Octupolar Materials
Molecular Crystals and Liquid Crystals 415 (2004) 179-195
- Sellars, M., Fraval, E. and Longdell, J.
Investigation of Static Electric Dipole-dipole Coupling Induced Optical Inhomogeneous Broadening in Eu³⁺:Y₂SiO₅
Journal of Luminescence 107 (2004) 150-154
- Sukhorukov, A.A., Neshev, D., Krolikowski, W. and Kivshar, Y.S.
Nonlinear Bloch-wave Interaction and Bragg Scattering in Optically Induced Lattices
Physical Review Letters 92 (2004) 093901-1-4
- Ta'eed, V.G.*, Moss, D.J.*, Eggleton, B.J.*, Freeman, D., Madden, S., Samoc, M., Luther-Davies, B., Janz, S.* and Xu, D.-X.*
Higher Order Mode Conversion via Focused Ion Beam Milled Bragg Gratings in Silicon-on-insulator Waveguides
Optics Express 12 (2004) 5274-5284
- Uteza, O., Gamaly, E.G., Rode, A.V., Samoc, M. and Luther-Davies, B.
Gallium Transformation under Femtosecond Laser Excitation: Phase Coexistence and Incomplete Melting
Physical Review B 70 (2004) 054108-1-13
- Refereed Conference Proceedings
- Bulla, D.A.P.†, Li, W.T., Charles, C., Boswell, R. and Love, J.D.
OH Absorption Peak on Silica Planar Waveguide Deposited by HARE-PECVD
ACOFT/AOS '04, Canberra (2004) ACOFT-PO4-1-3
- Fraval, E. and Sellars, M.
Solid State Spin Qubit Decoherence Times in Excess of 20s Achieved using Dynamic Decoherence Control
ACOFT/AOS '04, Canberra (2004) ThurAfter2.45-1
- Freeman, D., Ruan, Y., Madsen, N., Jarvis, R., Rode, A.V., Samoc, M. and Luther-Davies, B.
Nanophotonic Structures Fabricated in Chalcogenide Glass Films by Focused Ion Beam Milling
ACOFT/AOS '04, Canberra (2004) 1-3
- Gamaly, E.G., Juodkakis, S.*, Rode, A.V., Luther-Davies, B. and Misawa, H.*
3-D Memory Bits Recording and Reading with Femtosecond Laser
ACOFT/AOS '04, Canberra (2004) ACOFT-PO14-1-3
- Hanna, B., Neshev, D., Sukhorukov, A.A., Krolikowski, W. and Kivshar, Y.S.
Dispersion and Mutual Focusing in Nonlinear Periodic Lattices
ACOFT/AOS '04, Canberra (2004) TueMorn9.00-1-3
- Hanna, B., Neshev, D., Sukhorukov, A.A., Krolikowski, W. and Kivshar, Y.S.
Observation of Multi-gap Vector Solitons
Optical Society of America Topical Meetings, Toronto, Canada (2004) PD6-1-3
- Jarvis, R., Ruan, Y., Madsen, N., Rode, A.V. and Luther-Davies, B.
Characterisation of Chalcogenide Glass for Magneto-optic Waveguides
ACOFT/AOS '04, Canberra (2004) ACOFT-PO33-1-3
- Juodkakis, S.*, Kondo, T.*, Rode, A.V., Matsuo, S.* and Misawa, H.*
Three-dimensional Recording and Structuring of Chalcogenide Glasses by Femtosecond Pulses
Fifth International Symposium on Laser Precision Microfabrication, Nara, Japan, (2004) 179-195
- Krolikowski, W., Nikolov, N.I.*, Bang, O.*, Neshev, D., Wyller, J.*, Rasmussen, J.J.* and Edmundson, E.#
Optical Beams and Spatial Solitons in Nonlocal Nonlinear Media
CLEO/IQEC 2004, San Francisco, USA (2004) IML3-1-2
- Li, W.T., Bulla, D.A.P.†, Love, J.D., Luther-Davies, B., Charles, C. and Boswell, R.
Dry Etching of SiO₂ Thin Films for Optical Waveguide Fabrication
ACOFT/AOS '04, Canberra (2004) ACOFT-PO19-1-3
- Longdell, J. and Sellars, M.
Two Qubit Operations using Optically Active Centres in Solids
ACOFT/AOS '04, Canberra (2004) AOS-PO20-1
- Luo, X., Zha, C., Luther-Davies, B. and Samoc, A.
Photosensitivity of Titania-doped Hybrid sol-Gel Glassy Thin Films
Austceram 2004 - 4th International Ceramic Conference and Exhibition, Melbourne (2004) 197-198

Luo, X., Zha, C., Luther-Davies, B. and Samoc, A.
Preparation and Photosensitivity of TiO₂-doped Hybrid Sol-gel Glass Films
ACOFT/AOS '04, Canberra (2004) TueAft5.45-1-3

Luo, X., Zha, C., Luther-Davies, B. and Samoc, A.
Preparation of Photosensitive Titania-Doped Hybrid Polymer via Anhydrous Sol-gel Process
Austceram 2004 – 4th International Ceramic Conference and Exhibition, Melbourne (2004) 205-206

Luther-Davies, B., Gamaly, E.G., Rode, A.V., Kolev, V.Z., Madsen, N., Duering, M. and Giesekus, J.*
Applications of High Power Slow Mode-locked Lasers for Ablation and Non-linear Optics
SPIE Annual Meeting: High Power Laser Ablation V, Taos, USA (2004) 432-440

Neshev, D., Sukhorukov, A.A., Kivshar, Y.S., Hanna, B. and Krolikowski, W.
Controlled Generation and Steering of Spatial Gap Solitons in Optically-induced Lattices
Optical Society of America Topical Meetings, Toronto, Canada (2004) WB4-1-3

Neshev, D., Sukhorukov, A.A., Ostrovskaya, E.A., Alexander, T.J., Kivshar, Y.S., Hanna, B., Krolikowski, W., Martin, H.* and Chen, Z.*
Photonics in Optically-induced Lattices
CLEO/IQEC 2004, San Francisco, USA (2004) JTuF6-1-2

Nikolov, N.I.*, Neshev, D., Bang, O.*, Krolikowski, W. and Wyller, J.*
A Nonlocal Description of Two-color Parametric Solitons
Optical Society of America Topical Meetings, Toronto, Canada (2004) TuC4-1-3

Rode, A.V., Madsen, N., Kolev, V.Z., Gamaly, E.G., Luther-Davies, B., Dawes, J.M.* and Chan, A.*
Subpicosecond and Picosecond Laser Ablation of Dental Enamel: Comparative Analysis
Commercial and Biomedical Applications of Ultrafast Lasers IV, Photonic West 2004, Jan Jose, USA (2004) 76-86

Ruan, Y., Li, W.T., Luther-Davies, B. and Rode, A.V.
Fabrication and Characterization of Ridge Chalcogenide Waveguides
ACOFT/AOS '04, Canberra (2004) TueAfter6.30-1-3

Ruan, Y., Li, W.T., Luther-Davies, B. and Rode, A.V.
Low Loss Ridge Chalcogenide Waveguide Made by Plasma Etching and Observed Strong Self-phase Modulation
ECOC 2004 – 30th European Conference on Optical Communication, Stockholm, Sweden (2004) 552-553

Saffman, M.*, McCarthy, G. and Krolikowski, W.
Two-dimensional Modulational Instability in Photorefractive Media
Optical Society of America Topical Meetings, Toronto, Canada (2004) 1-3

Samoc, M., Powell, C.E.#, Morrall, J.P., Ward, S.A.#, Cifuentes, M.P.#, Notaras, E.G. and Humphrey, M.G.
Two-photon Absorption, Absorption Saturation and Dispersion of the Real and Imaginary Parts of the Third-order Optical Nonlinearity in Organometallic Dendrimers
The International Symposium on Optical Science and Technology, Denver, USA (2004) 86-96

Ta'eed, V.G.*, Moss, D.J.*, Eggleton, B.J.*, Freeman, D., Samoc, M., Madden, S., Luther-Davies, B., Janz, S.* and Xu, D.-X.*
Bragg Gratings in Silicon-on-insulator Waveguides using Focused Ion Beam Milling
ACOFT/AOS '04, Canberra (2004) TueAfter6.15-1-3

Patents

Zha, C. and Atkins, G.R.
Preparation of Metal Alkoxide Polymers for Optical Applications
US Patent No US 6800724

Zha, C. and Kukulj D.
Process for Producing Polysiloxanes and Use of the Same
US Patent No US 6818721



Professor Yuri Kivshar

Nonlinear Physics Centre

The recently established Nonlinear Physics Centre is one of the most active and productive groups of young researchers in the School engaged into interdisciplinary research that covers a number of diverse topics such as nonlinear optics and all-optical switching devices; nano-optics and photonic crystals; self-trapping effects and energy transfer in condensed matter physics and biopolymers; nonlinear atom optics and dynamics of matter waves including the dynamics of the Bose-Einstein condensates; and more recently, linear and nonlinear effects in left-handed metamaterials. Other research topics covered are linear and nonlinear guided wave optics; parametric effects and frequency conversion; dissipative solitons; nonlinear composite materials; etc.

Research highlights for 2004 include a number of important theoretical and experimental results, presented in many research publications including eight papers in *Physical Review Letters*, the top-ranked journal in physics. The most remarkable results include the prediction of matter-wave gap vortices in Bose-Einstein condensates (Ostrovskaya) and the extension of this concept to asymmetric vortices (Sukhorukov and Alexander); the first experimental generation of photonic gap solitons in optically-induced lattices (Neshev and Sukhorukov); the prediction of a number of novel nonlinear effects in left-handed metamaterials (Shadrivov and Zharov); the theoretical demonstration of a giant Lamb shift in photonic crystals (Wang); the prediction and analysis of nonlinear resonant Fano effects (Miroshnichenko) and beaming effect in photonic crystals (Morrison); and the experimental demonstrations of interesting properties of photonic Bragg gratings including tunable negative refraction (Neshev, Sukhorukov and Rosberg), performed in collaboration with the group of Professor W. Krolikowski from the Laser Physics Centre. Added to our important milestones for 2004, were the publication of a book on the Frenkel-Kontorova model (Braun and Kivshar) and a completion of a comprehensive review paper on optical vortices and vortex solitons for the famous book series "Progress in Optics" (Desyatnikov, Torner and Kivshar).

This was another successful year for new competitive funding. The Centre continues to play an important role in the two Centres of Excellence funded by the Australian Research Council announced at the end of 2002, namely the ARC Centre of Excellence for Ultra-high Bandwidth Devices for Optical Systems (CUDOS) and the ARC Centre of Excellence for Quantum-Atom Optics (ACQAO). In view of our earlier success with ARC funding, we have a limited ability to attract additional funding from the ARC. Nevertheless, a new ARC Discovery grant (\$1.036k), the largest in the School, was won in the 2004 round to support our research on left-handed metamaterials and negative refraction (Kivshar).

The Centre congratulates Dragomir Neshev on his promotion to level C, and Ilya Shadrivov who received a number of student awards in 2004 including the Australian Optical Society Postgraduate Prize. We were pleased to welcome three new PhD students, namely Steven Morrison, Aaron Matthews, and Christian

Rosberg. During 2004, the Centre hosted a number of long-term visiting scholars and visiting fellows, including Igor Barashenkov (South Africa), Alex Dreischuh (Bulgaria), Dmitry Pelinovsky (Canada), Jaroslav Prilepsky (Ukraine), Nikolay Rosanov (Russia), Jose Salgueiro (Spain), Anatoly Sukhorukov (Russia), John Wyller (Norway), Xiulun Yang (China), Alex Zharov and Nina Zharova (Russia), Boris Malomed (Israel), Christian Motzek (Germany), Ray-Kuang Lee (Taiwan), Lukasz Wolf (Sweden), and Ling Xiao Zhu (Sweden), who also contributed into the Centre's outstanding performance and success.

Staff List

Professor and Head of Department

Yuri Kivshar, PhD Kharkov UKR, FAIP, FOSA, FAA (ARC Federation Fellow)

Professor

Alexander Zharov, BSc Gorky, PhD USSR AcadSci, DSc NIRFI, Russia (September to December)

Research Fellows

Anton Desyatnikov, PhD Moscow
 Michael Feise, MSc PhD Pullman USA
 Dragomir Neshev, MSc PhD Sofia, BG (ARC Fellow)
 Andrey Sukhorukov, PhD ANU
 Xue-Hua Wang, PhD China (until May)

Postdoctoral Fellows

Tristram Alexander PhD ANU
 Chaohong Li, PhD China
 Andrey Miroshnichenko PhD Dresden
 Elena Ostrovskaya, MSc Moscow, PhD ANU (ARC Fellow)

Visiting Fellows

Igor Barashenkov, MSc PhD Moscow (December)
 Alex Dreischuh, MSc PhD DSc Sofia (October to December)
 Sergey Gredeskul, PhD DSc Kharkov (January to March)
 Sergei Kun, MSc PhD Kiev (jointly with Theoretical Physics) (January to December)
 Gershon Kurizki, BSc MSc Haifa, PhD New Mexico (December)
 Kristian Motzek, MSc Darmstadt (August to September)
 Dmitry Pelinovsky, MSc PhD Monash (December)
 Jaroslav Prilepsky, MSc PhD Kharkov (April to June)
 Nikolay Rosanov, PhD, DSc St. Petersburg (August to September)
 Jose Ramon Salgueiro, MS PhD Compostela, (January to March and from October)
 Anatoly Sukhorukov, MSc PhD DSc Moscow State (July to September)
 John Wyller, MSc PhD Tromsø (jointly with Laser Physics Centre) (January to August)
 Xiulun Yang, BSc MSc PhD Shandong (July – August)
 Alexander Zharov, BSc Gorky, PhD USSR AcadSci, DSc NIRFI, Russia (April)

Nina Zharova, BSc Gorky, PhD USSR AcadSci (September to December)

Research Assistant

Robert Fischer, MSc Darmstadt (from November)

Departmental Administrator

Wendy Quinn, BA

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

Books and Book Chapters

Braun, O.M.* and Kivshar, Y.S.
The Frenkel–Kontorova Model Concepts, Methods, and Applications
 Springer-Verlag Heidelberg, Germany (2004) 440pp

Publications in Refereed Journals

Alexander, T.J., Sukhorukov, A.A. and Kivshar, Y.S.
Asymmetric Vortex Solitons in Nonlinear Periodic Lattices
Physical Review Letters **93** (2004) 063901-1-4

Campbell, D.K.*, Flach, S.* and Kivshar, Y.S.
Localizing Energy through Nonlinearity and Discreteness
Physics Today January (2004) 43-49

Dabrowska, B.J., Ostrovskaya, E.A. and Kivshar, Y.S.
Interaction of Matter-wave Gap Solitons in Optical Lattices
Journal of Optics B **6** (2004) 423-427

Desyatnikov, A.S.*, Denz, C.* and Kivshar, Y.S.
Nonlinear Optical Beams Carrying Phase Dislocations
Journal of Optics A **6** (2004) S209-S212

Dong, Y.*, Wang, Q.*, Li, S.*, Duan, L.*, Wu, H.*, Xu, H.*, Chen, R.*, Xu, H.*, Han, J.*, Li, Z.*, Lu, X.*, Zhao, K.*, Zhou, P.*, Liu, J.* and Kun, S.[†]
Angular Distribution of Products in Deep Inelastic Collision of ¹⁹F + ²⁷Al
Nuclear Physics Review **21** (2004) 387-389

Feise, M.W. and Kivshar, Y.S.
Sub-wavelength Imaging with a Left-handed Material Flat Lens
Physics Letters A **334** (2004) 326-330

Feise, M.W., Shadrivov, I.V. and Kivshar, Y.S.
Tunable Transmission and Bistability in Left-handed Band-gap Structures
Applied Physics Letters **85** (2004) 1451-1453

Fleischer, J.W.*, Neshev, D., Bartal, G.*, Alexander, T.J., Cohen, O.*, Ostrovskaya, E.A., Manela, O.*, Martin, H.*, Hudock, J.*, Makasyuk, I.*, Chen, Z.*, Christodoulides, D.N.*, Kivshar, Y.S. and Segev, M.*
Nonlinear Optics: Observation of Discrete Vortex Solitons in 2D Photonic Lattices
Optics and Photonics News December (2004) 30

Jeng, C.-C.*, Shih, M.-F.*, Motzek, K. and Kivshar, Y.S.
Partially Incoherent Optical Vortices in Self-focusing Nonlinear Media
Physical Review Letters **92** (2004) 043904-1-4

Krolikowski, W., Bang, O.*, Nikolov, N.I.*, Neshev, D., Wyller, J., Rasmussen, J.J.* and Edmundson, D.
Modulational Instability, Solitons and Beam Propagation in Spatially Nonlocal Nonlinear Media
Journal of Optics B **6** (2004) S288-S294

- Louis, P.J.Y., Ostrovskaya, E.A. and Kivshar, Y.S.
Matter-wave Dark Solitons in Optical Lattices
Journal of Optics B 6 (2004) S309-S317
- Matthews, A.F., Mingaleev, S.F. and Kivshar, Y.S.
Band-gap Engineering and Defect Modes in Photonic Crystals with Rotated Hexagonal Holes
Laser Physics 14 (2004) 631-634
- Morandotti, R.*, Mandelik, D.*, Silberberg, Y.*, Aitchison, J.S.*, Sorel, M.*, Christodoulides, D.N.*, Sukhorukov, A.A. and Kivshar, Y.S.
Observation of Discrete Gap Solitons in Binary Waveguide Arrays
Optics Letters 29 (2004) 2890-2892
- Motzek, K.*, Kaiser, F.*, Salgueiro, J.R., Kivshar, Y.S. and Denz, C.*
Incoherent Vector Vortex-mode Solitons in Self-focusing Nonlinear Media
Optics Letters 29 (2004) 2285-2287
- Motzek, K.*, Kaiser, F.*, Chu, W.-H.*, Shih, M.-F.* and Kivshar, Y.S.
Soliton Transverse Instabilities in Anisotropic Nonlocal Self-focusing Media
Optics Letters 29 (2004) 280-282
- Neshev, D., Sukhorukov, A.A., Hanna, B., Krolikowski, W. and Kivshar, Y.S.
Controlled Generation and Steering of Spatial Gap Solitons
Physical Review Letters 93 (2004) 083905-1-4
- Neshev, D., Alexander, T.J., Ostrovskaya, E.A., Kivshar, Y.S., Martin, H.*, Makasyuk, I.* and Chen, Z.*
Observation of Discrete Vortex Solitons in Optically Induced Photonic Lattices
Physical Review Letters 92 (2004) 123903-1-4
- Neshev, D., Sukhorukov, A.A., Kivshar, Y.S. and Krolikowski, W.
Observation of Transverse Instabilities in Optically Induced Lattices
Optics Letters 29 (2004) 259-261
- Neshev, D., Kivshar, Y.S., Martin, H.* and Chen, Z.*
Soliton Stripes in Two-dimensional Nonlinear Photonic Lattices
Optics Letters 29 (2004) 486-488
- Nikolov, N.I.*, Neshev, D., Krolikowski, W., Bang, O.*, Rasmussen, J.J.* and Christiansen, P.I.*
Attraction of Nonlocal Dark Optical Solitons
Optics Letters 29 (2004) 286-288
- Ostrovskaya, E.A. and Kivshar, Y.S.
Localization of Two-component Bose-Einstein Condensates in Optical Lattices
Physical Review Letters 92 (2004) 180405-1-4
- Ostrovskaya, E.A. and Kivshar, Y.S.
Matter-Wave Gap Vortices in Optical Lattices
Physical Review Letters 93 (2004) 160405-1-4
- Ostrovskaya, E.A. and Kivshar, Y.S.
Photonic Crystals for Matter Waves: Bose-Einstein Condensates in Optical Lattices
Optics Express 12 (2004) 19-27
- Pelinovsky, D.E.*, Sukhorukov, A.A. and Kivshar, Y.S.
Bifurcations and Stability of Gap Solitons in Periodic Potentials
Physical Review E 70 (2004) 036618-1-17
- Salgueiro, J.R., Carlsson, A., Ostrovskaya, E.A. and Kivshar, Y.S.
Second-harmonic Generation in Vortex-induced Waveguides
Optics Letters 29 (2004) 593-595
- Salgueiro, J.R. and Kivshar, Y.S.
Single and Double-vortex Vector Solitons in Self-focusing Nonlinear Media
Physical Review E 70 (2004) 156613-1-7
- Shadrivov, I.V. and Kivshar, Y.S.
Bending Waves in a Wrong Way
The Physicist 41 (2004) 137-140
- Shadrivov, I.V., Zharov, N.A., Zharov, N.A. and Kivshar, Y.S.
Defect Modes and Transmission Properties of Left-handed Bandgap Structures
Physical Review E 70 (2004) 046615-1-6
- Shadrivov, I.V.
Nonlinear Guided Waves and Symmetry Breaking in Left-handed Waveguides
Photonics and Nanostructures: Fundamentals and Applications 29 (2004) 175-180
- Shadrivov, I.V., Sukhorukov, A.A., Kivshar, Y.S., Zharov, A.A.*, Boardman, A.* and Egan, P.*
Nonlinear Surface Waves in Left-handed Materials
Physical Review E 69 (2004) 016617-1-9
- Sukhorukov, A.A., Neshev, D., Krolikowski, W. and Kivshar, Y.S.
Nonlinear Bloch-wave Interaction and Bragg Scattering in Optically Induced Lattices
Physical Review Letters 92 (2004) 093901-1-4
- Vicencio, R.*, Molina, M.I.* and Kivshar, Y.S.
Switching of Discrete Optical Solitons in Engineered Waveguide Arrays
Physical Review E 70 (2004) 026602-1-8
- Vincencio, R.A.*, Molina, M.I.* and Kivshar, Y.S.
All-optical Switching and Amplification of Discrete Vector Solitons in Nonlinear Cubic Birefringent Waveguide Arrays
Optics Letters 29 (2004) 2905-2907
- Wang, Q.*, Dong, Y.*, Li, S.*, Duan, L.*, Xu, H.*, Xu, H.*, Chen, R.*, Wu, H.*, Han, J.*, Li, Z.*, Lu, X.*, Zhao, K.*, Liu, J.* and Kun, S.†
*Angular Distribution and Angular Dispersion in Collision of $^{19}\text{F} + ^{27}\text{Al}$ at 114MeV**
Chinese Physics Letters 21 (2004) 1911-1913
- Wang, X., Kivshar, Y.S. and Gu, B.-Y.*
Giant Lamb Shift in Photonic Crystals
Physical Review Letters 93 (2004) 073901-1-4
- Zhou, G.*, Ventura, M.J.*, Straub, M.*, Gu, M.*, Ono, A.*, Kawata, S.*, Wang, X. and Kivshar, Y.S.
In-plane and Out-of-plane Band-gap Properties of a Two-dimensional Triangular Polymer-based Void Channel Photonic Crystal
Applied Physics Letters 84 (2004) 4415-4417

Refereed Conference Proceedings

- Alexander, T.J., Sukhorukov, A.A. and Kivshar, Y.S.
Discrete Vortices: Soliton Clusters with a Nontrivial Phase
Optical Society of America Topical Meetings, Toronto, Canada (2004) TuC48-1-3
- Desyatnikov, A.S., Kivshar, Y.S. and Denz, C.*
Composite Bound States of Self-trapped Laser Beams
ACOFT/AOS '04, Canberra (2004) AOS-P06-1
- Desyatnikov, A.S., Sukhorukov, A.A., Neshev, D., Ostrovskaya, E.A., Martin, H.*, Chen, Z.*, Denz, C.* and Kivshar, Y.S.
Composite Optical Solitons in Self-induced Lattices
CLEO/IQEC 2004, San Francisco, USA (2004) CMT5-1-2
- Desyatnikov, A.S., Sukhorukov, A.A., Ostrovskaya, E.A., Kivshar, Y.S. and Denz, C.*
Dynamic Band-gap Solitons in Nonlinear Optically-induced Lattices
Optical Society of America Topical Meetings, Toronto, Canada (2004) 140-142

- Desyatnikov, A.S., Neshev, D., Kivshar, Y.S., Sagemerten, N.*, Denz, C.* and Kartashov, Y.V.*
Robust Two-dimensional Soliton Lattices in Photorefractive Medium
ACOFT/AOS '04, Canberra (2004) TueMornTea11.45-1-3
- Feise, M.W., Shadrivov, I.V. and Kivshar, Y.S.
Sub-wavelength Imaging with Layered Left-handed Media
ACOFT/AOS '04, Canberra (2004) WedAfter4.15-1
- Feise, M.W., Shadrivov, I.V. and Kivshar, Y.S.
Tunable Transmission in Novel Types of Photonic Crystals Based on Left-handed Metamaterials
PIERS 2004, PISA, Italy (2004) Session 35
- Feise, M.W., Shadrivov, I.V. and Kivshar, Y.S.
Wave Propagation through Left-handed Layered Media
PIERS 2004, PISA, Italy (2004) Session 26B
- Hanna, B., Neshev, D., Sukhorukov, A.A., Krolikowski, W. and Kivshar, Y.S.
Gap Solitons and Mutual Focusing in Nonlinear Periodic Lattices
ACOFT/AOS '04, Canberra (2004) TueMorn9.00-103
- Hanna, B., Neshev, D., Sukhorukov, A.A., Krolikowski, W. and Kivshar, Y.S.
Observation of Multi-gap Vector Solitons
Optical Society of America Topical Meetings, Toronto, Canada (2004) PD6-1-3
- Kivshar, Y.S., Shadrivov, I.V. and Zharov, N.A.
Nonlinear Effects in Left-handed Metamaterials
Complex MediumsV: Light and Complexity, Denver, USA (2004) 138-142
- Kivshar, Y.S.
Optical Vortices and Vortex Solitons
Complex MediumsV: Light and Complexity, Denver, USA (2004) 16-31
- Krolikowski, W., Bang, O.*, Wyller, J. and Edmundson, D.#
Nonlocal Incoherent Solitons
ACOFT/AOS '04, Canberra (2004) WedAfter5.15-1
- Krolikowski, W., Nikolov, N.I.*, Bang, O.*, Neshev, D., Wyller, J.*, Rasmussen, J.J.* and Edmundson, D.#
Optical Beams and Spatial Solitons in Nonlocal Nonlinear Media
CLEO/IQEC 2004, San Francisco, USA (2004) IML3-1-2
- Ku, T.-S.*, Shih, M.-F.* and Kivshar, Y.S.
Coherence-controlled Soliton Interaction
CLEO/IQEC 2004, San Francisco, USA (2004) IMH1
- Neshev, D., Hanna, B., Sukhorukov, A.A., Krolikowski, W. and Kivshar, Y.S.
Gap Solitons and Mutual Focusing in Nonlinear Periodic Lattices
OSA Topical Meetings Nonlinear Optics: Materials, Fundamentals and Applications, Waikoloa, Hawaii (2004) WD1
- Neshev, D., Alexander, T.J., Ostrovskaya, E.A., Kivshar, Y.S., Martin, H.* and Chen, Z.*
Observation of Discrete Vortex Solitons
Optical Society of America Topical Meetings, Toronto, Canada (2004) MA4-1-3
- Neshev, D., Sukhorukov, A.A., Ostrovskaya, E.A., Alexander, T.J., Kivshar, Y.S., Hanna, B., Krolikowski, W., Martin, H.* and Chen, Z.*
Photonics in Optically-induced Lattices
CLEO/IQEC 2004, San Francisco, USA (2004) JTuF6-1-2
- Neshev, D., Kivshar, Y.S., Martin, H.* and Chen, Z.*
Stripe Composite Solitons in Two-dimensional Nonlinear Photonic Lattices
Optical Society of America Topical Meetings, Toronto, Canada (2004) TuC22-1-3
- Nikolov, N.I.*, Neshev, D., Bang, O.*, Krolikowski, W. and Wyller, J.*
A Nonlocal Description of Two-color Parametric Solitons
Optical Society of America Topical Meetings, Toronto, Canada (2004) TuC4-1-3
- Ostrovskaya, E.A. and Kivshar, Y.S.
Matter-wave gap Vortices in Optical Lattices
CLEO/IQEC 2004, San Francisco, USA (2004) IMM3-1-2
- Sagemerten, N.*, Desyatnikov, A.S.*, Denz, C.*, Kartashov, Y.V.*, Neshev, D. and Kivshar, Y.S.
Stable Two-dimensional Nonlinear Periodic Lattices
Optical Society of America Topical Meetings, Toronto, Canada (2004) WB7-1-3
- Salgueiro, J.R., Carlsson, A., Ostrovskaya, E.A. and Kivshar, Y.S.
Second-harmonic Generation in Waveguides Induced by Optical Vortices
Optical Society of America Topical Meetings, Toronto, Canada (2004) MC34-1-3
- Shadrivov, I.V., Kivshar, Y.S., Zharov, A.A.* and Ziolkowski, R.*
Enhancement of the Goos-Hanchen Effect and Temporal Beam Dynamics at the Reflection from Double Negative Metamaterials
2004 URSI EMTS, Pisa, Italy (2004) 96-98
- Shadrivov, I.V., Sukhorukov, A.A. and Kivshar, Y.S.
Nonlinear Guided Waves and Solitons in Left-handed Materials
2004 URSI EMTS, Pisa, Italy (2004) 742-744
- Shadrivov, I.V.
Nonlinear Guided Waves in Negative Refraction Waveguides
CLEO/IQEC 2004, San Francisco, USA (2004) CMX1-1-2
- Shadrivov, I.V., Kivshar, Y.S. and Zharov, A.A.*
Nonlinear Left-handed Metamaterials
2004 URSI EMTS, Pisa, Italy (2004) 385-387
- Shadrivov, I.V., Kivshar, Y.S. and Zharov, A.A.*
Nonlinear Properties of Left-handed Composite Metamaterials
CLEO/IQEC 2004, San Francisco, USA (2004) CMF7-1-2
- Shadrivov, I.V. and Kivshar, Y.S.
Spatial Solitons in Left-handed Metamaterials
CLEO/IQEC 2004, San Francisco, USA (2004) IMD5-1-2
- Shadrivov, I.V., Feise, M.W. and Kivshar, Y.S.
Tunable Transmission in Left-handed Photonic Crystals
5th International Symposium on Photonic and Electromagnetic Crystal Structures V (PECS-V), Kyoto, Japan (2004)200
- Sukhorukov, A.A. and Kivshar, Y.S.
All Optical Switching of Spatial Gap Solitons
CLEO/IQEC 2004, San Francisco, USA (2004) CMX2-1-2
- Sukhorukov, A.A. and Kivshar, Y.S.
Soliton Control in Waveguide Arrays through Bloch-wave Engineering
Optical Society of America Topical Meetings, Toronto, Canada (2004) WB8-1-3
- Vincencio, R.A.*, Molina, M.I.* and Kivshar, Y.S.
Controlled Switching of Discrete Solitons in Arrays of Cubic and Quadratic Nonlinear Optical Waveguides
SPIE - 5th Iberoamerican Meeting on Optics and 8th Latin American Meeting on Optics, Lasers and their Applications, Porlamar, Venezuela (2004) 811-815



Professor George Dracoulis

Nuclear Physics

The Department again 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.

Approximately 54 papers were published in major peer-reviewed journals with five refereed conference papers and numerous contributions to international conferences and workshops, including ten invited papers.

Research highlights reflect the breadth of the research program that extends from basic research in nuclear structure to the varied applications accessible with accelerator mass spectrometry. The basic research carried out using the local facilities has been regularly complemented with the winning of access to major overseas facilities in collaborative proposals led by Department staff. In 2004 they included pioneering experiments carried out at the National Superconducting Cyclotron Laboratory, Michigan State University which yielded the first magnetic moment measurements of very short-lived states in exotic neutron-rich isotopes, results that are a challenge to conventional nuclear models. Broadly related studies exploiting recoil-into-vacuum techniques were carried out at the Holifield Radioactive Ion-beam Facility and all of these new studies have been complemented by experiments using the ANU Facility. Other experiments aimed at the exploitation of radioactive ion-beams included experiments on trans-lead nuclei at the SPIRAL Facility in France and the development of collaborations focusing on heavy-ion fusion with RIKEN in Japan.

Other successful ventures aimed at the study of deformed nuclei near stability and to the neutron-rich side of the stability line have exploited deep-inelastic reactions and Gammasphere at Argonne National Laboratory. These began in 2003 and have since produced a wealth of new information on metastable states. The studies were extended in 2004 using a variety of pulsed-beam conditions provided by the ATLAS accelerator at Argonne. The experiments involved five Department staff and are a central part of an ARC Discovery project.

In 2004 external funding obtained through ARC Discovery grants included an award for the study of climate change using cosmogenic isotopes in glaciers (Tim Barrows), an award to David Hinde and Nanda Dasgupta in collaboration with groups from the UK and Japan for extensive experimental and theoretical studies of the break-up and fusion of weakly-bound nuclei, and an award to Steve Tims and Keith Fifield in collaboration with external groups for the development of the accelerator mass spectrometry of plutonium as a tracer of sediment transport into the Great Barrier Reef Lagoon. As well as these project grants, a proposal led by Keith Fifield to the ARC LIEF program for development of a new generation ultra-sensitive radio-carbon system for multi-institution research on climate, natural resources and ecosystems, was successful. The project involves eight Australian universities and the CSIRO.

This year also saw the first operation of the new superconducting solenoid for fusion studies, SOLITAIRE, conceived by Nanda Dasgupta and David Hinde with the close involvement of local technical staff and ARC support. In parallel, a bid to the ANU Major Equipment committee to develop a novel recoil spectrometer based on SOLITAIRE, for gamma-ray and electron spectroscopy of nuclei far from stability, was successful. This is a project funded initially by an ARC grant to George Dracoulis, Greg Lane and Tibor Kibedi.

Considerable progress was also made in the restructuring of the LINAC accelerator, the implementation of improved computer control, beam improvements including more efficient bunching of pulsed beams and construction of a new ion source. All will contribute to the main thrust of the 2004 LIEF project to develop the capabilities of the "National Heavy Ion Accelerator" which is central to an extensive range of research in basic science, applications and research training.

George Dracoulis was awarded the 2004 Walter Boas medal of the Australian Institute of Physics while Nanda Dasgupta, as the incumbent AIP Women in Physics Lecturer for 2004 gave over twenty lectures around Australia during the year, and numerous radio interviews. Other highlights included the presentation of the 2003 Lyle Medal of the Australian Academy of Science to George Dracoulis at the Annual General Meeting in May 2004, an occasion which also marked the 50th Anniversary of the Academy.

Anna Wilson was promoted to level C and began a three-year joint appointment with the Faculties. Professor Aidan Byrne who also maintains a joint position was appointed as Head of Physics in the Faculties. Nanda Dasgupta was promoted to level D and Keith Fifield to Professor (level E).

Staff List

Professor and Head of Department

George Dracoulis, BSc PhD Melb, FAIP, FAPS, Hon. FRSNZ, FAA

Professors

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

David Hinde, BSc Manc, PhD ANU, FAIP

Senior Fellows

Tezer Esat, MSc Queens, PhD ANU (jointly with Research School of Earth Sciences)

Keith Fifield, MSc Auck, PhD Penn, FAIP

Andrew Stuchbery, BSc PhD Melb, FAIP

Fellows

Mahananda Dasgupta, BSc MSc Rajasthan, PhD Bombay, FAIP

Tibor Kibédi, PhD Debrecen

Research Fellows

Timothy Barrows, BSc, PhD ANU (ARC Fellowship)

Greg Lane, BSc PhD ANU (ARC Fellow)

Clyde Morton, BSc Sydney, PhD ANU (ARC Fellow until May)

Stephen Tims, BSc, PhD Melb

Anna Wilson, BSc Bristol, PhD Liverpool (jointly with Department of Physics, The Faculties)

Ricardo Yanez, BSc PhD Uppsala (from January)

Postdoctoral Fellows

Bertrand Bouriquet, PhD Caen (from August)

Paivi Nieminen, Msc PhD Jyväskylä (from May)

Hiroshi Watanabe, BSc PhD Kyushu (from May)

Visiting Fellows

Jorge Fernández Niello, BSc Buenos Aires, PhD Munich (from November)

Karl-Hugo Maier, PhD Berlin (from March)

John Newton, MA PhD Camb, DSc Manc, FAA (Emeritus Professor)

Ray Spear, PhD, DSc Melb, FAPS, FAIP (Emeritus Professor) (until December)

Heiko Timmers, Dipl. Phys. Munich, PhD ANU (jointly with Electronic Materials Engineering)

Wolf-Dietrich Zeitz, PhD Berlin (from October)

Accelerator Research and Operations Manager

David Weisser, MSc, PhD Minn, FAIP

Engineer

Nikolai Lobanov, BSc Moscow, PhD St Petersburg

Research Officers

Paul Davidson, BSc, MSc Auckland, PhD ANU

Gordon Foote, BSc Lond, PhD ANU

Vladimir Levchenko, MSc PhD St Petersburg

Technical Officers

John Bockwinkel, AssocDipMechEng

Alan Cooper, AssocDipMechEng

Alan Harding

Justin Heighway, AssocDipAppSci

John Kennedy

Lorenzo Lariosa

Scott McLachlan (until March)

Alistair Muirhead

Andrew Rawlinson (from May)

Bob Turkentine

Howard Wallace

Departmental Administrator

Marj O'Neill

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

Books and Book Chapters

Hagino, K.*, Rowley, N.*, Ohtsuki, T.*, Dasgupta, M., Newton, J.O. and Hinde, D.J.

Fusion Dynamics around the Coulomb Barrier in Tours Symposium on Nuclear Physics V, American Institute of Physics, USA (2004) 82-91

Yokoyama, Y.* and Esat, T.M.

Long Term Variations of Uranium Isotopes and Radiocarbon in the Surface Seawater Recorded in Corals in Global Environmental Change in the Oceans and on Land, Terrapub, Japan (2004) 279-309

Publications in Refereed Journals

Alloway, B.V.*, Pribadi, A.*, Westgate, J.A.*, Bird, M.I.*, Fifield, L.K., Hogg, A.* and Smith, I.*

Correspondence between Glass-FT and ¹⁴C Ages of Silicic Pyroclastic Flow Deposits Sourced from Maninjau Caldera, West Central Sumatra
Earth and Planetary Science Letters 227 (2004) 121-133

Barbosa, J.*, Cordeiro, R.C.*, Silva, E.V.*, Turcq, B.*, Gomes, P.R.S.*, dos Santos, G.M., Sifedinne, A.*, Albuquerque, A.L.S.*, Lacerda, L.D.*, Hausladen, P.A., Tims, S.G., Levchenko, V.A. and Fifield, L.K.

¹⁴C-AMS as a Tool for the Investigation of Mercury Deposition at a Remote Amazon Location
Nuclear Instruments and Methods in Physics Research B 223-224 (2004) 528-534

Barker, P.H.*, Barnett, I.C.*, Baxter, G.J.* and Byrne, A.P.

Half-life of the Superalloyed Positron Emitter ¹⁴O
Physical Review C 70 (2004) 024302-1-5

Barrows, T.T., Stone, J.O.* and Fifield, L.K.

Exposure Ages for Pleistocene Periglacial Deposits in Australia
Quaternary Science Reviews 23 (2004) 697-708

Bird, M.I.*, Fifield, L.K., Chua, S.* and Goh, B.*

Calculating Sediment Compaction for Radiocarbon Dating of Intertidal Sediments
Radiocarbon 46 (2004) 421-435

Bird, M.I.*, Chua, S.*, Fifield, L.K., Sa Teh, T.* and Lai, J.*

Evolution of the Sungei Buloh-Kranji Mangrove Coast, Singapore
Applied Geography 24 (2004) 181-198

Bordreault, G.*, Elliman, R.G., Grötzschel, R.*, Gujrathi, S.C.*, Jeynes, C.*, Lennard, W.N.*, Rauhala, E.*, Sajavaara, T.*, Timmers, H., Wang, Y.Q.* and Dall (nee Weijers), T.D.M.†

Round Robin: Measurement of H Implantation Distributions in Si by Elastic Recoil Detection
Nuclear Instruments and Methods in Physics Research B 222 (2004) 547-566

Bostock, H.C.#, Opdyke, B.N.#, Gagan, M.K.# and Fifield, L.K.

Carbon Isotope Evidence for Changes in Antarctic Intermediate Water Circulation and Ocean Ventilation in the Southwest Pacific during the Last Deglaciation
Paleoceanography 19 (2004) PA4013-1-15

Butcher, K.S.A.*, Wintrebert-Fouquet, M.*, Chen, P.*, Tansley, T.L.*, Dou, H.*, Shrestha, S.K.*, Timmers, H.†, Kuball, M.*, Prince, K.E.* and Bradby, J.E.

Nitrogen-rich Indium Nitride
Journal of Applied Physics 95 (2004) 6124-6128

Curtis, N.*, Ashwood, N.I.*, Clarke, N.M.*, Freer, M.*, Metelko, C.J.*, Soi, N.*, Catford, W.N.*, Mahboub, D.*, Pain, S.* and Weisser, D.C.

Angular Correlation Measurements for the α + ⁶He Decay of ¹⁰Be
Physical Review C 70 (2004) 014305-1-5

Dasgupta, M., Gomes, P.R.S.*, Hinde, D.J., Moraes, S.B.*, Anjos, R.M.*, Berriman, A.C., Butt, R.D., Carlin, N.*, Lubian, J.*, Morton, C.R., Newton, J.O. and Santo de Toledo, A.*

Effect of Breakup on the Fusion of ⁶Li, ⁷Li and ⁹Be with Heavy Nuclei
Physical Review C 70 (2004) 024606-1-20

Dasgupta, M. and Hinde, D.J.

Importance of Entrance Channel Dynamics on Heavy Element Formation
Nuclear Physics A 734 (2004) 148-155

Dracoulis, G.D., Kondev, F.G.*, Lane, G.J., Byrne, A.P., Kibédi, T., Ahmed, I.*, Carpenter, M.P.*, Freeman, S.J.*, Janssens, R.V.F.*, Hammond, N.J.*, Lauritsen, T.*, Lister, C.J.*, Mukherjee, G.*, Seweryniak, D.*, Chowdhury, P.*, Tandel, S.K.* and Gramer, R.*

Identification of Yrast High-K Isomers in ¹⁷⁷Lu and Characterisation of ^{177m}Lu

Physics Letters B 584 (2004) 22-30

Dracoulis, G.D., Lane, G.J., Byrne, A.P., Kibédi, T., Baxter, A.M.#, Macchiavelli, A.O.*, Fallon, P.* and Clark, R.M.*

Spectroscopy of ¹⁸⁸Pb_{gs}: Evidence for Shape Co-existence
Physical Review C 69 (2004) 054318-1-22

Elliman, R.G., Timmers, H. and Dall (nee Weijers), T.D.M.†

Hydrogen Detection with a Gas Ionization Elastic Recoil Detector
Nuclear Instruments and Methods in Physics Research B 219-220 (2004) 410-414

Ferraz, K.*, Marques, A.*, Rodriguez, E.*, dos Santos, G.M. and Gomes, P.R.S.*

Use of ¹⁴C-AMS in the Study of Biological Production in Coastal Upwelling Areas
Brazilian Journal of Physics 34 (2004) 732-736

Fifield, L.K., Synal, H.-A.* and Suter, M.*

Accelerator Mass Spectrometry of Plutonium at 300 kV
Nuclear Instruments and Methods in Physics Research B 223-224 (2004) 802-806

Fifield, L.K.

Applications of Accelerator Mass Spectrometry: Advances and Innovation
Nuclear Instruments and Methods in Physics Research B 223-224 (2004) 401-411

Gontchar, I.I., Hinde, D.J., Dasgupta, M. and Newton, J.O.

Double Folding Nucleus-Nucleus Potential Applied to Heavy-ion Fusion Reactions
Physical Review C 69 (2004) 024610-1-14

Greenhalgh, B.J.*, Dillon, G.K.*, Fulton, B.R.*, Watson, D.L.*, Cowin, R.L.*, Freer, M.*, Singer, S.M.*, Chappell, S.P.G.*, Bremner, C.A.*, Rae, W.D.M.* and Weisser, D.C.

Structures in the Excitation Functions of High Lying Inelastic Channels of the O¹⁶ + O¹⁶ System in the Region E_{cm} = 26 to 47 MeV
Physical Review C 69 (2004) 054316-1-8

Hagino, K.*, Dasgupta, M. and Hinde, D.J.

Fusion and Breakup in the Reactions of ^{6,7}Li and ⁹Be
Nuclear Physics A 738 (2004) 475-478

Keutgen, T.*, Cabrera, J.*, El Masri, Y.*, Dufauquez, C., Roberfroid, V.*, Tilquin, I., Ninane, A.*, Van Mol, J.*, Regimbart, R., Charity, R.J.*, Natowitz, J.B.*, Hagel, K.*, Wada, R.* and Hinde, D.J.

Properties of Neutron Emission in Fission Processes Induced by ²⁰Ne + ¹⁵⁹Tb and ²⁰Ne + ¹⁶⁹Tm Reactions Between E=8 and 16 MeV/nucleon
Physical Review C 70 (2004) 014611-1-13

Khalil, A.S., Llewellyn, D.J., Ridgway, M.C., Stewart, A.M., Byrne, A.P. and Chadderton, L.T.

Swift Heavy Ion Irradiation of Single-crystal Indium Phosphide
Microscopy and Microanalysis 10 (2004) 580-581

Kiernan, K.*, Fifield, L.K. and Chappell, J.*

Cosmogenic Nuclide Ages for Last Glacial Maximum Moraine at Schnells Ridge, Southwest Tasmania
Quaternary Research 61 (2004) 335-338

Kondev, F.G.*, Dracoulis, G.D., Lane, G.J., Ahmad, I.*, Byrne, A.P., Carpenter, M.P.*, Chowdhury, S.J.*, Freeman, S.J.*, Hammond, N.J.*, Janssens, R.V.F.*, Kibédi, T., Lauritsen, T.*, Lister, C.J.*, Mukherjee, G.*, Seweryniak, D.* and Tandel, S.K.*

K-Mixing and Fast Decay of a Seven-quasiparticle Isomer in ¹⁷⁹Ta
European Physical Journal A 22 (2004) 23-27

Martin, P.*, Tims, S.G., Ryan, B.* and Bollhöfer, A.*

A Radon and Meteorological Measurement Network for the Alligator Rivers Region, Australia
Journal of Environmental Radioactivity 76 (2004) 35-49

- Morwood, M.J.*, Saejono, R.P.*, Roberts, R.G.*, Sutikna, T.*, Turney, C.S.M.*, Westaway, K.E.*, Rink, W.J.*, Zhao, J.-X.*, van den Bergh, G.D.*, Due, R.A.*, Hobbs, D.R.*, Moore, M.W.*, Bird, M.I.* and Fifield, L.K.
Archaeology and Age of a New Hominin from Flores in Eastern Indonesia
Nature 431 (2004) 1087-1091
- Navin, A.*, Tripathi, V.*, Blumenfeld, Y.*, Nanal, V.*, Simenel, C.*, Casandjijan, J.M.*, de France, G.*, Raabe, R.*, Bazin, D.*, Chatterjee, A.*, Dasgupta, M.*, Kailas, S.*, Lemmon, R.C.*, Mahata, K.*, Pillay, R.G.*, Pollacco, E.C.*, Ramachandran, K.*, Rejmund, M.*, Shrivastava, A.*, Sida, J.L.* and Tryggstad, E.*
Direct and Compound Reactions Induced by Unstable Helium Beams near the Coulomb Barrier
Physical Review C 70 (2004) 044601-1-10
- Newton, J.O., Butt, R.D., Dasgupta, M., Hinde, D.J., Gontchar, I.I., Morton, C.R. and Hagino, K.*
Systematic Failure of the Woods-Saxon Nuclear Potential to Describe Both Fusion and Elastic Scattering: Possible Need for a New Dynamical Approach to Fusion
Physical Review C 70 (2004) 024605-1-15
- Newton, J.O., Butt, R.D., Dasgupta, M., Hinde, D.J., Gontchar, I.I., Morton, C.R. and Hagino, K.*
Systematics of Precise Nuclear Fusion Cross Sections: The Need for a Dynamical Treatment of Fusion?
Physics Letters B 586 (2004) 219-224
- Olivier, S.*, Bajo, S.*, Fifield, L.K., Gaggeler, H.W.*, Papina, T.*, Santschi, P.H.*, Schotterer, U.*, Schwikowski, M.* and Wacker, L.
Plutonium from Global Fallout Recorded in an Ice Core from the Belukha Glacier, Siberian Altai
Environmental Science and Technology 38 (2004) 6507-6512
- Olley, J.M.*, De Deckker, P.*, Roberts, R.G.*, Fifield, L.K., Yoshida, H.* and Hancock, G.J.*
Optical Dating of Deep-sea Sediments using Single Grains of Quartz: A Comparison with Radiocarbon
Sedimentary Geology 169 (2004) 175-189
- Olliver, H.*, Glasmacher, T.* and Stuchbery, A.E.
 α - α Angular Correlations from Reactions with Intermediate-energy Beams
Physical Review C 69 (2004) 024301-1-6
- Oughton, D.H.*, Skipperud, L.*, Fifield, L.K., Cresswell, R.G., Salbu, B.* and Day, P.*
Accelerator Mass Spectrometry Measurement of $^{240}\text{Pu}/^{239}\text{Pu}$ Isotope Ratios in Novaya Zemlya and Kara Sea Sediments
Applied Radiation and Isotopes 61 (2004) 249-253
- Scholes, D.*, Cullen, D.*, Kondev, F.G.*, Janssens, R.V.F.*, Carpenter, M.P.*, Hartley, D.*, Djongolov, M.*, Sletten, G.*, Hagemann, G.*, Wheldon, C.*, Walker, P.*, Abu Saleem, K.*, Ahmed, I.*, Balabanski, D.*, Chowdhury, P.*, Danchev, M.*, Dracoulis, G.D., El-Masri, H.*, Goon, J.*, Heinz, A.*, Kaye, R.*, Khoo, T.*, Lauritsen, T.*, Lister, C.J.*, Moore, E.*, Riedinger, L.*, Riley, M.*, Seweryniak, D.*, Shestakova, I.*, Wiedenhover, I.*, Zeidan, O.* and Zhang, J.*
Highly-deformed Bands in ^{175}Hf
Physical Review C 70 (2004) 054314-1-8
- Shrestha, S.K.*, Timmers, H.†, Butcher, K.S.A.* and Wintrebert-Fouquet, M.*
Accurate Stoichiometric Analysis of Polycrystalline Indium Nitride Films with Elastic Recoil Detection
Current Applied Physics 4 (2004) 237-240
- Shrestha, S.K.*, Butcher, K.S.A.*, Wintrebert-Fouquet, M.* and Timmers, H.†
Reliable ERD Analysis of Group-III Nitrides Despite Severe Nitrogen Depletion
Nuclear Instruments and Methods in Physics Research B 219-20 (2004) 686-692
- Skipperud, L.*, Oughton, D.H.*, Fifield, L.K., Lind, O.C.*, Tims, S.G., Brown, J.* and Sickel, M.*
Plutonium Isotope Ratios in the Yenisey and Ob Estuaries
Applied Radiation and Isotopes 60 (2004) 589-593
- Soic, N.*, Freer, M.*, Donadille, L.*, Clarke, N.M.*, Leask, P.J.*, Catford, W.N.*, Jones, K.L.*, Mahboub, D.*, Fulton, B.R.*, Greenhalgh, B.J.*, Watson, D.L.* and Weisser, D.C.
-decay of Excited States in C-11 and B-11
Nuclear Physics A 742 (2004) 271-290
- Stone, J.O.*, Fifield, L.K., Beer, J.*, Vonmoos, M.*, Obrist, C.*, Grajcar, M.*, Kubik, P.*, Muscheler, R.*, Finkel, R.* and Caffee, M.*
Co-Precipitated Silver-metal Oxide Aggregates for Accelerator Mass Spectrometry of ^{10}Be and ^{26}Al
Nuclear Instruments and Methods in Physics Research B 223-224 (2004) 272-277
- Stuchbery, A.E.
Transient-field Strengths for High-velocity Light Ions and Applications to g-factor Measurements on Fast Exotic Beams
Physical Review C 69 (2004) 064311-1-5
- Timmers, H.*, Shrestha, S.K.* and Byrne, A.P.
The Potential of Ion Beam Techniques for the Development of Indium Nitride
Journal of Crystal Growth 269 (2004) 50-58
- Tims, S.G., Hancock, G.J.*, Wacker, L. and Fifield, L.K.
Measurements of Pu and Ra Isotopes in Soils and Sediments by AMS Nuclear Instruments and Methods in Physics Research B 223-224 (2004) 796-801
- Turney, C.S.M.*, Kershaw, A.P.*, Clemens, S.C.*, Branch, N.*, Moss, P.T.* and Fifield, L.K.
Millennial and Orbital Variations of El Niño/Southern Oscillation and High-latitude Climate in the Last Glacial Period
Nature 428 (2004) 306-310
- Vyvey, K.-H., Dracoulis, G.D., Wilson, A.N., Davidson, P.M., Stuchbery, A.E., Lane, G.J., Byrne, A.P. and Kibédi, T.
g-factors of the 9^- and the 11^- Isomers in ^{194}Pb and ^{196}Pb ; Configuration Mixing and Deformation
Physical Review C 69 (2004) 064318-1-8
- Wacker, L., Fifield, L.K. and Tims, S.G.
Developments in AMS of ^{99}Tc
Nuclear Instruments and Methods in Physics Research B 223-224 (2004) 185-189
- Wheldon, C.*, Stuchbery, A.E., Wilson, A.N., Dracoulis, G.D., Bruce, A.M.*, Bark, R.A., Byrne, A.P., Prados-Estevéz, F.M.*, Lane, G.J., Moon, C.-B., Orce, J.N.* and Wood, R.*
Electromagnetic Properties of Pseudo-Nilsson Bands in ^{185}Os
European Physical Journal A 19 (2004) 319-325
- Wilson, A.N. and Davidson, P.M.
Decay-out from Low-lying Superdeformed Bands in Pb Isotopes: Tunneling Widths in a Two-level Mixing Model
Physical Review C 69 (2004) 041303-1-5(R)
- Wischusen, J.D.*, Fifield, L.K. and Cresswell, R.G.
Hydrogeology of Palm Valley, Central Australia; a Pleistocene Flora Refuge?
Journal of Hydrology 293 (2004) 20-46
- Woolliscroft, R.J.*, Fulton, B.R.*, Cowin, R.L.*, Dasgupta, M., Hinde, D.J., Morton, C.R. and Berriman, A.C.
Elastic Scattering and Fusion of $^9\text{Be} + ^{208}\text{Pb}$: Density Function Dependence of the Double-folding Renormalisation
Physical Review C 69 (2004) 044612-1-7

Refereed Conference Proceedings

- Dasgupta, M., Hinde, D.J., Newton, J.O. and Hagino, K.*
The Nuclear Potential in Heavy-ion Fusion
FUSION03: From a Tunneling Nuclear Microscope to Nuclear Processes in Matter, Matsushima, Japan (2004) 209-216
- Hinde, D.J. and Dasgupta, M.
Three Steps to Fusion: What Are the Questions? Where Are the Answers?
FUSION03: From a Tunneling Nuclear Microscope to Nuclear Processes in Matter, Matsushima, Japan (2004) 1-10
- Khalil, A.S., Stewart, A.M., Ridgway, M.C., Chadderton, L.T., Llewellyn, D.J. and Byrne, A.P.
Formation of Ion Tracks in Single-crystal Indium Phosphide Irradiated by Swift Heavy Ions
28th Annual Condensed Matter and Materials Meeting, Wagga Wagga, (2004) WP40-1-3
- Lenahan, M.J.*, Kirste, D.M.*, McPhail, D.C.* and Fifield, L.K.
Hydrogeochemical Controls of Variable Regolith Materials on the Distribution, Mobility and Age of Salts: Barmedman Creek Catchment, NSW
Regolith 2004, Adelaide, Perth and Canberra (2004) 209-214
- Wilson, A.N.
Decay-out Probabilities of Superdeformed Bands in Statistical and Two-level Mixing Models
FUSION03: From a Tunneling Nuclear Microscope to Nuclear Processes in Matter, Matsushima, Japan (2004) 138-145



Optical Sciences Group

Our small Group undertook a rather eclectic range of research activities within guided wave photonics. On the theoretical side, a new compact purely geometrical planar device was devised and quantified for the multiplexing and de-multiplexing of well-separated wavelength channels in optical communications systems, and photonic band-gap structures were also investigated for their wavelength splitting properties. Tapered holey fibres were analysed for potential application in scanning near-field optical microscopy (SNOM). The complex Ginzburg-Landau equations were solved for a range of non-linear problems pertaining to dissipative solitons, chaotic solitons when viewed as strange attractors, and solitons with stationary to pulsating behaviour.

Experimental research included a number of improvements to the uniformity of the geometry and material quality of silica-based planar waveguides fabricated using the HARE system in the Space Plasma and Plasma Processing Group. Measurement of bend loss for a range of different single-mode optical fibres in various configurations will enable comparison to be made with theoretical strategies for the minimisation of this loss. A taper rig was established for the fabrication of novel compact fibre-based optical devices using the heating and drawing of fibres.

Staff List

Professors

John Love, MA Camb, MA DPhil DSc Oxf
Nail Akhmediev, DSc USSR Acad Sci

Fellows

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

Postdoctoral Fellow

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

Visiting Fellows

Satis Arnold, BSc MSc UNSW (Techne Pty Ltd)
Martin Elias (ADC Australia Pty Ltd)
Andrew Stevenson, BSc PhD ANU (Photonics Institute)
Snjezana Tomljenovic-Hanic, PhD ANU

Departmental Administrators

Wendy Quinn, BA ANU (until September)
Trina Merrell (part-time from September)

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

Books and Book Chapters

Akhmediev, N.N., Soto-Crespo, J.M.* and Ankiewicz, A.
Solitons as Strange Attractors
in **Nonlinear Waves: Classical and Quantum Aspects**, Kluwer
Academic Publishers, Netherlands (2004) 45-60

Publications in Refereed Journals

Akhmediev, N.N. and Soto-Crespo, J.M.*
Strongly Asymmetric Soliton Explosions
Physical Review E 70 (2004) 036613-1-8

Bulla, D.A.P.†, Li, W.T., Charles, C., Boswell, R., Ankiewicz, A. and Love, J.D.
Deposition and Characterization of Silica-based Films by Helicon-activated Reactive Evaporation Applied to Optical Waveguide Fabrication
Applied Optics 43 (2004) 2978 -2985

Dong, Y.*, Wang, Q.*, Li, S.*, Duan, L.*, Wu, H.*, Xu, H.*, Chen, R.*, Xu, H.*, Han, J.*, Li, Z.*, Lu, X.*, Zhao, K.*, Zhou, P.*, Liu, J.* and Kun, S.†
Angular Distribution of Products in Deep Inelastic Collision of $^{19}\text{F} + ^{27}\text{Al}$
Nuclear Physics Review 21 (2004) 387-389

Grelu, P.* and Akhmediev, N.N.
Group Interactions of Dissipative Solitons in a Laser Cavity: The Case of 2+1
Optics Express 12 (2004) 3184-3189

Kanna, T., Tsoy, E. and Akhmediev, N.N.
On the Solution of Multicomponent Nonlinear Schrödinger Equations
Physics Letters A 330 (2004) 224-229

Khalil, A.S., Llewellyn, D.J., Ridgway, M.C., Stewart, A.M., Byrne, A.P. and Chadderton, L.T.
Swift Heavy Ion Irradiation of Single-crystal Indium Phosphide Microscopy and Microanalysis 10 (2004) 580-581

Maddess, T.†, Nagai, Y.*, James, A.C.† and Ankiewicz, A.
Binary and Ternary Textures Containing Higher-order Spatial Correlations
Vision Research 44 (2004) 1093-1113

Pace, P.*, Huntington, S.T.*, Lyytikäinen, K.*, Roberts, A.* and Love, J.D.
Refractive Index Profiles of Ge-doped Optical Fibers with Nanometer Spatial Resolution using Atomic Force Microscopy
Optics Express 12 (2004) 1452-1457

Soto-Crespo, J.M.*, Grapinet, M.*, Grelu, P.* and Akhmediev, N.N.
Bifurcations and Multiple-period Soliton Pulsations in a Passively Mode-locked Fiber Laser
Physical Review E 70 (2004) 066612-1-11

Tomljenovic-Hanic, S. and Ankiewicz, A.
Wavelength Splitting in Photonic Band-gap Structures with Multiple Defects
Optics Communications 237 (2004) 351-355

Wang, Q.*, Dong, Y.*, Li, S.*, Duan, L.*, Xu, H.*, Xu, H.*, Chen, R.*, Wu, H.*, Han, J.*, Li, Z.*, Lu, X.*, Zhao, K.*, Liu, J.* and Kun, S.†
*Angular Distribution and Angular Dispersion in Collision of $^{19}\text{F} + ^{27}\text{Al}$ at 114MeV**
Chinese Physics Letters 21 (2004) 1911

Refereed Conference Proceedings

Akhmediev, N.N., Soto-Crespo, J.M.* and Ankiewicz, A.
Chaotic Dissipative Solitons as Strange Attractors
Optical Society of America Topical Meetings, Toronto, Canada (2004) MD7-1-3

Akhmediev, N.N., Soto-Crespo, J.M.* and Dobson, B.
Directional Explosions of Solitons Produced by Passively Mode-locked Lasers
ACOFT/AOS '04, Canberra (2004) MonMorn10.45-1-3

Bulla, D.A.P.†, Li, W.T., Charles, C., Boswell, R. and Love, J.D.
OH Absorption Peak on Silica Planar Waveguide Deposited by HARE-PECVD
ACOFT/AOS '04, Canberra (2004) ACOFT-PO4-1-3

Gibson, B.C.*, Love, J.D. and Cahill, L.*
Thin-film Palladium Coatings on Single-mode Fibre Tapers
ACOFT/AOS '04, Canberra (2004) ACOFT-PO15-1-3

Huntington, S.T.*, Jarvis, S.P.*, Lewis, A.*, Canning, J.*, Praver, S.*, Love, J.D., Gibson, B.C.* and Lyytikäinen, K.-I.*
Topographical and Optical Enhancement of NSOM Probes
ACOFT/AOS '04, Canberra (2004) TuesMorn10.00-1-3

Khalil, A.S., Stewart, A.M., Ridgway, M.C., Chadderton, L.T., Llewellyn, D.J. and Byrne, A.P.
Formation of Ion Tracks in Single-crystal Indium Phosphide Irradiated by Swift Heavy Ions
28th Annual Condensed Matter and Materials Meeting, Wagga Wagga (2004) WP40-1-3

Li, W.T., Bulla, D.A.P.†, Love, J.D., Luther-Davies, B., Charles, C. and Boswell, R.
Dry Etching of SiO_2 Thin Films for Optical Waveguide Fabrication
ACOFT/AOS '04, Canberra (2004) ACOFT-PO19-1-3

Love, J.D.
Modal Adiabaticity in Optical Fibres: Waveguides & Devices
Advances and Trends in Fiber Optics and Applications, Chongqing, China (2004) 23-29

Love, J.D. and Gibson, B.C.*
Single Material Slab Waveguides
ACOFT/AOS '04, Canberra (2004) TueAft5.30-1-3

Maruno, K.*, Ankiewicz, A. and Akhmediev, N.N.
Discrete Dissipative Solitons
Optical Society of America Topical Meetings, Toronto, Canada (2004) TuC29-1-3

Maruno, K.*, Ankiewicz, A. and Akhmediev, N.N.
Dissipative Solitons in the Discrete Complex Ginzburg-Landau Model
2004 International Symposium on Nonlinear Theory and its Applications, Fukuoka, Japan (2004) We1-D2-1-4

Maruno, K., Ankiewicz, A. and Akhmediev, N.N.
Nonlinearly Nonlocal Discrete Complex Quintic Ginzburg-Landau Equation - Selected Solutions
ACOFT/AOS '04, Canberra (2004) ACOFT-PO1-1-3

Soto-Crespo, J.M.* and Akhmediev, N.N.
Multiple Solitons in Systems Governed by the Swift-Hohenberg Equation
Optical Society of America Topical Meetings, Toronto, Canada (2004) MC14-1-3

Tomljenovic-Hanic, S. and Ankiewicz, A.
Coupling between Multiple Defects in Photonic Band Gap Structures with Variable Defect Parameters
ACOFT/AOS '04, Canberra (2004) ACOFT-PO30-1-3

Tomljenovic-Hanic, S. and Ankiewicz, A.
Multiple Defects in Photonic Band Gap Structures with Variable Defect Parameters
6th International Conference on Transparent Optical Networks: ICTON 2004, Warswa, Poland (2004) 105-108



Plasma Research Laboratory

The Laboratory's research is in three main areas: magnetically confined plasma physics, space plasma and plasma processing (SP3), and aspects of communications, organised as several pursuits, and attracts over \$1M per year in external funding, from the ARC, DEST and ACT research grants, Euratom and international and industrial contracts.

The H-1 Major National Research Facility is the focus of basic research on magnetically confined plasma, important in developing fusion energy, which powers the Sun. The innovative plasma geometry of the H-1 heliac allows exploration of ideas for improved design of the fusion power stations that will follow the ITER international fusion experiment.

Automation of H-1 has enabled detailed scans of magnetic configurations (shapes) and fundamental plasma properties by Boyd Blackwell, Jeffrey Harris and colleagues. The vast quantity of data is being explored by data mining techniques. Related plasma shape modification has suppressed some plasma instabilities in a collaborative experiment on the DIII-D tokamak in the USA.

The Advanced Imaging and Inverse Methods Group led by John Howard has expanded the development of novel multi-spectral imaging systems with two provisional patents on instruments suitable for industrial pyrometry and for fast high-resolution spectroscopic imaging. Several cameras have been sold overseas. With the recent graduation of three PhD scholars, the Group also maintains a major focus on plasma physics and various problems in tomography and remote sensing.

Ground-breaking experimental studies of plasma turbulence in the heliac by Michael Shats and his colleagues demonstrated the role of zonal flows, spectral energy transfer and self-organisation in regulating the outward transport of particles and achieving enhanced plasma confinement.

The SP3 Group, led by Rod Boswell and Christine Charles, conducts work on both basic and applied plasma physics. Recent discovery of current-free double layers has led to a DEST contract with the CRC for Satellite Systems and AUSPACE Pty Ltd to construct a plasma spacecraft thruster prototype to be tested by the European Space Agency early in 2004, and featured in the ABC program "Catalyst". Optimisation of the bright plasma source for the FEI Company is proceeding well and employs two post-doctoral fellows. The Group was awarded a large ARC grant to develop hydrogen powered fuel cells and another to investigate non-linear phenomena in optical thin films which complements the work on thin film stress. Excellent results have been obtained in the basic science area: in protein mobility, non-linear wave plasma interaction (auroral physics, electric double layers), plasma detachment from spacecraft and computer simulation.

The BushLAN radiofrequency network communications pursuit, led by Gerard Borg, has joined Standard Communications of Sydney in an ARC linkage project to develop a UHF BushLAN device providing Internet connectivity at ranges up to 50 km. A custom communication (MAC) protocol allows instantaneous sharing of frequency spectrum from 520 – 820 MHz. The original VHF BushLAN system has demonstrated a 26 km "Voice over IP" link for HiBiS in collaboration with YLESS4U Pty Ltd of Bywong.

Staff List

Professor and Head of Department

Jeffrey Harris, MS MIT, PhD Wisc, FAPS, FAIP

Professor

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

Senior Fellows

Boyd Blackwell, BSc PhD Syd

John Howard, BSc (Hons) PhD Syd, FlinstP

Michael Shats, MSc Kiev Poly Inst, PhD Gen Phys Inst Mosc

Fellow

Gerard Borg, BSc PhD Syd

Christine Charles, Ingénieur INSA Rennes, PhD Orléans (jointly with APCRC)

Post-doctoral Fellows

Ane Aanesland, MSc PhD, Tromso

Douglas Bulla, MSc PhD USP Brazil (jointly with APCRC)

Wei Tang Li, MSc China, PhD Syd (jointly with APCRC)

Adjunct Fellows

Mr Scott Collis, BSc Syd,

Mr Fenton Glass, BSc Qld

Mr Clive Michael, BSc

Mr Horst Punzmann, BSc Polytech Regensburg

Ms Hua Xia, Msc Chongqing University, China

Visiting Fellows

Joe Baker, MSc PhD Qld, OBE, FTSE

Marcela Bilek, Bsc Syd, PhD Camb

Andrew Cheetham, BSc PhD Flinders

Roger Gammon, Btech PhD Brunel, FlinstP, Cphys, MIE Aust, CP Eng, FAIE, FAIM

Sydney Hamberger, PhD DSc Lond, FAIP (Emeritus Professor)

Mike Lieberman, PhD Elect Eng, Berkeley

Dennis Mather, BSc PhD UNSW, Dip Ed STC

John O'Connor, BSc PhD DSc

Anthony Sproule, ME UT Syd, GradDipOR NSW IT

Robin G. Storer, Bsc PhD Flinders

Head Technical Officer

Clinton Davies

Senior Technical Officers

Peter Alexander

Ray Kimlin

John Wach, BAppSci CAE Ball, GradDipEI CCAE

Technical Officer

Costanzo Costa

Departmental Administrator

Helen Hawes, BA

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. and Fredriksen, A.*
Helicon Plasma with Additional Immersed Antenna
Journal of Physics D 37 (2004) 1334-41

Boswell, R., Sutherland, O., Charles, C., Squire, J.P.*, Diaz, F.R.*, Glover, T.W.*, Jacobson, V.T.*, Chavers, D.G.*, Bengtson, R.D.*, Bering, E.A.*, Goulding, R.H.* and Light, M.*
Experimental Evidence of Parametric Decay Processes in the Variable Specific Impulse Magnetoplasma Rocket (VASIMR) Helicon Plasma Source
Physics of Plasmas 11 (2004) 5125-9

Braut, P.*, Caillard, A.*, Thomann, A.L.*, Mathias, J.*, Charles, C., Boswell, R., Escribano, S.*, Durand, J.* and Sauvage, T.*
Plasma Sputtering Deposition of Platinum into Porous Fuel Cell Electrodes
Journal of Physics D 37 (2004) 3419-23

Bulla, D.A.P.†, Li, W.T., Charles, C., Boswell, R., Ankiewicz, A. and Love, J.D.
Deposition and Characterization of Silica-based Films by Helicon-activated Reactive Evaporation Applied to Optical Waveguide Fabrication
Applied Optics 43 (2004) 2978-2985

Charles, C.
Hydrogen Ion Beam Generated by a Current-free Double Layer in a Helicon Plasma
Applied Physics Letters 84 (2004) 332-4

Charles, C. and Boswell, R.
Laboratory Evidence of a Supersonic Ion Beam Generated by a Current-free Helicon Double-layer
Physics of Plasmas 11 (2004) 1706-14

Charles, C. and Boswell, R.
Time Development of a Current-free Double-layer
Physics of Plasmas 11 (2004) 3808-3812

Corr, C.S.*, Plihon, N.*, Chabert, P.*, Sutherland, O. and Boswell, R.
Spatially Limited Ion Acoustic Wave Activity in Low-pressure Helicon Discharges
Physics of Plasmas 11 (2004) 4596-4602

Degeling, A.W.*, Borg, G.G. and Boswell, R.
Transitions from Electrostatic to Electromagnetic Whistler Wave Excitation
Physics of Plasmas 11 (2004) 2144-55

Evans, T.E.*, Moyer, R.A.*, Thomas, P.R.*, Watkins, J.G.*, Osborne, T.H.*, Boedo, J.A.*, Doyle, E.J.*, Fenstermacher, M.E.*, Finken, K.H.*, Groebner, R.J.*, Groth, M.*, Harris, J.H., La Haye, R.J.*, Lasnier, C.J.*, Masuzaki, S.*, Ohyabu, N.*, Pretty, D.G., Rhodes, T.L.*, Reimerdes, H.*, Rudakov, D.L.*, Schaffer, M.J.*, Wang, G.* and Zeng, L.*

Suppression of Large Edge-localized Modes in High-confinement DIII-D Plasmas with a Stochastic Magnetic Boundary

Physical Review Letters 92 (2004) 235003

Harris, J.H., Shats, M.G., Blackwell, B.D., Solomon, W.M., Pretty, D.G., Collis, S.M., Howard, J., Xia, H., Michael, C.A. and Punzmann, H.

Fluctuations and Stability of Plasmas in the H-INF Heliac

Nuclear Fusion 44 (2004) 279-286

Harris, J.H.

Small-to-midsized Stellarator Experiments: Topology, Confinement and Turbulence

Plasma Physics and Controlled Fusion 46 (2004) B77-B90

Li, W.T., Charters, R.B., Mar, L.* and Luther-Davies, B.

Significant Improvement of Adhesion between Gold Thin Films and a Polymer

Applied Optics 43 (2004) 2978

Michael, C.A. and Howard, J.

Determination of Electron Temperature from Spectral Line Intensity Decay for Radiation Dominated Plasmas

Review of Scientific Instruments 75 (2004) 4180-82

Michael, C.A., Howard, J. and Blackwell, B.D.

Measurements and Modeling of Ion and Neutral Distribution Functions in a Partially Ionized Magnetically Confined Argon Plasma

Physics of Plasmas 11 (2004) 4008-17

Punzmann, H. and Shats, M.G.

Formation and Structure of Transport Barriers during Confinement Transitions in Toroidal Plasma

Physical Review Letters 93 (2004) 125003-1-4

Shats, M.G., Xia, H., Punzmann, H. and Solomon, W.M.

Spectral Energy Transfer, Generation of Zonal Flows and their Role in Confinement Transitions

Fusion Science and Technology 46 (2004) 279-87

Sutherland, O., Boswell, R., Keller, J. and Irzyk, M.

Comparison between Experiment and Two Simulation Strategies for the Extraction of Focused Ion Beams

Review of Scientific Instruments 75 (2004) 2379-86

Xia, H. and Shats, M.G.

Spectral Energy Transfer and Generation of Turbulent Structures in Toroidal Plasma

Physics of Plasmas 11 (2004) 561-571

Yamada, H.*, Ida, K.*, Murakami, S.*, Watanabe, K.Y.*, Ascasibar, E.*, Brakel, R.*, Dinklage, A.*, Harris, J.H., Okamura, S.*, Sano, F.*, Stroth, U.*, Inagaki, S.*, Tanaka, K.*, Goto, M.*, Nishimura, K.*, Narihara, K.*, Morita, S.*, Sakakibara, S.*, Peterson, B.J.*, Sakamoto, R.*, Miyazawa, J.*, Morisaki, T.*, Osakabe, M.*, Toi, K.*, Tamura, N.*, Ikeda, K.*, Yamazaki, K.*, Kawahata, K.*, Kaneko, O.*, Ohyabu, N.*, Komori, A.* and Motojima, O.*

Configuration Effect on Energy Confinement and Local Transport in LHD and Contribution to the International Stellarator Database

Fusion Science and Technology 46 (2004) 82-90

Yin, Y.*, Bilek, M.M.*, McKenzie, D.R.*, Boswell, R. and Charles, C.

Micro-arcing Instability in Radio Frequency Plasmas

Journal of Physics D 37 (2004) 2871-2875

Refereed Conference Proceedings

Bulla, D.A.P.[†], Li, W.T., Charles, C., Boswell, R. and Love, J.D.
OH Absorption Peak on Silica Planar Waveguide Deposited by HARE-PECVD

ACOFT/AOS '04, Canberra, (2004) ACOFT-P04-1-3

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

Dry Etching of SiO₂ Thin Films for Optical Waveguide Fabrication

ACOFT/AOS '04, Canberra, (2004) ACOFT-P019-1-3

Punzmann, H. and Shats, M.G.

Cellular Automata Model in Particle Transport Studies in Magnetized Plasma

The 7th Asia-Pacific Complex Systems Conference, Complex 2004, Queensland, (2004) pp 8

Patent

Howard, J.

MOSS Coherence Imaging System

US Patent No US 6462826



Professor Vladimir Bazhanov

Theoretical Physics

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

Research highlights for 2004 include new three-dimensional integrable models; the investigation of conduction mechanisms of chloride ions in CIC-type ion channels; clarification of the shot noise in quantum point contact; the calculation of thermal and magnetic properties of spin-1 chains and their application to experimental compounds; a comprehensive review of the physics of the one-dimensional Kondo model; and the investigation of quantum chaos theory in toroidal plasmas.

The Department continued its strong success in competitive funding, with nearly \$1.1M held for 2004 in external grants and fellowships. Robert Dewar received \$1.5M in funding over five years as Network Convenor for the ARC Research Network on Complex Open Systems. Success was also obtained with a Linkage International award to Murray Batchelor for research collaboration with the University of Tokyo.

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

Staff List

Professor and Head of Department

Vladimir Bazhanov, PhD Serpukhov

Professors

Murray Batchelor, BSc UNSW, PhD ANU, FAIP, FaustMS, FlntP, (ARC Fellow) (jointly with Mathematical Sciences Institute)

Robert Dewar, MSc Melb, PhD Princ, FAIP, FAPS, FAA

Senior Fellows

Shin-Ho Chung, PhD Harv

Mukunda Das, MSc Utkal, PhD Roorkee, FAIP, CPhys.FlnstP

Miklos Gulacsi, BSc MSc Cluj, PhM PhD Trieste

Anatoli Kheifets, Msc PhD St Petersburg (jointly with Atomic and Molecular Physics Laboratories)

Serdar Kuyucak, BSc Ankara, PhD Yale (until January)

Fellows

Wen Xu, BSc, MSc, PhD Antwerp

Research Fellows

Rowena Ball, BSc, PhD Macquarie (ARC Fellow)

Xi-Wen Guan, BSc Qufu, MSc Sichuan, PhD Jilin (jointly with Mathematical Sciences Institute)

Sergei Sergeev, MSc Moscow, PhD Serpukhov, 2nd PhD St Petersburg

Post-doctoral Fellows

Matthew Hoyles, BSc ANU
 Igor Ivanov BSc Moscow IPT, PhD RAS (ARC Fellow)
 (jointly with Atomic and Molecular Physics Laboratories)
 (from July)
 Ryusuke Numata BSc MSc PhD Tokyo (from September)
 Megan O'Mara BSc UCan PhD ANU (from October)

ARC Linkage International Fellow

Benedicte Ponsot MIP Paris6-Ulm, Phd Montpellier 2
 (from April)

Visiting Fellows

Fred Barker, MSc Melb, PhD Birm (Emeritus Professor)
 Kevin Bryant, BSc Adel, MSc, PhD ANU
 Conrad Burden, BSc Qld, PhD ANU
 Jorgen Frederiksen, BSc DSc Adel, PhD ANU
 Michael Hall, MSc PhD ANU
 Xi Li, BSc Fudan (from December)S
 Li-Bin Lin, BSc Chengdu (Professor)
 Brian Kenny, BA, BSc MSc (Hons) Melb, PhD Chicago, FAIP
 Kailash Kumar, BSc Agra, MSc Aild, PhD McM, FAIP
 Sergei Kun, MS PhD Kiev
 Jinlan Nie, BSc Chengdu
 Ryusuke Numata, BSc MSc PhD UTokyo
 Ravi Rau, BSc MSc Delhi, PhD Chicago (Professor)
 Brian Robson, MSc PhD DSc Melb, FAIP
 Robert Robson, BSc Qld, DipMet, PhD, FRMS, FAPS, FAIP
 (jointly with Atomic and Molecular Physics Laboratories)
 Susan Scott, BSc Monash, PhD Adel
 Michael Simpson, BSc Adel, PhD Newcastle
 Irina Talanina, MSc PhD GPI Moscow
 Lindsay Tassie, MSc PhD Melb, FAIP
 William Woolcock, BSc Qld, PhD Camb, FAIP
 Dingwang Yuan, BSc Hunan

Departmental Administrator

Mrs Trina Merrell (part time)

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

Books and Book Chapters

Xu, W. and Das, M.P.
Coupled Plasmon-phonon Modes in a Two-dimensional Electron Gas in Presence of Spin Orbit Interaction in Phonons in Condensed Materials, Allied Publishers Pvt Limited, India (2004) 24-31

Publications in Refereed Journals

Ball, R., McIntosh, A.C.* and Brindley, J.*
Feedback Process in Cellulose Thermal Decomposition: Implications for Fire-retarding Strategies and Treatment Combustion Theory and Modelling 8 (2004) 281-291

Barker, F.C.
Level Widths in ^9He and ^{10}He
Nuclear Physics A 741 (2004) 42-51

Barker, F.C.
T=3/2 Levels in A=11 Nuclei
Physical Review C 69 (2004) 024310-1-7

Batchelor, M.T., Burne, R.V.#, Henry, B.I.* and Jackson, M.J.*
A Case for Biotic Morphogenesis of Coniform Stromatolites
Physica A 337 (2004) 319-326

Batchelor, M.T., Guan, X.-W. and McGuire, J.B.*
Ground State of 1D Bosons with Delta Interaction: Link to the BCS Model
Journal of Physics A 37 (2004) L497-L504

Batchelor, M.T., Guan, X., Oelkers, N. and Ying, Z.J.*
Quantum Phase Diagram of an Exactly Solved Mixed Spin Ladder
Journal of Statistical Physics 116 (2004) 571 - 589

Batchelor, M.T., Guan, X., Oelkers, N. and Foerster, A.*
Thermal and Magnetic Properties of Integrable Spin-1 and Spin-3/2 Chains with Applications to Real Compounds
Journal of Statistical Mechanics 4 (2004) 10017-1-37

Batchelor, M.T., Guan, X.-W. and Oelkers, N.
Thermal and Magnetic Properties of Spin-1 Magnetic Chain Compounds with Large Single-ion and In-plane Anisotropies
Physical Review B 70 (2004) 184408-1-16

Chan, R. and Gulacsi, M.
The Exact Schrieffer-Wolff Transformation
Philosophical Magazine 84 (2004) 1265-1279

Corry, B., O'Mara, M. and Chung, S.-H.
Conduction Mechanisms of Chloride Ions in CIC-type Channels
Biophysical Journal 86 (2004) 846-860

Corry, B., O'Mara, M. and Chung, S.-H.
Permeation Dynamics of Chloride Ions in the CIC-0 and CIC-1 Channels
Chemical Physics Letters 386 (2004) 233-238

Dewar, R.L., Tatsuno, T.*, Yoshida, Z.*, Nührenberg, C.* and McMillan, B.F.
Statistical Characterization of the Interchange-instability Spectrum of a Separable Ideal-magnetohydrodynamic Model System
Physical Review E 70 (2004) 066409 (11)

Dong, Y.*, Wang, Q.*, Li, S.*, Duan, L.*, Wu, H.*, Xu, H.*, Chen, R.*, Xu, H.*, Han, J.*, Li, Z.*, Lu, X.*, Zhao, K.*, Zhou, P.*, Liu, J.* and Kun, S.†
Angular Distribution of Products in Deep Inelastic Collision of $^{19}\text{F} + ^{27}\text{Al}$
Nuclear Physics Review 21 (2004) 387-389

Giraud, B.G.*, Karataglidis, S.*, Amos, K.* and Robson, B.A.
Is Friction Responsible for the Reduction of Fusion Rates Far below the Coulomb Barrier?
Physical Review C 69 (2004) 064613-1-8

Green, F., Thakur, J.S.* and Das, M.P.
Where is the Shot Noise of Quantum Point Contact?
Physical Review Letters 92 (2004) 156804-1-4

Gulacsi, M., Bussmann-Holder, A.* and Bishop, A.R.*
Competing Interactions of Spin and Lattice in the Kondo Lattice Model
Journal of Superconductivity 17 (2004) 167-171

Gulacsi, M., McCulloch, I.P., Juozapavicius, A.* and Rosengren, A.*
Magnetism in the Dilute Kondo Lattice Model
Physical Review B 69 (2004) 174425(6)

- Gulacsi, M.
The One-dimensional Kondo Lattice Model at Partial Band Filling
Advances in Physics 53 (2004) 769-937
- Gulacsi, M.
Variational Solution of the One-dimensional T-J Model
Philosophical Magazine Letters 84 (2004) 607-623
- Hall, M.J.W.
Incompleteness of Trajectory-based Interpretations of Quantum Mechanics
Journal of Physics A 37 (2004) 9549-9556
- Hall, M.J.W.
Prior Information: How to Circumvent the Standard Joint-measurement Uncertainty Relation
Physical Review A 69 (2004) 052113-1-12
- Hall, M.J.W.
Superselection from Canonical Constraints
Journal of Physics A 37 (2004) 7799-7811
- Kuan, W.H.*, Tang, C.S.* and Xu, W.
Energy Levels of a Parabolically Confined Quantum Dot in the Presence of Spin-orbit Interaction
Journal of Applied Physics 95 (2004) 6368/6
- McMillan, B.F., Dewar, R.L. and Storer, R.G.*
A Comparison of Incompressible Limits for Resistive Plasmas
Plasma Physics and Controlled Fusion 46 (2004) 1027-1038
- Mitra, S.*, Nienhuis, B.*, de Gier, J.* and Batchelor, M.T.
Exact Expressions for Correlations in the Ground State of the Dense $O(1)$ Loop Model
Journal of Statistical Mechanics 4 (2004) 9010-1-24
- Pershina, V.*, Bastug, T., Sarpe-Tudoran, C.*, Anton, J.* and Fricke, B.*
Predictions of Adsorption Behaviour of the Superheavy Element 112
Nuclear Physics A 734 (2004) 200-203
- Robson, B.A.
Relation between Strong and Weak Isospin
International Journal of Modern Physics E 13 (2004) 999-1018
- Sergeev, S.
Evolution Operator for a Quantum Pendulum
Theoretical and Mathematical Physics 138 (2004) 28-32
- Sergeev, S.
Functional Equations and Quantum Separation of Variables for 3d Spin Models
Theoretical and Mathematical Physics 138 (2004) 226-237
- Sergeev, S.
Quantum Integrable Models in Discrete $2 + 1$ Dimensional Space-time: Auxiliary Linear Problem on a Lattice, Zero-curvature Representation, Isospectral Deformation of the Zamolodchikov-Bazhanov-Baxter Model
Physics of Particles and Nuclei 35 (2004) 1-31
- Sudip, S.
Stability of Drift Waves in the Presence of Dust
Physics of Plasmas 11 (2004) 548-551
- Thakur, J.S.*, Green, F. and Das, M.P.
Sum-rule Constraints for Open Mesoscopic Conductors
International Journal of Modern Physics B 18 (2004) 1479-1488
- Von Gehlen, G.*, Pakuliak, S.* and Sergeev, S.
Theta-function Parametrization and Fusion for 3D Integrable Boltzmann Weights
Journal of Physics A 37 (2004) 1159-1179
- Wang, Q.*, Dong, Y.*, Li, S.*, Duan, L.*, Xu, H.*, Xu, H.*, Chen, R.*, Wu, H.*, Han, J.*, Li, Z.*, Lu, X.*, Zhao, K.*, Liu, J.* and Kun, S.*
*Angular Distribution and Angular Dispersion in Collision of $^{19}\text{F} + ^{27}\text{Al}$ at 114MeV**
Chinese Physics Letters 21 (2004) 1911
- Xiao, C.*, Hirose, A.* and Sudip, S.
Improved Confinement Induced by Tangential Injection of Compact Torus into the Saskatchewan Torus-modified (STOR-M) Tokamak
Physics of Plasmas 11 (2004) 4041-4049
- Xu, W. and Lin, L.B.*
Elementary Electronic Excitation from a Two-dimensional Hole Gas in the Presence of Spin-orbit Interaction
Journal of Physics 16 (2004) 1777-1788
- Xu, W., Lewis, R.A.*, Koenraad, P.M.* and Langerak, C.J.*
High-field Magnetotransport in a Two-dimensional Electron Gas in Quantizing Magnetic Fields and Intense Terahertz Laser Fields
Journal of Physics 16 (2004) 89-101
- Xu, W., Vasilopoulos, P.* and Wang, X.F.*
Lifetimes of a Two-dimensional Electron Gas in the Presence of Spin-orbit Interaction
Semiconductor Science and Technology 19 (2004) 224-229
- Xu, W., Vasilopoulos, P.* and Wang, X.F.*
Quantum and Transport Lifetimes of a Two-dimensional Hole Gas in the Presence of Spin-orbit Interaction
Physica Status Solidi B 241 (2004) 1871-1882
- Xu, W., Vasilopoulos, P.* and Wang, X.F.*
Spin-dependent Quantum and Transport Lifetimes in a Two-dimensional Electron or Hole Gas in the Presence of Spin-orbit Interaction
Physica E 22 (2004) 455-459
- Xu, W.
Spin-split Two-dimensional Electron Gas Perturbed by Intense Terahertz Laser Fields
Physical Review B 70 (2004) 193301
- Ying, Z.J.*, Foerster, A.*, Guan, X., Chen, B.* and Roditi, I.*
Magnetization Plateau and Quantum Phase Transitions in a Spin-orbital Model
European Physical Journal B 38 (2004) 535-539
- Yu-Shun, Z.* and Robson, B.A.
Antiproton-deuteron Scattering at 600 MeV/c
European Physical Journal A 22 (2004) 515-517
- Refereed Conference Proceedings
- Ball, R.
The Case of the Trapped Singularities
7th Asia-Pacific Complex Systems Conference: Complex 2004, Cairns (2004) 266-286
- Dewar, R.L., Nührenberg, C.* and Tatsuno, T.*
Quantum Chaos Theory and the Spectrum of Ideal-MHD Instabilities in Toroidal Plasmas
13th International Toki Conference (ITC-13), Toki City, Japan (2004) 40-44