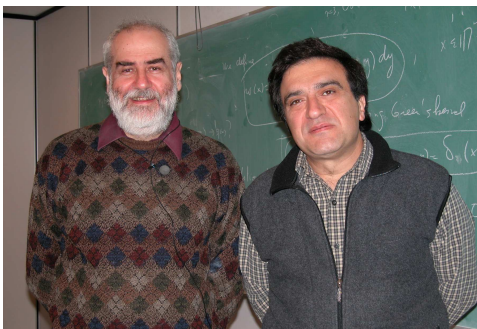# III.   CORE SCIENTIFIC PROGRAMMES

The participants in the 2002 Frontier in Mathematical Physics Workshop on Brane Worlds and Supersymmetry.

The speakers at the Combinatorial Potlatch that took place at the University of Puget Sound on February 16, 2002: Jonathan Jedwab (SFU), Brett Stevens (Carleton) and Brian Alspach (Regina and SFU (Emeritus)).

Gunther Uhlmann and Nassif Ghoussoub. Gunther Uhlmann was a PIMS Distinguished Chair in November 2002 at UBC.

PIMS Mini-Programmes

Mini-programmes are more focused events than the thematic programmes and span a shorter period of time. They place the focus on having fewer formal lectures and more opportunities for active collaborative work between the participants, who typically stay for the duration of the programme.

Frontiers in Mathematical Physics on Workshop on Particles, Fields and Strings, PIMS-SFU, July 16–27, 2001

Organizers: K. S. Viswanathan, chair (Simon Fraser University), Taejin Lee (Kangwon University, Korea), Yuri M. Makeenko (Niels Bohr Institute, Copenhagen/ITEP, Moscow), John Ng (TRIUMF), Alexander Rutherford (PIMS) and Gordon W. Semenoff (University of British Columbia)

The sixth workshop in the Frontiers in Mathematical Physics Series focused on the consequences of recent breakthroughs in the rapidly developing areas of superstring theory and nonperturbative gauge field theory.

Invited Speakers:

Dongsu Bak (U. Seoul, Korea): *Noncommutative Supersymmetric Tubes*

Bruce Campbell (U. Alberta)

Steve Giddings (UC): *Strong Gravity at the TEV Scale*

Seungjoon Hyun (Seoul National U, Korea)

Y. Kitazawa (KEK, Japan)

Per Kraus (Enrico Fermi Institute)

Robert Leigh (U. Illinois): *D-branes on Orbifolds: The Standard Model*

Shiraz Minwalla (Harvard)

Rob Myers (McGill): *Dielectric Branes*

Soonkeon Nam (Kyung Hee U., Korea): *Orientifolds, Conifolds and Quantum Deformations*

Mark Van Raamsdonk (Stanford)

Simon Ross (U. Durham)

Savdeep Sethi (U. Chicago)

Richard Szabo (Heriot-Watt U., Edinburgh): *Gauge Symmetries in Noncommutative Yang-Mills Theory*

Arkady Tseytlin (Ohio State U.): *Magnetic Backgrounds and Tachyons in Closed Strings*

Frontiers in Mathematical Physics on Workshop on Brane Worlds and Supersymmetry, UBC, July 22–August 2, 2002

Organizers: John Ng (TRIUMF, Chair), Andreas Karch (University of Washington), Taejin Lee (APCTP), Moshe Rozali (UBC), Alexander Rutherford (PIMS) and Gordon Semenoff (UBC).

Held at the Department of Physics and Astronomy, UBC, this two-week workshop featured a variety of talks on topics ranging from fundamental questions in superstring theory and supersymmetry to the cosmological implications of brane world models and higher dimensional physics. Brane world models suggest that the observable universe is a domain wall (the word brane derives from membrane) in a higher dimensional universe. These models have been proposed as a possible solution to the hierarchy problem, which asks why in the standard model of par-

ticle physics the hierarchy of mass scales that is observed in nature can occur.

The standard model of particle physics is a complicated nonlinear dynamical system. In such systems, predictions of dimensional numbers like particle masses tend to be of the same size, the size of the largest input parameter. In nature, there is a distribution of different masses, from massless particles like the photon and the very light particles like the electron or neutrino to the mass scale which describes gravitational interactions, a factor of 10^{20} heavier. Previous to these new ideas, the only solution of this hierarchy problem was to invoke symmetries. In fact, supersymmetry—a hypothetical and as yet unobserved symmetry whose transformations mix fermionic and bosonic particles—was needed. These new ideas about extra dimensions give a radical new alternative solution of the hierarchy problem. This solution is so compelling that it has been the focus of intense theoretical particle physics research over the past few years.

The new ideas about extra dimensions have also led to a revolution in our thinking about the role of gravity in particle physics. Gravity was previously thought to be important to the interactions of elementary particles only at extremely short distance scales, 10–34 centimetres, or in processes involving extremely high energies, far beyond the reach of any conceivable experiments. In most of the extra dimension scenarios, gravity becomes an important player in particle physics modelling.

Some of the extra dimension scenarios use superstring theory to quantize gravity and predict that superstring excitations should be observable at much lower energies than was previously thought. The elementary particles seen so far would be the lowest energy excitations of superstrings. The next excited states would occur at energies not much higher than the masses of already observed particles. This has the exciting consequence that these new ideas are testable by present and imminent experiments. For example, the existence of extra dimensions modifies the gravitational interaction at short distances. If objects are close together, gravity would no longer have the Newtonian inverse square dependence on distance but would have a different power depending on the total number of dimensions of spacetime. There are now several new experiments dedicated to testing the laws of gravity at the micron level.

Lectures were given by:

Alessandro D'Adda (INFN, Torino): *Gauge theories of the symmetric group in the large N limit*

Ignatios Antoniadis (CERN): *Physics with large extra dimension (2 lectures)*

Cliff Burgess (McGill): *Fixing runaway moduli*

Kiwoon Choi (KAIST): *Radius-dependent gauge coupling renormalization in AdS5*

Keith Dienes (Arizona): *Shape versus volume: rethinking the properties of large extra dimensions and Solving the hierarchy problem without SUSY or extra dimensions: an alternative approach*

Bogdan Dobrescu (Yale): *Universal extra dimension*

Andreas Karch (Washington): *Adding flavour to ADS/CFT*

Emanuel Katz (Washington): *Little Higgses*

Noboru Kawamoto (Hokkaido): *Twisted superspace and Dirac-Kaehler fermions*

Hyung Do Kim (KIAS): *Deconstructing warped gauge theory and unification*

C.S. Lam (McGill): *What can neutrino oscillation tells us about the possible existence of an extra dimension?*

Y.S. Myung (Inje University): *Limitation of Cardy-Verlinde formula on the holographic description of brane cosmology*

Erich Poppitz (Toronto): *Instanton effects in 5d theories and deconstruction*

Konstantin Savvidis (Perimeter Institute): *A new noncommutative field theory*

George Savvidy (National Research Center, Demokritos): *Conformal invariant string with extrinsic curvature action*

Gordon Semenoff (UBC): *Nonplanar corrections to PP-wave strings*

Mikhail Shifman (Minnesota): *Cosmological constant problem in infinite volume extra dimensions: a possible solution and Topological effects in our brane world from extra dimensions*

Henry Tye (Cornell): *Brane world cosmology: from superstring to cosmic strings*

Neal Weiner (Washington): *Supersoft supersymmetry breaking*

The programme was organized as that it allowed the opportunity for extensive discussion between the lectures. The lectures were videotaped and are available in realvideo and MP3 format from **www.pims.math.ca/science/2002/fmp**.

This workshop was the sixth of the annual workshops in the Frontiers in Mathematical Physics series. It was cosponsored by PIMS, the Perimeter Institute for Theoretical Physics and the Asia Pacific Center for Theoretical Physics.

Upcoming Frontiers of Mathematical Physics Summer School on String Theory, PIMS-UBC, July 14–25, 2003

Organizing Committee: Taejin Lee (APCTP), John Ng (TRIUMF), Moshe Rozali (UBC), Alexander Rutherford (PIMS) and Gordon W. Semenoff (UBC).

The lecturers include:

V. Balasubramanian (Penn)

M. Berkooz (Weizmann)

R. Brandenberger (Brown)

M. Dine (UC Santa Cruz)

D. Kutasov (Chicago)

V. Schomerus (Saclay)

P. Yi (KIAS)

Frontiers of Mathematical Physics is part of the string theory CRG.

NATO Advanced Research Workshop: New Techniques in Topological Quantum Field Theory, University of Calgary and Delta Lodge at Kananaskis, August 23–27, 2001

Directors: John M. Bryden (U. Calgary and Southern Illinois U.), F. Deloup (Université Paul Sabatier) and Victor A. Vassiliev (Steklov Mathematical Institute, Independent U. Moscow).

Organizers: D. Rolfsen (UBC), V. Turaev (Université Louis Pasteur, CNRS Strasbourg) and P. Zvengrowski (U. Calgary).

This workshop was held from August 23–24 at the University of Calgary and August 25–27 at the Delta Lodge at Kananaskis.

The objective of the meeting was to develop a common framework for ideas coming from many important areas of mathematical research related to topological quantum field theory (tqft). In particular, the intent was to examine the interaction between algebraic topology and Vassiliev Theory with Turaev's development of both topological quantum field theory and homotopy quantum field theory. It also dealt with the study of the interaction between the representation theory of braids and other related subjects with tqft.

The participants of the NATO workshop.

Plenary Speakers:

D. Bar-Natan (Hebrew University)

S. Bigelow (U. Melbourne): *Homology and the Hecke algebra*

J. Birman (Columbia): *Knots and Contact Structures on the Three-Sphere*

M. Karoubi (U. Paris 7): *Braiding of Differential Forms and Homotopy Type*

G. Masbaum (U. Paris 7): *Matrix-Tree Theorems and the Alexander-Conway Polynomial*

Speakers:

D. Auckly (Kansas State U.): *Twisted Yang-Mills Theory*

M. Boileau (Universit´e Paul Sabatier): *Uniformization of Small 3-Orbifolds*

P. Bona (U. Bratislava): *Nonlinear Quantum Systems as Subsystems in Quantum Field Theory*

J. Bryden (U. Calgary & Southern Illinois U.): *Quantum Homotopy theory II*

F. Cohen (U. Rochester): *Braid Groups and Modular form*

L. Crane (Kansas State U.): *Matheamtical Lessons from Quantum General relativity*

C. Cunningham (U. Calgary): *Perverse Sheaves and Loop Groups*

F. Deloup (Universit´e Paul Sabatier): *How to Recognize a Linking Summand*

S. Duzhin (Steklov Mathematical Institute, St. Petersburg): *On Kleinian Weight systems*

I. Dynnikov (Moscow State U.): *Finitely Presented Groups and Semigroups in Knot Theory*

M. Heusener (Universit´e Blaise Pascal): *Regenerating Singular Hyperbolic Structures From Sol*

S. Lando (Independent U. Moscow): *Vassiliev Invariants Obtained from Graph Invariants*

R. Lawrence (Hebrew U.): *Representation Theory of the Braid Groups and Computation of Quantum Invariants*

J. Milgram (Stanford)

S. Natanzon (Moscow State U. & Independent U. Moscow): *Topological Classification of $\mathbf{Z}/p$ Actions on Surfaces*

M. Polyak (Tel Aviv University)

J. Przytycki (George Washington U.): *Symplectic Structure on Coloring of Tangles*

D. Rolfsen (UBC): *Orderable Three-Manifold Groups*

D. Sjerve (UBC): *Automorphisms of Bilyea Surfaces*

D. Thurston (Harvard): *Wheels and Wheeling*

V. Tourtchine (Independent U. Moscow): *On the Homology of the Spaces of Long Knots*

A. Tralle (U. Warmia and Mazuria):

V. Turaev (U. Louis Pasteur): *Quantum Homotopy I*

L. Vainerman (Kiev State U.): *Quantum Invariants of 3-Manifolds from Quantum Groupoids*

V. Vassiliev (Steklov Mathematical Institute & Independent U. Moscow): *New Invariants of Spaces of Knots*

V. Vershinin (Novosibirsk State U.): *Homological Properties of Virtual Braids*

Distinguished Chairs

PIMS has established a programme of Distinguished Chairs, which serves to host eminent researchers in the mathematical sciences for extended visits at the PIMS sites. The researchers will have the opportunity to collaborate with colleagues at the PIMS universities and to give a series of lectures on their work.

PIMS Distinguished Chairs for 2001/02

Vladimir Turaev (CNRS Strasbourg VI)
Site: University of Calgary
July–August, 2001

Gang Tian (MIT)
Site: University of British Columbia
August 2001

Michael Shelly (Courant Institute)
Site: Simon Fraser University
November–December 2001

Vladimir Turaev (Research Director, CNRS IV, Strasbourg) was the PIMS Distinguished Chair at the University of Calgary for the months of July and August 2001 where he gave a series of 6 lectures on *Torsion Invariants of 3-manifolds.*

Turaev has made several seminal contributions to quantum invariants of 3-manifolds and topological quantum field theory. His recent research has been motivated by the development of topological quantum field theory by Edward Witten in 1988. Witten used the Feynman path integral in his construction, even though there is no rigorous mathematical justification for the path integral in this context. Following the publication of Witten's work, Turaev and

Reshetikhin proved that a system of topological invariants of 3-manifolds could be developed using the representation theory of quantum groups. In their work they exploited a relationship between the representation theory of quantum groups and

Vladimir Turaev

solutions of the Yang-Baxter equation of statistical mechanics. This allowed them to use the theory of representations of the quantum group $U_q(sl_2(\mathbb{C}))$ to define invariants of 3-manifolds. They then went on to give a rigorous construction of a topological quantum field theory in dimension 3.

Professor Turaev's work has led to many advances in mathematics and physics. In particular, an understanding of the topological and geometric nature of quantum invariants is viewed by many to be essential for the development of a quantum theory of gravity.

PIMS hosted **Gang Tian** as a PIMS Distinguished Chair at UBC during the month of August, 2001. Professor Tian is the Simons Professor of Mathematics at MIT. While at UBC, he gave 4 lectures on *Recent Progress in Complex Geometry* as part of the

Gang Tian

Geometric PDEs session of the PDE Thematic Programme and he also lectured at the Canada-China congress.

Gang Tian's research covers such diverse areas as
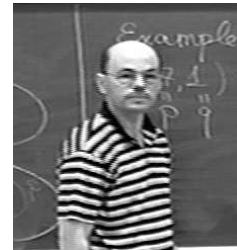
differential geometry, algebraic geometry, geometric analysis and PDEs. He has made fundamental contributions in each of these areas. In particular, he is well known for his work on the question of existence and obstructions for Kähler-Einstein metrics on complex manifolds with positive first Chern class, for his proof that the quantum cohomology ring is associative (joint with Y. Ruan) and for his work on higher dimensional gauge theory.

Gang Tian received the 19th Alan Waterman Award from the NSF in 1994, the Oswald Veblen Prize in 1996 and was an Alfred P. Sloan Research Fellow from 1991–93.
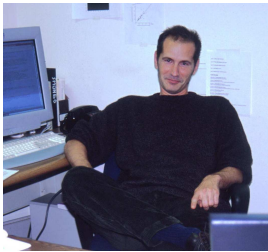
Michael Shelly is a Professor of Mathematics at the Courant Institute of Mathematical Sciences at New York University, where he is also Co-Director of the Applied Mathematical Laboratory, an experimental laboratory in

Mike Shelley

fluid dynamics and related areas. Besides being interested in fluid dynamics and free-boundary problems, Dr. Shelley also works actively in the neuroscience of vision. He was the PIMS Distinguished Chair at SFU, November–December 2001. He gave 5 lectures with entitled *Computing Free Boundary Problems in Moving Fluids*, *Computing with Surface Tension, and Discovering Singularities, Pattern Formation in Fluid Dynamics: Fluid Dynamics meets Materials Science, Why do Flags Flap?* and *Bending in the Wind: Elasticity and Drag Reduction.*

PIMS Distinguished Chairs for 2002/03

Donald G. Saari (University of California, Irvine)
Site: University of Victoria
September 2002

Klaus Schmidt (University of Vienna and Director, Erwin Schrödinger Institute)
Site: University of Victoria
November 2002

Gunther Uhlmann (University of Washington)

Site: University of British Columbia
November 2002

In September 2002, **Donald Saari** delivered a series of five lectures at the University of Victoria as a PIMS Distinguished Chair. Don is a Distinguished Professor of Mathematics and Economics and Director of the Center for Decision Analysis at the University of California, Irvine, and the former Arthur and Gladys Pancoe Professor of Mathematics and Professor of Economics at Northwestern University. He is recognized for his important contributions to the theory of dynamical systems and to the social sciences.

In his research Don uses mathematical models to analyze a wide variety of social phenomena: politics, markets, and intra-organizational behaviour. He made significant advances in celestial mechanics, in which Saari's conjecture—proposed in 1970 and now a landmark in the field—is still unsolved. Don is a member of the National Academy of Sciences.

His UVic lectures were intended to a broad general audience, showing how interesting mathematics is generated by questions coming from the social sciences.

Mathematical Social Sciences, an Oxymoron? presented how basic questions from the social sciences lead to new mathemat-

Donald Saari

ics or new uses of mathematics. The talk emphasized how hidden symmetries influence everyday decision making.

Singularity Theory and Departmental Discussions dealt with simple models of basic decision theory, connecting it with singularity theory and with some unresolved questions from the n-body problem of celestial mechanics.

Evolutionary Game Theory; Examples and Dynamics explained why dynamical systems are becoming an important tool for handling the new area of evolutionary game theory. The conclusions for game theory can be surprising. The impact for dynamical systems is that new structures are found.
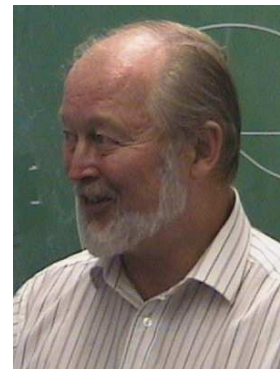
Chaotic Dynamics of Economics refuted Adam Smith's invisible hand theory through a careful mathematical examination, which showed that chaos is more likely than stability in economics models.

Dynamics, Symmetry, and the Social Sciences concluded the lecture series by showing other uses of dynamics and symmetry in understanding basic concerns coming from the social sciences. One of the issues discussed was Arrow's theorem and a new way of interpreting it.

The lectures were widely attended by faculty, PDFs, graduate and undergraduate students from the mathematics and the economics departments, visitors from other universities, and several members of the general public. Long and interesting discussion followed after every talk. This has been a highly rewarding experience for all those who attended. A video recording of the lectures and a written version of the notes are available on PIMS's website.
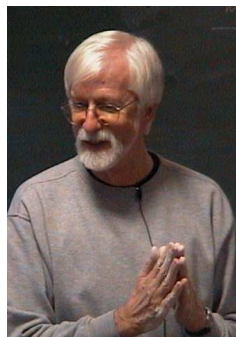
During November 2002 **Klaus Schmidt**, who is a Professor at the Mathematics Institute of the University of Vienna, and the Director of the Erwin Schrödinger Institute for Mathematical Physics, gave series of five talks at the University of Victoria.

Klaus Schmidt

The talks were about Algebraic $\mathbb{Z}^d$-*actions* and covered the following topics: $\mathbb{Z}^d$-actions by automorphisms of compact abelian groups: general theory, higher order mixing, homoclinic points and the symbolic representations of algebraic $\mathbb{Z}^d$-actions, and rigidity properties.

Klaus Schmidt was the winner of the 1993 Ferran Sunyer i Balaguer Prize. He was a founding editor of the journal *Ergodic Theory and dynamical systems* and is a member of the Austrian Academy of Sciences.

At the start of November 2002 **Gunther Uhlmann** (University of Washington) gave three two-hour talks at UBC. The topics were *inverse boundary and inverse scattering problems*. Inverse boundary problems are a class of problems in which one seeks to determine the internal properties of a medium by performing measurements along the boundary of the medium. These inverse problems arise in many important physical situations, ranging from geophysics to medical imaging to the nondestructive evaluation of materials. The appropriate mathematical model of the physical situation is usually given by a PDE (or a system of such PDEs) inside the medium. The boundary measurements are then encoded in a certain boundary map, usually called the Dirichlet-to-Neumann (DN) map. The inverse boundary problem is to determine the coefficients of the PDE inside the medium from knowledge of the boundary map. In inverse scattering problems, in which the observations are made far from the medium, the information is encoded in the scattering amplitude. The inverse scattering problem is to determine the medium properties from this information.

The first two lectures discussed the prototypical example of an inverse boundary problem, the inverse conductivity problem, also called electrical impedance tomography, whose mathematical formulation is due to A. P. Calderón. In this case the DN map is the voltage to current map; that is, the map assigns to a voltage potential on the boundary of a medium the corresponding induced current flux at the boundary of the medium. The inverse problem is to recover the electrical conductivity of the medium from the DN map. Gunther Uhlmann discussed the role of complex geometrical optics solutions in solving this inverse problem.

The first part of the last lecture described a solution of the inverse scattering problem at a fixed energy in dimension three or larger by reducing the problem to the study of the set of Cauchy data for the Schrödinger equation for a large ball. In the second half it was discussed recent progress on an inverse boundary problem arising in geophysics and rigidity questions in Riemannian geometry. The problem is to determine a Riemannian metric on a compact Riemannian manifold with boundary by measuring the lengths of geodesics (travel times) joining points of the boundary.

The lectures series by Vladimir Turaev, Gang Tian, Michael Shelley, Donald G. Saari, Klaus Schmidt and Gunther Uhlmann may be watched in real video format at **www.pims.math.ca/video/mini/**.

Distinguished Chairs for 2003

András Hajnal (Rutgers University)
Site of Chair: U. Calgary

Bryan Grenfell (Univ. of Cambridge)
Site of Chair: U. Alberta

Ashoke Sen (Harish-Chandra Research Institue)
Site of Chair: UBC

Jeffrey Vaaler (University of Texas)
Site of Chair: SFU and UBC

Pacific Northwest Seminar Series

These are annual or biannual meetings that bring together various regional groups of mathematicians in areas represented by strong communities in British Columbia, Alberta, Washington, Oregon and Northern California. Some of the scientific goals of PIMS, e.g. promoting communication and interactions among mathematical scientists, are served by *ad hoc* organizations formed in Western Canada and the U.S. Pacific Northwest.

The PNW meetings form the backbone of the PIMS Collaborative Research Groups.

PNW Algebraic Geometry Seminar

Organizers: Jim Bryan (UBC), James Carrell (UBC) and Sandor Kovacs (U. Washington).

October 13, 2001 at Western Washington U:
This meeting in Bellingham featured the following three speakers.

Mark Haiman (UC Berkeley): *The Hilbert scheme and Bridgeland-King-Reid correspondence for the diagonal action of S_n*

Brendan Hassett (Rice): *Moduli spaces and the minimal model program*

Aaron Bertram (Utah): *Reconstructing genus zero Gromov-Witten invariants*

February 9, 2002 at Western Washington U:
The following people spoke at the meeting:

Jim Bryan (UBC): *Gromov-Witten invariants of curves in Calabi-Yau 3-folds and Topological Quantum Field Theory*

Michael Thaddeus (Columbia): *Spaces of Higgs bundles as mirror partners*

Ravi Vakil (Stanford): *Vanishing of cohomology classes on the moduli space of curves*

October 20, 2002 at Western Washington U:
There were three speakers at this meeting:

Tom Graber (UC, Berkeley): *Generalizations of Tsen's Theorem*

Karen Smith (Michigan): *A non-vanishing conjecture of Kawamata and the core of an ideal*

Bill Fulton (Michigan):

Combinatorial Potlatches

Combinatorial Potlatches have been held for many years at various locations around Puget Sound and southern British Columbia, and are an opportunity for combinatorialists in the region to gather informally for a day of invited talks and conversation.

February 16, 2002 at University of Puget Sound:
The organizer of this meeting was **Nancy Neudauer** (U. Puget Sound). The invited speakers were:

Brian Alspach (U. Regina and SFU (Emeritus)): *Group Actions and Hamilton Decompositions of Complete Graphs*

Brett Stevens (Carleton University): *On Universal Cycles of k-sets of an n-set*

Jonathan Jedwab (SFU): *Combinatorial Design Theory and the IEEE 802.12 Transmission Code*

November 9, 2002 at University of Victoria: The organizers of this meeting were **Frank Ruskey** (chair), **Jing Huang**, **Gary MacGillivray** and **Wendy Myrvold** (U. Victoria). The speakers were:

Andrzej Proskurowski (U. Oregon): *Width parameters of graphs and discrete optimization problems*

Branko Grunbaum (U. Washington): *Polyhedra: Combinatorial and Geometric*

Jozef Siran (Slovak University of Technology): *Links between graph theory, group theory, geometry, Riemann surfaces, and Galois theory*

PNW Geometry Seminar

The Pacific Northwest Geometry Seminar (PNGS) is a regional meeting for geometers of all kinds. It is held at least twice during the academic year, rotating among UBC, Oregon State U., U. Oregon, Portland State U., U. Utah and U. Washington.

October 27–28, 2001 at University of Oregon: The organisers of this meeting were **Boris Botvinnik**, **Peter Gilkey**, **Jim Isenberg** (University of Oregon) and **Christine Escher** (Oregon State University). The speakers were:

Egidio Barrera-Yanez (Instituto de Matematicas, UNAM, Cuernavaca, Mexico): *The eta invariant and the "twisted;; connective real K-theory*

Ben Chow (UC San Diego): *Hamilton's injectivity radius estimate for the Ricci flow*

Claude LeBrun (SUNY Stony Brook): *Curvature and smooth topology in dimension four*

Gregor Weingart (U. Bonn and OSU): *Spectral Sequences arising in Differential Geometry*

Kazuo Akutagawa (Shizuoka University & U. Oregon): *Yamabe metrics on cylindrical manifolds*

Joint Meeting of the PNW Geometry Seminar and the Cascade Topology Seminar, May 11–12, 2002 at U. Washington: Roughly 60 people attended this meeting, mostly from Washington, Oregon, and British Columbia. Individually, the PNW Geometry Seminar and the Cascade Topology Seminar are regular, regional meetings for geometers and topologists, respectively. This joint meeting provided a good setting for the usual interactions within each group, but also interactions between the groups. The meeting also received funding from the National Science Foundation. The talks were designed so as to be accessible to the entire audience, and they were well-received. This was reflected in the broad participation in the problem sessions following the talks. Topics for talks included information theory, gauge theory, conformal field theory, and rational homotopy theory. The following people spoke:

John Baez (UC Riverside): *Categorified gauge theory*

Dan Christensen (Western Ontario): *Quantized geometry via representation theory*

Ralph Cohen (Stanford): *Duality phenomena in loop spaces and conformal field theory*

Megan Kerr (Wellesley): *A study of homogeneous Einstein metrics*

Laura Scull (UBC): *Rational Equivariant Homotopy*

Deane Yang (Polytechnic University): *Geometry, analysis, and information theory*

Western Canada Linear Algebra Meeting (W-CLAM)

Organizing Committee: Shaun Fallat, Steve Kirkland (U. Regina), Hadi Kharaghani (U. Lethbridge), Peter Lancaster (U. Calgary), Dale Olesky, Pauline van den Driessche (U. Victoria) and Michael Tsatsomeros (Washington State U.).

W-CLAM is a biannual sequence of meetings on linear algebra and related fields; previous meetings have been held in Regina, Lethbridge and Kananaskis. The objective is to foster research in linear algebra and its applications. While the primary purpose of W-CLAM is to enable researchers (including graduate students) from Western Canada to get together to present current work and to exchange ideas, the meeting is open to anyone.

May 10–11, 2002 at University of Regina: This meeting received financial support from the National Programme Committee, the University of Regina Conference Fund, and the University of Regina Faculty of Science. WCLAM 2002 featured 18 talks by speakers from Canada, the United States and Germany. The lectures covered a range of research areas associated with linear algebra, include matrix theory, operator theory, graph theory, applied mathematics, numerical analysis and combinatorics. The list of speakers included two winners of the Hans Schneider prize, which is given out every three years by the

International Linear Algegra Society for outstanding contributions to research in linear algebra.

In addition to the contributed talks, the meeting featured lectures from three invited speakers:

Jane Day (San Jose State)

Ludwig Elsner (Universitˇat Bielefeld)

Chris Godsil (Waterloo)

PNW Number Theory Seminar

January 13, 2001 at Western Washington University: The speakers were:

Michael Spiess (U. Nottingham): *Logarithmic differential forms on p-adic symmetric spaces*

Imin Chen (SFU): *On relations between induced representations for $GL_2(Z/p^2)$ and applications to modular curves*

January 27, 2001 at SFU Harbour Centre: The speakers were:

Nils Bruin (PIMS, SFU, UBC): *Generalised Fermat equations*

Adrian Iovita (U. Washington): *Explicit description of the local Galois representations attached to modular forms*

Stephen Choi (SFU): *A Problem of Cohn on Classifying Characters*

February 24, 2001 at University of Washington: The speakers were:

Haruzo Hida (UCLA): *Arithmetic of p-adic Hecke L-functions*

Nike Vatsal (UBC): *Elliptic curves over anticyclotomic fields*

April 28, 2001 at Redmond, Washington: This was the 5th PNW Number Theory Seminar. It was organized by **Matt Klassen** (DigiPen Inst. Tech.), **Kristen Lauter** (Microsoft Research) and **Peter Borwein** (SFU). The speakers were:

Ed Schaefer (Santa Clara Univ.): *How to compute the p-Selmer group of an elliptic curve for an odd prime p*

Audrey Terras (UC San Diego): *Comparison of Selberg's Trace Formula with its Discrete Analogues*

Nike Vatsal (UBC): *Ergodic theory and Heegner points*

Trevor Wooley (U. Michigan): *Slim exceptional sets in Waring's problem*

July 5, 2001 at PIMS-SFU: The meeting was entitled "A Day of Number Theory at SFU." The speakers were:

Doug Bowman (U. Illinois): *Zeta Values: From Leibniz to Today*

David Bradley (U. Maine): *Research Update on Multiple Polylogarithms*

Nils Bruin (PIMS, SFU): *Skolem-Mahler-Lech and Chabauty-Coleman*

Edlyn Teske (U. Waterloo): *Factoring $N = pq^2$ with the Elliptic Curve Method*

October 13, 2001 at Western Washington U: The speakers are this meeting were:

Glenn Stevens (Boston): *The eigencurve and p-adic L-functions*

Will Galway (PIMS, SFU): *The density of Pseudoprimes with Two Prime Factors*

November 17, 2001 at Western Washington U: The speakers are this meeting were:

Robert Pollack (U. Washington): *p-adic L-functions of elliptic curves at supersingular primes*

John Friedlander (U. Toronto): *The subconvexity problem for Artin L-functions*

December 1, 2001 at Western Washington U: The speakers are this meeting were:

Laurent Berger (Brandeis U.): *p-Adic Representations and Differential Equations*

Chris Smyth (U. Edinburgh): *Variations on the theme of Hilbert's Theorem 90*

Adrian Iovita (U. Washington): *A p-adic Shimura type construction for modular forms on quadratic imaginary fields*

February 23, 2002 at Western Washington U: There were three talks at this meeting:

Matt Baker (Harvard): *Canonical heights over abelian varieties*

Imin Chen (SFU): *Elliptic curves with non-split mod 11 representations*

Adrian Iovita (U. Washington): *Families of exponential maps attached to p-adic families of modular forms*

April 20–21, 2002 at PIMS-SFU: The sixth annual PNW Number Theory Meeting had about 40 participants primarily from Washington, Oregon, Alberta and BC. The invited speakers were:

Kristin Lauter (Microsoft): *Curves over Finite Fields and Applications to Cryptography*

Greg Martin (UBC): *Inequities in the Shanks-Rényi Prime Number Race*

Carl Pomerance (Bell Labs): *Mersenne numbers*

Mark Sheingorn: *Geometric Resonances in the Hall Ray of the Discrete Portion of the Markoff Spectrum*

Fernando Rodriguez Villegas (Texas, Austin): *Periods, L-functions and hyperbolic manifolds*

Hugh Williams (U. Calgary): *Computing Certain Invariants in Real Quadratic Number Fields*

November 2, 2002 at Western Washington U: The speakers at this meeting are:

Bisi Agboola (U. Santa Barbara): *Galois structure, Galois representations and metrised line bundles*

Will Galway (PIMS-SFU): *The pseudoprimes below* 2^{64}

Jim Mailhot (U. Washington): *Selmer Groups of Elliptic Curves with p-Isogenies*

PNW Numerical Analysis Seminar

September 29, 2001 at Western Washington U: The 15th annual PNWNAS. It was organized by **Tjalling Ypma** (Western Washington U). The speakers were:

Randy Bank (UC San Diego): *Pre-conditioning*

Tim Chartier (U. Colorado, Boulder): *Multigrid*

Lisa Stanley (Montana State U.): *Sensitivity Computation*

Wei-Pai Tang (Boeing): *Linear Algebra*

Harold Trease (Batelle): *Large-Scale Computation*

September 28, 2002 at University of Victoria: This meeting was organised by **Dale Olesky** (U. Victoria). The speakers were:

Mike Foreman (Institute of Ocean Sciences, Victoria): *Modelling tidal resonance and tidal power around Vancouver Island*

John Fyfe (Canadian Centre for Climate Modelling and Analysis): *Numerical methods in climate research*

Joerg Gablonsky (Boeing): *Effective parallel optimization of expensive functions*

John Gilbert (MIT Laboratory for Computer Science and UC, Santa Barbara): *Graph algorithms in numerical linear algebra: past, present and future*

Chen Greif (UBC): *On the solution of indefinite linear systems*

Tom Hogan (Boeing): *Fitting position, direction and curvature with a C^2 Quartic Spline*

Volker Mehrmann (Technical University Berlin): *Numerical methods for model reduction and the control of partial differential equations*

West Coast Optimization Seminar

The West Coast Optimization Meeting takes place twice each year, and alternates between Vancouver and Seattle. In Vancouver, PIMS, CECM and the math departments at UBC and SFU share the hosting duties, with local contacts Jonathan M. Borwein and Philip D. Loewen. In Seattle, UW/Math and UW/Applied Math contribute the organizational personnel: R. T. Rockafellar and J. V. Burke do most of the work. The meetings involve an informal get-together for social and technical discussions on Friday evening, followed by a series of talks on Saturday. Speakers are drawn from the considerable body of optimization talent now gathered in the six PIMS partner sites and Washington State University; a featured guest from outside is also usually invited.

May 4–5, 2001 at PIMS-SFU: The speakers were:

Heinz Bauschke (Okanagan U. College): *The method of cyclic projections - the inconsistent case*

James Burke (U. Washington): *Approximating of subdifferentials by random sampling of gradients*

Warren Hare

Lisa Korf (U. Washington): *Duality Theorems in Stochastic Programming*

Mason Macklem (SFU): *Current Models in Image Quality Evaluation*

R. T. Rockafellar (U. Washington): *Variational Geometry and Equilibrium*

Stephen Simons (UC, Santa Barbara): *Hahn-Banach and minimax theorems*

Herre Wiersma (SFU): *A C^1 function that is even on a sphere and has no critical points in the ball*

Jim Zhu (Western Michigan U.): *Necessary conditions for constrained optimization problems in smooth Banach spaces and applications*

May 3–4, 2002 at SFU: The spring session of the West Coast Optimization Meeting was well-attended, with over thirty participants. There were seven 45-minute technical presentations and a short theoretical talk, covering the full spectrum of theory, implementations, and applications of continuous optimization. The session concluded with a small group discussion, led by Tamas Terlaky, of the prospects for stimulating and structuring a nation-wide collaboration in optimization. Speakers:

James V. Burke (UW): *Gauss's approach to the variational analysis of functions of the roots of polynomials*

Asen Dontchev (Mathematical Reviews): *The many faces of the condition number theorem*

Oliver Dorn (UBC): *A level set method for shape reconstruction in medical and geophysical imaging*

Marian Fabian (Czech Academy of Sciences): *Topological and Sequential Normal Compactness*

Gabor Pataki (North Carolina): *On the closedness of the linear image of a closed convex cone*

Tamas Terlaky (McMaster): *Interior Point Methods: Dynamic Update and Self-Regularity*

Paul Tseng (UW): *Signal denoising by maximum likelihood estimation with l_1-penalty*

Jonathan Borwein (SFU): *Differentiability of Monotone Functions on Separable Banach Space*

PNW PDE Seminar

May 19, 2001 at University of Washington: This meeting was organized by **Richard Froese** (UBC), **Nassif Ghoussoub** (PIMS and UBC) and **Gunther Uhlmann** (U. Washington). Speakers:

James Colliander (UC, Berkeley): *Global well-posedness and long-time behavior of solutions of nonlinear dispersive equations*

Izabella Łaba (UBC): *Recent work on the Kakeya conjecture*

Hart Smith (U. Washington): *Global Existence for Quasilinear Wave Equations outside of Star-Shaped Domains*

Luis Vega (Universidad del Pais Vasco, Spain): *Formation of singularities for the vortex filament motion under LIA*

May 23–25, 2002 at Washington State University, Pullman: This meeting was held in honor of John R. Cannon's 65th birthday. The invited speakers covered a wide range of topics including inverse and ill-posed problems, free boundary problems, PDEs arising in the life sciences, PDEs arising in financial mathematics and numerical analysis of PDEs.

It was organized by **Robert Dillon**, **Alex Khapalov**, **V.S. Manoranjan** and **Hong-Ming Yin** (Washington State University).

The speakers were: Ralph Showalter (UT, Austin), Gary Lieberman (Iowa State), Thomas Seidman (U. Maryland, Baltimore), Zhilin Li (North Carolina State), Gunther Uhlmann (U. Washington), Kumud S. Altmayer (U. Wisconsin, Whitewater), Karthik Ramaseshan (U. Washington), Shuqing Ma (U. Alberta), Eduardo Chappa (U. Washington), Jim Douglas (Purdue), Emmanuele DiBenedetto (U. Vanderbilt), William Rundell (Texas A&M), Yanping Lin (U. Alberta), Paul DuChateau (Colorado State), David Wollkind (Washington State), Hong-Ming Yin (Washington State), Robert Dillon (Washington State), Takashi Suzuki (Osaka), Jodi Mead (Boise State), Emily Tian (Wright State), Long Lee (U. Washington), Sergei Avdonin (U. Alaska) and John Chadam (U. Pittsburgh).

PNW Probability Seminar

This seminar is organized by the probability groups at the UBC, U. Washington and Oregon State U. It usually attracts 25–30 participants and gives the various groups a chance to interact with each other. As these are among the strongest probability groups in North America it has been easy to attract outstanding scientists as speakers. This is also a good way for these groups to share many of the visiting scientists with the other sites.

Scientific advisory committee: Martin Barlow (UBC), Richard Bass (UW), Chris Burdzy (UW), Ed Perkins (UBC) and Ed Waymire (OSU).

October 20, 2001 at University of Washington: The speakers were:

David C. Brydges (UBC): *Branched Polymers and Dimensional Reduction*

Jim Fill (Johns Hopkins & Microsoft Research): *he Randomness Recycler: A new technique for perfect sampling*

Christopher Hoffman (U. Washington): *Phase Transition in Dependent Percolation*

Enrique Thomann (Oregon State U.): *Stochastic Cascades applied to the Navier Stokes Equations*

October 19, 2002 at University of Washington:
The speakers were:

Martin T. Barlow (UBC): *Random walks on supercritical percolation clusters*

Scott Sheffield (Microsoft Research): *Crystal facets and the amoeba*

Hao Wang (U. Oregon): *A class of interacting superprocesses*

Martin T. Barlow (UBC), Scott Sheffield (Microsoft Research) and Hao Wang (U. Oregon), PNW Probability Seminar speakers.

PNW Statistics Group

This is a biannual meeting.

March 16, 2001 at SFU:
The speakers were:

Merlise Clyde (Duke): *Empirical Bayes Prior Distirbutions and Bayesian Model Averaging*

Julia Wirch (SFU): *Coherent Risk Measures and Stochastic Dominance*

November 16, 2001 at University of Victoria:
The fall 2001 meeting had the following speakers:

Subhash Lele (U. Alberta): *The analysis of data that depicts the form of objects*

Jenny Bryan (UBC): *Finding Informative Genes based on Microarrays and Deletion Sets*

Subhash Lele showed that many commonly used methods base inference on non-identifiable parameters and he discussed the scientific implications of those methods. Throughout the presentation, he related the theoretical concepts to his projects on the shapes of skulls of children with Down's syndrome which motivated his theoretical work.

Jenny Bryan's work focuses on modelling gene expression data where it is informative to find sets of genes that exhibit interesting expression profiles or groups of genes that appear to be functionally related. In her talk, she discussed the research questions posed for such data and the challenges and opportunities they present for statisticians.

April 12, 2002 at UBC:
The Spring 2002 meeting included 44 participants, with good representation from various institutions and excellent participation by graduate students. The main speaker was:

Ying MacNab (Health Care and Epidemiology, UBC and Centre for Community Health and Health Evaluation Research, BC Research Institute for Children's and Women's Health): *Statistical modeling issues in hospital performance comparison studies: the Neonatal Health Services in Canada Project*

PNW Seminar on String Theory

March 17, 2001 at UBC:
This meeting was organized by **Konstantin Zarembo** (UBC), **Gordon Semenoff** (UBC) and **Sandy Rutherford** (PIMS). The speakers were:

Washington Taylor (MIT): *Tachyon condensation in open string field theory*

Kostas Skenderis (Princeton): *Holographic renormalization*

Amanda Peet (U. Toronto): *String theoretic mechanisms for spacetime singularity resolution*

Emil Martinec (U. Chicago): *D-branes as noncommutative solitons: an algebraic approach*

Hiroshi Ooguri (Caltech): *Strings in AdS_3 and the $SL(2, R)$ WZW model*

All these lectures were taped and are available from **www.pims.math.ca/video/meetings/**.

March 8–10, 2002, at PIMS-UBC: This seminar featured a series of talks on recent developments in string theory. This weekend meeting provides an opportunity for graduate students to interact with leading researchers in the field.

The organisers were **Kazayuki Furuuchi** (PIMS & UBC), **Moshe Rozali** (UBC) and **Gordon Semenoff** (UBC), and the following people spoke:

Kazuyuki Furuuchi (PIMS & UBC): *Non-commutative Space And Chan-Paton Algebra in Open String Field Algebra*

Andreas Karch (UW): *Adding Flavor to AdS/CFT*

David Kutasov (Chicago): *Localized Closed String Tachyons*

Shin Nakamura (KEK): *Extension of Boundary String Field Theory on Disc and RP^2 Worldsheet Geometries*

Kazumi Okuyama (Chicago): *Comments on Vacuum String Field Theory*

Jan Plefka (AEI, Potsdam): *Wilson Loops in $N = 4$ Super Yang-Mills Theory*

Lisa Randall (Harvard): *The Hierarchy Unification and the Entropy of de Sitter Space*

Eva Silverstein (Stanford): *Nonperturbative Nonrenormalization in a Non-supersymmetric Nonlocal String Theory*

Matthias Staudacher (AEI, Potsdam): *Index Puzzles in SUSY Gauge Mechanics*

Leonard Susskind (Stanford): *Quantum Gravity dS Space*

All these lectures were taped and are available from **www.pims.math.ca/video/meetings/**.

Cascade Topology

This is a twice-yearly seminar which rotates among the universities of the US Pacific Northwest, and western Canada. Its purpose is to gather topologists of the region, and present lectures on recent progress in the field, at an informal weekend meeting. The meetings are informal and friendly, and a special effort is made to encourage participation by graduate students by providing theire housing cost.

Joint Meeting of the PNW Geometry Seminar and the Cascade Topology Seminar, May 11–12, 2002 at U. Washington:

November 2–3, 2002 at UBC: The 29th meeting of the Cascade Topology Seminar was organized by Kee Lam and Dale Rolfsen (UBC). Speakers:

David Gillman (UCLA): *The best picture of Poincare's homology sphere*

Ian Hambleton (McMaster): *Homotopy self-equivalences of 4-manifolds*
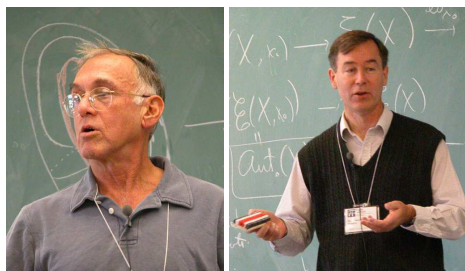
Vaughan Jones (UC Berkeley): *Skein theory in knot theory and beyond*

Dev Sinha (U. Oregon): *New perspectives on self-linking*

Catherine Webster (UBC): *Cryptography and the braid groups*

Sergey Yuzvinsky (U. Oregon): *Topological robotics; topological complexity of projective spaces*

All these lectures were taped and can be watched by going to **www.pims.math.ca/video/meetings/**.

Clockwise from top left: David Gillman (UCLA), Ian Hambleton (McMaster), Vaughan Jones (UC Berkeley), Sergey Yuzvinsky (Oregon), Dev Sinha (Oregon) and Catherine Webster (UBC).

PIMS Lecture Series

- IAM-PIMS Joint Distinguished Lecture Series in Applied Mathematics

- PIMS-MITACS Mathematical Finance Seminar

- PIMS-Shell Lunchbox Lecture Series

- PIMS String Theory Seminar

- PIMS Centre for Scientific Computing Seminar

- PIMS Centre for Mathematical Biology Seminar

IAM-PIMS Joint Distinguished Colloquium Series

This series of seminars is co-hosted by the Institute for Applied Mathematics at UBC and PIMS.

Organizer:
Bernie Shizgal (Director of the IAM)

2001/02 Series

Philippe R. Spalart (Boeing), *Detached-Eddy Simulation (DES)*, October 1, 2001

David Gottlieb (Brown University), *Spectral Methods for Discontinuous Problems*, October 29, 2001

Joel H. Ferziger (Stanford University), *Numerical Simulation of Turbulence*, November 26, 2001

Russel Caflisch (UCLA), *Modeling and Simulation for Epitaxial Growth*, January 28, 2002

Adam Arkin (UC Berkeley), *Signal Processing in Cellular Regulatory Networks: Physical Models, Formal Abstractions and Applications*, February 18, 2002

Eva Tardos (Cornell University), *Approximation Algorithms and Games on Networks* , March 11, 2002

These lectures were taped and may be watched by going to **www.pims.math.ca/video/dist/**.

Planned 2002/03 Series

Gordon E. Swaters(University of Alberta): *Dynamics of Abyssal Ocean Currents*, October 7, 2002

David Chandler (University of California): *Transition pathways in complex systems: throwing ropes over rough mountain passes, in the dark*, October 28, 2002

Ulf Dieckmann (The International Institute for Applied Systems Analysis, Laxenburg): *Spatial complexity in ecology and evolution*, December 2, 2002

Parviz Moin (Stanford University): *Turbulence and its Computation*, January 13, 2003

Leon Glass (McGill University): *Dynamics of Genetic Networks.* January 27, 2003

Lloyd N. Trefethen (Oxford University): *Fast accurate solution of stiff PDE*, March 17, 2003

These lectures are being taped and will be made available at **www.pims.math.ca/video/dist/**.

PIMS-MITACS Mathematical Finance Seminars

In conjunction with research activities of MITACS, PIMS hosts a series of talk on recent work in financial mathematics.

Organizer: Ulrich Haussmann (Math, UBC)

Seminars for 2001/02

A. Lazrak (USC and U. d'Evry): *Incomplete Information with Recursive Preferences,* January 11, 2001

Tan Wang (UBC): *Model Misspecification and Under-Diversification,* February 8, 2001

Simon McNair (UBC): *Delta Hedging and Survival Probabilities in Markets with Frictions,* March 1, 2001

Dilip Madan (University of Maryland): *Levy Processes in Financial Modeling,* March 9, 2001

Alan King (IBM Research Division): *A Contingent Claims Approach to Setting the Franchise Fee for Capacity Constrained, Quantity-Flexible Supply Contracts,* March 22, 2001

Robert Jones (SFU): *Valuing Revolving Lines of Credit Under Jump-Diffusion Credit Quality,* March 29, 2001

A. Lazrak (U. d'Evry): *Information Neutrality in Stochastic Differential Utility and Related Backward Stochastic Differential Equations,* September 6, 2001

R. Tompkins (T. U. Vienna): September 27, 2001

J. Cvitanek (USC): *Computation of Hedging Portfolios for Options with Discontinuous Payoffs,* October 11, 2001

Joern Sass (UBC): *Maximizing the asymptotic growth rate under fixed and proportional transaction costs,* October 25, 2001

Robert Tompkins (Technische Universität Wien): *Pricing, no-arbitrage bounds and robust hedging of installment options,* December 10, 2001

Ulrike Reich (UBC): *Hedging in an international perspective,* January 24, 2002

Bo-Young Chang (UBC): *Introduction to Credit Derivatives,* February 28, 2002

Rik Blok (Centre for Applied Ethics, UBC): *Statistical properties of financial timeseries,* May 28, 2002

Joern Sass (PIMS and UBC): *Portfolio Optimization under Partial Information: The Drift Process as Continuous Time Markov Chain,* July 11, 2002

Satish Reddy (Quadrus Financial Tech. Inc.): *Introduction to Options and their Valuation,* September 20, 2002

Costis Skiadas (Northwestern U.): *Optimal Lifetime Consumption-Portfolio Strategies under Trading Cone Constraints and Recursive Preferences,* October 4, 2002

Gabriel Mititica (student): *Introduction to Collateralized Debt Obligations,* October 10, 2002

Gillian Clegg (UBC): *Introduction to Mortage-Backed Securities,* October 24, 2002

Alex Schied (Humboldt U. & UBC): *Variational problems for capacities arising in risk theory,* November 13, 2002

Jean-Marie Dufour (U. Montreal): *Testing mean-variance efficiency in CAPM with possibly non-Gaussian errors: an exact simulation-based approach,* November 28, 2002

PIMS-Shell Lunchbox Lecture Series 2002

PIMS is presenting a series of lectures at the Shell Centre in downtown Calgary. These lectures, given by experts from the PIMS Universities, focus on mathematical techniques and applications relevant to the oil and gas industry and demonstrate the utility and beauty of applied mathematics. The talks are aimed at a general audience. Attendance may qualify for APEGGA Professional Development Hours.

Organizer: Gary Margrave (U. Calgary)

Michael Lamoureux (U. Calgary): *Wavelets in Industry,* February 12, 2002

Rita Aggarwala (U. Calgary): *Designing better industrial experiments,* April 16, 2002

Antonin Settari (U. Calgary): *Mathematics of coupled reservoir and geomechanical modeling,* May 21, 2002

Ian Frigaard (UBC): *Advances in understanding well-construction fluid mechanics: cementing flows and turbulence,* June 13, 2002

Richard Churchill (Hunter College, CUNY): *Fermat's Last Theorem,* August 6, 2002

Len Bos (U. Calgary): *Fitting Surfaces to Data,* September 23, 2002

Christian Jacob (U. Calgary): *Design by Evolution The Art and Science of Genetic Computer Programming,* October 22, 2002

Tony Ware (U. Calgary): *Changing your point of view: modern Fourier analysis and other techniques for seeing data in a new light,* November 18, 2002

Edward S. Krebes (U. Calgary): *Seismic Waves in a Layered Earth,* December 12, 2002

PIMS String Theory Seminar for 2001/02

This is a series of lectures on String theory held approximately once per week at PIMS-UBC.

Organizer: K. Zarembo (PIMS PDF, UBC)

Gordon Semenoff (UBC): *Strings in external electromagnetic fields,* January 22, 2001

Konstantin Zaremb (UBC): *String theory: a link between gravity and gauge fields,* January 26, 2001

Gordon Semenoff (UBC): *Matrix strings in a B-field,* February 5, 2001

Sumati Surya (UBC): *Phase transitions for flat AdS black holes,* February 26, 2001

Moshe Rozali (Rutgers): *Thermodynamics of Nongravitational String Theories,* March 5, 2001

Konstantin Zarembo (UBC): *Testing AdS/CFT correspondence with Wilson loops,* March 12, 2001

Jorgen Rasmussen (U. Lethbridge): *Superconformal algebras on the boundary of AdS_3,* March 19, 2001

Sachindeo Vaidya (UC Davis): *Perturbative dynamics on fuzzy surfaces,* May 1, 2001

Sumati Surya (UBC): *Discussion of "Fluxbranes in String Theory" by M. Gutperle and A. Strominge,* May 14, 2001

Emil Akhmedov (UBC): *On Unification of D-Brane Couplings to RR Fields,* May 28, 2001

Robert Brandenberger (Brown): *Review of approaches to string cosmology,* June 18, 2001

Robert Brandenberger (Brown): *Review of approaches to string cosmology (ctd),* June 25, 2001

Robert Brandenberger (Brown): *Review of approaches to string cosmology (ctd),* July 9, 200

M. Rozali (UBC): *Strings on AdS3,* October 22, 2001

S. Bal (Math Science, India): *Interaction of Fuzzy Spheres,* October 26, 2001

M. Rozali (UBC): *Strings on AdS3,* October 29, 2001

Kristen Schleich (UBC): *Exotic differentiable structures in quantum gravity,* January 4, 2002

Aki Hashimoto (IAS): *Observables of String Field Theory,* January 18, 2002

Ben Sussman (UBC): *Kalb-Ramond Solitons in Bosonic String Theory,* January 25, 2002

Kazuyuki Furuuchi (UBC): *Non-Commutative Space and D-Branes in Open String Algebra,* February 1, 2002
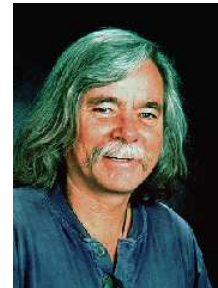
Jeremy Michelson (Rutgers): *Non-Commutative Field Theory from String Theory,* February 8, 2002

Kirk Buckley (UBC): *Superconducting strings in high density QCD,* November 8, 2002

Hong Liu (Rutgers): *Strings in Time-Dependent Orbifolds,* November 22, 2002

PIMS-MITACS Centre for Scientific Computing Seminar for 2001/02

Organizer: Bob Russell (CSC Director)

Stephen Whitaker (UC Davis): *Coupled Transport During Drying in Porous Media,* January 5, 2001

Tom Manteuffel (U. Colorado): *arge First-order Systems Least-squares Functionals for Linear Elasticity,* January 12, 2001

Radu Bradean (SFU): *Heat and Mass Transfer in Porous Fuel Cell Electrodes,* January 19, 2001

Ray Zahar (SFU): *A Uniform Analysis of Difference Systems,* February 2, 2001

Wolfgang Heidrich (UBC): *Towards Realistic Materials and Lighting in Interactive Applications,* February 9, 2001

John Bowman (Alberta): *A Statistical Description of Two and Three-Dimensional Turbulence,* February 16, 2001

Lia Bronsard (McMaster): *Phase Boundaries in Ginzburg-Landau Models of Materials Science,* February 19, 2001

Bernard Deconick (U. Washington): *The computation of quasi-periodic solutions of integrable partial differential equations,* March 2, 2001

Ian Frigaard (UBC): *Super-Stable Parallel Flows of Multiple Visco-Plastic Fluids,* March 9, 2001

Bjorn Sandstede (Ohio State): *Stability and bifurcations of spiral waves,* March 16, 2001

Chris Jones (Brown): *Do Invariant Manifolds Hold Water?,* March 23, 2001

Bengt Fornberg (U. Colorado): *Radial Basis Functions - A future way to solve PDEs to spectral accuracy on irregular multidimensional domains?,* March 30, 2001

Jane Wang (Cornell): April 6, 2001

Emily Stone (Utah State) and **Abe Askari** (Boeing): *Nonlinear Models of Dynamics in Drilling,* May 4, 2001

Yannis Kevrekidi (Princeton): *Enabling Microscopic Simulators To Perform System-Level Analysis,* May 18, 2001

Nicolas Robidoux (SFU): *Numerical solution of the Poisson equation — $divkgradd = f$ with discontinuous diffusion tensor k and source term f,* September 7, 2001

Florin Diacu (U. Victoria): *On the dynamics of Langmuir's Problem,* September 21, 2001

Adrian Lewis (SFU): *Optimization Problems Involving Pseudospectra,* September 28, 2001

Claudio Fernandez (Catholic U. Chile): *Lifetime in Quantum Mechanics,* October 5, 2001

Uri Ascher (UBC): *Multilevel Techniques for Large Scale Distributed Parameter Estimation in 3D,* October 12, 2001

Xiaofeng Ren (Utah State): *Analysis of Block Copolymer Morphology,* October 19, 2001

Carson C. Chow (U. Pittsburgh): *Collective dynamics of coupled neurons,* November 2, 2001

Ricardo Carretero (PIMS PDF): *Breathers in Bose-Einstein condensate lattices: from multi-soliton interactions to homoclinic tangles,* November 9, 2001

Diana Allen (SFU): *Applications of Numerial Modelling to Groundwater Flow,* November 16, 2001

Oliver Dorn (UBC): *A level set method for shape reconstruction in 3D Electromagnetic Induction Tomography,* November 23, 2001

Gene H. Golub (Stanford): *Solution of Non-Symmetric, Real Positive Linear Systems,* November 30, 2001

K.K. Tung (U. Washington): *Turbulent Energy Spectrum in the Atmosphere for Scales of Motion from 10^0 to 10^5 Kilometer,* January 4, 2002

Thomas Hillen (U. Alberta): *Pattern Formation in Chemotaxis Systems,* January 11, 2002

Edward J. Kansa (Lawrence Livermore National Lab): *Meshless, Radial Basis Function Collocation Methods for PDEs,* January 18, 2002

Richard Bartels (U. Waterloo): *Constructing multiresolutions from subdivisions,* February 1, 2002

Peter Berg (SFU): *Microscopic Parameters and Macroscopic Features of Traffic Flow,* February 15, 2002

Professor Vladimir Dorodnitsyn (Russian Academy of Sciences): *Lie Group Symmetries of Difference Equations: how to construct the invariant difference models,* March 7, 2002

Philip Sharp (U. Auckland): *Numerical challenges in long N-body simulations of the Solar System,* March 15, 2002

Dale Durran (U. Washington): *Wave Propagation in Quadratic-Finite-Element Approximations to Hyperbolic Equations,* April 5, 2002

Dr. Koorosh Nikfetrat (BCIT): *Three Dimensional Viscous Incompressible Flow Simulations Using Helpholz Velocity Decomposition,* April 12, 2002

Rajan Dassan and Brad Bondy (Genus Capital Management): *Investment Problems: Mathematics and Computation,* April 19, 2002

Alex Kurganov (Tulane): *Smoothness Indicator for Adaptive Algorithms,* May 17, 2002

Chris Budd (U. Bath): *Can an adaptive method live with a symplectic method and still be friends?,* May 17, 2002

Lubomir Bakule (Academy of Sciences of the Czech Republic): *Decentralized Control of Large Scale Systems,* May 23, 2002

Christopher P. Silva (Academy of Sciences of the Czech Republic): *Chaos, Fractals, and Wavelets in Communications & Signal Processing,* June 7, 2002

JF Williams (U. Bath): *Exactly self-similar blow-up in higher order semilinear parabolic equations,* August 2, 2002

Ioanis Nikolaidis (U. Alberta): *On the use of transmission power control for energy-efficiency MANET services,* August 22, 2002

Satish Reddy (Quadrus Financial Tech. Inc.): *Introduction to Options and their Valuation,* September 6, 2002

S. J. Paddison (Los Alamos National Lab): *Multi-scale Modeling of Proton Conduction in the Electrolyte of a PEM Fuel Cell,* September 13, 2002

Andrey Pavlov (SFU): *Homeownership as a Constraint on Asset Allocation,* September 20, 2002

Dr. Jose-Leonel Torres (U. Michoacan): *Biological Power Laws and Darwin's Principle,* September 25, 2002

Dr. Michael Ward (UBC): *The Stability and Dynamics of Localized Patterns for a Reaction-Diffusion System,* September 27, 2002

Chen Greif (UBC): *On the solution of indefinite linear systems,* October 4, 2002

Eirikur Palsson (UBC): *Exploring the interpaly of cell-adhesion and chemotaxis on cell sorting using a 3-D model,* October 11, 2002

Walter Craig (McMaster): *Traveling water waves,* October 21, 2002

Brad McNeny (SFU): *A stepwise procedure for detecting recombination breakpoints with application to HIV-1 molecular sequences from an individual,* October 25, 2002

Richard O. Moore (SFU): *Importance sampling applied to simulations in optical communications,* November 1, 2002

Bastiaan J. Braams (Courant): *The computational complexity of the Hartree-Fock approximation in quantum chemistry,* November 29, 2002

PIMS Centre for Mathematical Biology Seminar

Organizer: Mark Lewis (University of Alberta)

Kerry Landman (U. Melbourne): *Can you still read the fine print? Water transport in eye lenses and "How does your stomach feel? Development of the nervous system in the gut",* October 1, 2001

Hal Smith (Arizona State U.): November 1, 2001

Sebastian Schreiber (Western Washington U.): *Allee effects, chaotic transients, and extinction in simple population models*, November 19, 2001

Kevin Painter (Heriot-Watt U.): November 26, 2001

Brian Denis (U. Idaho): January 28, 2002

Leah Edelstein-Keshet (UBC): April 8, 2002

Alex Mogilner (UC Davis): *How nematode sperm crawl,* September 9, 2002

Rebecca Tyson (Okanagan University College): *How nematode sperm crawl,* November 4, 2002