WINNIPEG INSTITUTE

FOR

THEORETICAL PHYSICS

ANNUAL REPORT

September 1991- August 1992

WITP ANNUAL REPORT

September 1991-August 1992

CONTENTS:

1. INTRODUCTION

The community of theoretical physicists in Manitoba has grown significantly in the past few years. The combined group of 13 theorists (1 at AECL, Pinawa, 1 at Brandon University, 8 at the University of Manitoba and 3 at the University of Winnipeg) comprises one of the largest active Theoretical Physics groups in the country. This strong research environment has recently been enhanced by the formation of the Winnipeg Institute for Theoretical Physics, using seed money from both the University of Manitoba and the University of Winnipeg. The primary purpose of the Institute is to increase the cooperation and collaboration between the Theoretical Physicists in Manitoba, thereby strengthening the community, and to initiate and sustain research collaborations between the members of the Institute and first class researchers from all over the world. The activities of the Institute also help to expose the graduate students of its members to different people and ideas, through seminars and lecture series, thereby increasing the quality of training provided, and in the long term also attracting further high quality students from Canada and abroad.

The specific functions of the Institute are to fund both short and long term visitors to Winnipeg by recognized national and international experts in various areas of Theoretical Physics, and to coordinate and fund the organization of national and international workshops and/or conferences on topics of interest to the members.

The academic year 1991-92 was the second year of operation of the Institute, and as seen in the following report, it was as active and successful as the previous year. The Institute funded numerous long and short term visitors, and there were a total of 17 seminars given throughout the year. In addition an international Workshop on Perturbative Methods in Hot Gauge Theories was held at the University of Winnipeg. The Institute Director for the 1991/92 academic year was Gabor Kunstatter and Tom Osborn has taken over as Director starting September 1992.

The following pages summarize the activities of the Winnipeg Institute for Theoretical Physics during the 1991/92 academic year. For further information about the Institute and its activities contact the Director, Winnipeg Institute for Theoretical Physics at either address given below:

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2. LIST OF MEMBERS (September, 1992)

(a) Permanent Members

- B. Bhakar[1], *Ph.D.(Delhi)*
- P.G. Blunden[1], *Ph.D.(Queen's)*
- R.L. Kobes[2], *Ph.D.(Alberta)*
- G. Kunstatter[2], *Ph.D.(Toronto)*
  Director, 1991/92
- P.D. Loly[1], *Ph.D.(London)*
- T.A. Osborn[1], *Ph.D.(Stanford)*
  Director, 1992/93
- B.W. Southern[1], *Ph.D.(McMaster)*
- J.P. Svenne[1], *Ph.D.(M.I.T.)*
- J.M. Vail[1], *Ph.D.(Brandeis)*
- D.W. Vincent[2], *Ph.D.(Toronto)*
- J.G. Williams[3], *Ph.D.(Birmingham)*
- C.H. Woo[4] *Ph.D.(Waterloo)*
- J.A. Zuk[1], *D.Phil.(Oxford)*

[1] University of Manitoba

[2] University of Winnipeg

[3] Brandon University

[4] AECL, Pinawa

(b) Associate Members

- M. Carrington *(Postdoctoral Fellow)*
- V. Cherepanov *(NSERC International Fellow)*
- P. Kelly *(Postdoctoral Fellow)*
- V.I. Kukulin *(Visiting Scientist)*
- F. H. Molzahn *(Research Associate)*
- A. Mogilner *(Postdoctoral Fellow)*
- A.S. Raskin *(Research Associate)*

(c) Graduate Students *(Supervisor in Brackets)*

- J. Chen (M.Sc.), *(Kobes)*
- S. Cyr (Ph.D.), *(Southern)*
- R. Epp (Ph.D.), *(Bhakar & Kunstatter)*
- N. Li (M.Sc.), *(Vail and Woo)*
- R.J. Lee (M.Sc.), *(Southern)*
- Guo Lan (M.Sc.), *(Southern)*
- K. Mak (Ph.D.), *(Kobes & Kunstatter)*
- D.L. Martinez (Ph.D.) *(Kunstatter)*
- J. Wang (M.Sc.), *(Kobes)*
- Z. Yang (M.Sc.), *(Vail)*

3. RESEARCH INTERESTS OF PERMANENT MEMBERS

B. Bhakar:

Present activities are directed towards understanding of completely integrable and non-integrable field theories in low [(1+1) and (2+1)] dimensions. Therefore, investigations are being carried out to study the behaviour of spin chain models on a lattice in (1+1) dimensions with nearest neighbour interactions only. These models are closely related to nonlinear sigma models.

P.G. Blunden:

Electromagnetic interactions in complex and few-nucleon systems are being studied. I am particularly interested in the description of electron scattering at large energy and momentum transfers, the so-called quasi-elastic region, in which one or more constituents are knocked out of the nucleus. In this kinematical regime one can explore different aspects of the nuclear response to learn about two-nucleon correlations, two-body electromagnetic currents, the role of nucleon substructure, and the momentum distribution of the initial struck nucleon.

Another area of interest is in a quantum field theory of mesons and hadrons (QHD). Some of the topics under current investigation include: Dirac-Hartree-Fock calculations for the properties of finite nuclei; hadronic and electromagnetic reactions; a relativistic treatment of mesonic currents; and exact and approximate treatments of the negative energy Dirac sea in finite nuclei.

R.L. Kobes:

The general area of research is quantum field theory at finite temperature and density, with applications in both particle and condensed matter physics. We are presently interested in three specific problems: a study of properties of high temperature gauge theories such as the quark–gluon plasma, a general investigation of calculational methods in finite temperature field theory, and a study of the proximity effect between layers of superconducting materials in structures such as superlattices.

G. Kunstatter:

Gauge theories provide the theoretical basis for virtually all phenomenological descriptions of the fundamental interactions. They are also playing an increasingly important role in our understanding of certain condensed matter systems. The quantization of gauge theories is however complicated by the presence of unphysical modes in the classical description, which must be factored out in order to expose the true physical content of the theory. My research uses geometrical techniques to investigate physical and mathematical properties of quantized gauge theories such as Quantum Chromodynamics, Chern-Simons theory and Quantum Gravity, both at zero and finite temperature. Specific problems currently under investigation include: properties of the high temperature QCD plasma, the use of exactly soluble 2-dimensional models for quantum gravity around a black hole, and quantization ambiguities in gauge theories.

P.D. Loly:

Periodic Systems: I now operate two major themes, one with a nearly-free-electron flavour, and the other concerned with excitations in magnets which has more of a tight-binding flavour.

Quantum Well Spectra: Very recently pdf Alex Mogilner and I have resolved the recurring question of zero-energy gaps in 1D bandstructures by using quite general analytical results for the eigenvalues of "oscillatory" matrices. This exciting development facilitates another paper, extending some explicit calculations of the energy bands of a number of earlier "exactly soluble" potentials. In 2D and 3D we will use analogues of the Kronig-Penney potential to study bandstructures of mesoscopic ultrasmall quantum box structures now etched routinely in AlGaAs in semiconductor heterostructures which caught our interest as an application of our multi-dimension nearly-free-electron code.

T.A. Osborn:

A principal research interest is the investigation of quantum (and classical) evolution in a variety of gauge theories. Using the methods of mathematical physics, the goal is to describe the dynamics of these strongly interacting systems by the development of non-perturbative analytically explicit approximate solutions. The usefulness of such an approximate dynamics is that it allows detailed physical insights into the fundamental structure of the system as well as the computation of all observables of interest (such as the stress-energy tensor). For example, the large mass semi-classical expansion of the propagator for an N-body system coupled via the Lorentz force to an arbitrary external electromagnetic field has been recently shown to admit an asymptotic expansion in the reciprocal mass. This expansion is valid to infinite order in the external fields, is manifestly gauge and Lorentz invariant, possesses simple expansion coefficients, and has an a priori determined error bound. The extension of this type of semi-classical description to characterize relativistic quantum theories evolving on Riemannian and pseudo-Riemannian spacetime manifolds and interacting with Yang-Mills fields is currently underway.

B.W. Southern:

The nature of excitations in both regular lattices and disordered systems is being investigated using scaling techniques. Quantum spin chains are being studied in an attempt to understand the differences between integer and half-integer spin systems. A study of the effects of disorder on the nature of phase transitions is also in progress.

The disorder can be due to the fact that the degrees of freedom in the problem are not located at the sites of a perfect crystal or due to the fact that the interactions have a distribution of possible values. Both real space renormalization group methods and transfer matrix methods are used to study the relationship between the critical exponents of Ising models on these structures and the geometrical properties, and to explore questions about universality in these systems.

J.P. Svenne:

The investigation on the $\pi - NNN$ system has concerned up to now the absorption channel. Absorption amplitudes have been derived for the pion-induced break-up of the ^3He target into both two clusters and three free nucleons. Both one- and two-body elementary absorption mechanisms have been considered and harmonized with a dynamically correct few-body theory. As a consequence it is now possible to calculate absorption contributions in which the energy and momentum of the incoming pion are shared among all the three nucleons. Finally Weinberg's quasiparticle expansion has been employed for the reduction of the multi-dimensional Faddeev-Alt-Grassberger-Sandhas equations into an effective two-body, Lovelace-type equation. The numerical reliability of Weinberg's expansion has also been studied.

Presently we are investigating the numerical treatment of the equations leading to the above-mentioned three-body contributions and the possible generalization of the present work towards a unitary description of the $\pi NNN - NNN$ System.

John M. Vail:

My research is concerned with developing and applying methods to simulate the properties of solid materials. Reliable simulation is an important complement to experiment in studying material properties where subtle variations of chemical composition, crystal structure, electronic configuration, and disorder are crucial, or where time scales, and temperature and pressure regimes are experimentally inaccessible. In 1984, with collaborators, we made a major advance in the atomistic simulation of point defects in ionic materials by combining accurate electronic structure methods for the defect with total energy analysis of the crystal. The method includes consistent boundary conditions, the quantum-mechanical ion-size effect, and lattice distortion and polarization, and is embodied in an automated user-friendly program. The method has been applied to optical and spin resonance properties of color centers and impurities, derivation of effective interatomic forces, hole trapping by impurities in oxides, and quantum diffusion.

Four projects are currently in progress: (1) simulation of complicated impurity F-type centers, such as $(F_2^+)^*$ in NaF:Mg; (2) overlap effects from the embedding region in the simulation of defects by small clusters (collaboration at Virginia Commonwealth University); (3) simulation of ultrafine particles of insulating materials (collaboration at

Michigan Technological University); (4) a study of the effect of impurities on property changes in metals due to irradiation damage (collaboration with AECL, Pinawa).

D. Vincent:

My general research interests lie in gravitation theory and early universe cosmology. I am currently involved with calculations on multidimensional cosmology solutions of Einstein's equations which have relevance to the cosmological constant problem and the Anthropic Principle. I am also investigating bubble solutions in 2+1 gravity using Ashtekar's gravitational formalism.

J.G. Williams:

One of the developing trends in general relativity has been the interest in global, as opposed to local, properties of spacetime. My current research uses techniques of differential geometry and algebraic topology to study general relativistic metrics that represent homotopically nontrivial light cone configurations on spacetime manifolds that can be either simply or multiply connected. Progress to date includes the discovery of a number of perfect fluid solutions to the classical Einstein equations representing such twists in the light cone field. Work in 2+1 dimensions has demonstrated the existence of similar interesting solutions for the Einstein-Maxwell equations for a fluid with rotation and electric charge. For (2+1)-dimensional relativity, the manifold that forms the range of mapping for the light cone field has no natural group structure and is merely a *set*. Because of this, the homotopy analysis of the metric tensor bundle is considerably more complicated than in the usual (3+1)-dimensional case, and new kinds of topological invariants have been shown to arise. Future effort will be directed towards studying the quantization of scalar fields in these kinds of non-globally hyperbolic spacetimes.

J.A. Zuk:

The methods of quantum field theory are applied to problems in both condensed matter and elementary particle physics. In condensed matter physics, attention is focused on conductance and conductivity of electrons in disordered media, where such systems are described by random Hamiltonians. The general technique employs the representation of transport coefficients in terms of a generating functional involving integration over both commuting and anti-commuting variables. The direct ensemble averaging of the generating functional maps the problem onto a theory of interacting graded matrices of the non-linear sigma-model type. Applications to mesoscopic systems include universal conductance fluctuations in short wires and Altshuler-Aaronov-Spivak oscillations of the magneto-conductance in small disordered rings. The scattering-theoretic foundations enable a full account of the finite extent of such systems and their coupling to the external contacts and leads. Also of interest is the integer quantum Hall effect, studied from the point of view of localization theory, in terms of an effective non-linear sigma-model with topological term, defined on a supersymmetric coset manifold.

In particle physics, the emphasis is on the construction and analysis of low-energy effective theories of fundamental interactions. Therefore, the development of systematic, analytical low-energy expansion techniques for the evaluation of the effective action is investigated. These have been applied to the chiral soliton model, which can be thought of as the simplest low-energy approximation to QCD. It involves the chiral coupling of quark bilinears with auxiliary pion fields; is accompanied by a finite ultraviolet cut-off, determined by fitting the observed pion decay constant; and possesses a static soliton solution which, when coupled to valence quarks, may be viewed as a model of the nucleon. The implied self-consistent calculation of the chiral soliton necessitates integrating out the quark fields — leaving a highly non-local effective action of the meson fields. Systematic analytical approximations that preserve the important non-local nature of the problem, and provide a tractable approach to extracting physical results, have been developed. They lead to an explicit self-consistent integral equation for the soliton profile, from which the nucleon mass and size can be deduced, and which greatly reduces the numerical effort required as compared with the 'exact' procedure of computing and summing a complete set of Dirac eigenvalues at each step of the self-consistent iteration. The calculation of nucleon observables such as the moment of inertia and magnetic moments is also amenable. Applications to the Weinberg-Salam theory and models of polymers are also envisaged.

4. PUBLICATIONS OF MEMBERS

(a) **Refereed Journals**

1. **P.G. Blunden** and D.O. Riska, (1992), "The isoscalar electromagnetic current operator and the nucleon-nucleon interaction," Nucl. Phys. **A536**, 697-715.
2. K. Tsushima, D.O. Riska and **P.G. Blunden**, "The Electromagnetic exchange current, the nucleon-nucleon interaction and nuclear magnetic moments," University of Helsinki preprint HU-TFT-92-27, Nucl. Phys. **A.** (in press).
3. **V.B. Cherepanov**, (1991), "On the threshold of parametric instability of spin waves in a film with rough surface,"J. Appl. Phys., **69**, 8, 5733-5735.
4. **V.B. Cherepanov**, (1991), "On time dependence of spin wave damping in short pulses," J. Appl. Phys., **69**, 8, 6216-6218.
5. **V.B. Cherepanov**, (1992), "Influence of weak localization on the threshold of parametric excitation of magnons in low-dimensional magnets," Phys. Rev. **B45**, 12397-12404.
6. **V.B. Cherepanov**, (1992), I.V. Kolokolov and V.S. L'vov, "The saga of YIG or spectra, thermodynamics, interaction and relaxation of magnons in a complex magnet," Phys. Reports (in press).
7. **R. Kobes**, (1992), "Feynman rules for response functions at thermal equilibrium", Phys. Rev. **B45**, 3230–3235.
8. **R. Kobes**, (1992), "Comment on : Causal structure of the thermal propagator in real time formalisms", (1992) Z. Phys. **C53**, 537.
9. **R. Kobes**, **G. Kunstatter** and K. Mak, (1992), "Fermion damping in hot gauge theories", Phys. Rev. **D45**, 4632-4639.
10. **G. Kunstatter**, (1992), "Dirac vs. Reduced Quantization: A Geometrical Approach", Class. Qu. Grav. **9**, 1469-1485.
11. R. Baier, **G. Kunstatter** and D. Schiff, "High Temperature Fermion Damping Rate: Resummation and Gauge Independence", (1992), Phys. Rev. **D45** (Rapid Communications), R4381-R4384.
12. R. Baier, **G. Kunstatter** and D. Schiff, "Gauge Dependence of the Resummed Thermal Gluon Self-Energy", Nucl. Phys. **B** (in press).
13. X.H. Qu and **P.D. Loly**, (1992), "Two-Magnon excitations in the Heisenberg ferromagnet on the triangular lattice", J. Phys. Cond. Matter **4**, 5419-5432.
14. A.I. Mogilner and **P.D. Loly**, (1992), "Vanishing gaps in 1D bandstructures,' J. Phys. A: Math. Gen. **25**, L855-860.

15. F.H. Molzahn, **T.A. Osborn** and S.A Fulling, (1992), "Multi-scale semiclassical approximations for Schrodinger Propagators on Manifolds," Annals of Physics **214**, 102-141.

16. V.B. Cherepanov, S.L.M. Cyr and **B.W. Southern**, (1992), "Metastable states of the Potts Glass," J. Phys. A: Math. Gen. **25**, 4347-4358.

17. Y. Achiam and **B.W. Southern**, (1992), "Critical dynamics of the alternating bond kinetic Ising model," J. Phys. A: Math. Gen. **25**, L769-773.

18. R. Pandey, X. Yang, **John M. Vail** and J. Zuo, (1992), "Derivation of pair potentials from first principles and simulation of NaF clusters," Solid State Communications **81**, 549-552.

19. **J.G. Williams** and P. Zvengrowski, (1992), "Kink metrics in (2+1)-dimensional space-time," J. Math. Phys. **33**, 256-266.

20. **J.G. Williams**, K.A. Dunn and T.A. Harriott, (1992), "Toy model for gravitational kinks," J. Math. Phys. **33**, 1437-1444.

21. **J.G. Williams**, K.A. Dunn and T.A. Harriott, (1992), "FLRW kinks," Physics Letters **A163**, 152-154.

22. **C.H. Woo**, (1992), "Rate theory analysis of radiation damage effects near surfaces in hexagonal metals," *Phil. Mag.* **63** 915.

23. **C.H. Woo** and B.N. Singh, "Production bias due to clustering of point defects in irradiation- induced cascades," *Phil. Mag.* **A65** 889 (1992).

24. **C.H. Woo** and F.A. Garner, "A SIPA-based theory of irradiation creep in the low-swelling rate regime," *J. Nucl. Mater.* (in press).

25. **C.H. Woo**, B.N. Singh and F.A. Garner, "Production bias, A new driving force for void swelling under cascade damage conditions," *J. Nucl. Matter* (in press).

26. C.N. Tome, C.B. So and **C.H. Woo**, "Self-consistent calculation of steady-state creep and growth in textured zirconium," *Philos. Mag.* (accepted for publication).

27. I. Adjali, I.J.R. Aitchison & **J.A. Zuk**, (1992), "The two-point approximation for the casimir energy in the self-consistent chiral soliton model of the nucleon," Nuclear Physics **A537**, 457-485.

28. **J.A. Zuk**, (1992), "Cooperons from statistical scattering theory, with application to the disordered ring," Physical Review **B45**, 8952-8969.

29. **J.A. Zuk** & I. Adjali, (1992), "On the two-point approximation to the effective chiral action for large solitons," International Journal of Modern Physics **A7**, 3549-3565.

30. **J.A. Zuk**, (1992), "Eigenvalue problem for tridiagonal matrices arising in the scattering- theory analysis of disordered conductors," Canadian Journal of Physics, **70**, 257-267.

(b) **Articles in Books and Conference Proceedings**

1. **R. Kobes**, (1992), (invited), "Gauge independence of the plasmon pole," in *Hot summer daze: BNL summer study on QCD at nonzero temperature and density*, edited by A. Gocksch and R.D. Pisarski, (World Scientific Singapore, 1992), 78–84.
2. **G. Kunstatter**, "The Great Plasmon Puzzle Resolved", Proceedings of the Workshop on Heavy Ion Physics, Budapest, eds. T. Csorgo, S. Hegyi, B. Lukacs and J. Zimanyi (1991).
3. **G. Kunstatter**, "Path Integral for Gauge Theories: a Geometrical Approach", Proceedings of Les Journees Relativistes 1991, Class. Qu. Grav. 9, S157-S168 (1992).
4. **J.M. Vail**, R. Pandey and A. B. Kunz, "Embedded quantum cluster simulation of point defects and electronic band structures of ionic crystals," in Quantum Mechanical Cluster Calculations in Solid State Studies, ed. R.W. Grimes,C.R.A. Catlow, and A.L. Shluger (World Scientific, Singapore, 1992), pp. 181-223. Invited review paper.
5. **J.G. Williams**, K.A. Dunn and T.A. Harriott, "Kinks in 1+1, 2+1 and 3+1 dimensions," pp. 360-363, *Proceedings of the 4th Canadian Conference on General Relativity and Relativistic Astrophysics*, edited by G. Kunstatter, D.E. Vincent and J.G. Williams (World Scientific, Singapore, 1992).
6. **J.G. Williams** and P. Zvengrowski, "2+1 gravity kinks for multiply connected spacetime manifolds," pp. 364-367, *Proceedings of the 4th Canadian Conference on General Relativity and Relativistic Astrophysics*, edited by G. Kunstatter, D.E. Vincent and J.G. Williams (World Scientific, Singapore, 1992).
7. **C.H. Woo**, R.A. Holt and M. Griffith, "Anisotropic diffusion of point defects: effects on irradiation deformation," *Materials Modeling: from Theory to Technology.* Institute of Physics Pulbishing, Bristol and Philadelphia, 1992, p. 55.
8. B.N. Singh and **C.H. Woo**, "Collision cascades and defect accumulation during irradiation," *Materials Modeling: from Theory to Technology.* Institute of Physics Publishing, Bristol and Philadelphia, 1992, p. 117.

(c) **Books Edited**

1. **G. Kunstatter, D. Vincent** and **J.G. Williams**, *Proceedings of the 4th Canadian Conference on General Relativity and Relativistic Astrophysics* (World Scientific: Singapore 1992).

(d) **Invited Conference Presentations (Unpublished)**

1. **R. Kobes**, (1992), "The retarded product at finite temperature," talk presented at the 1992 Bielefeld workshop on finite temperature field theory (May, 1992: Bielefeld, Germany).
2. **G. Kunstatter**, "Gauge (In-)Dependence at Finite Temperature," Workshop on Finite Temperature Field Theory, Bielefeld, May, 1992.
3. G. Cattapan, L. Canton, G. Pisent, G.H. Rawitscher, **J.P. Svenne**, "Perspectives in Theoretical Nuclear Physics," *Proceedings of the IV Convengo su problemi di fisica teorica*, EIPC, Maciana Marina, Italy, (ETS, Pisa, 1991) pp. 170-179.
4. L. Canton, G. Cattapan, G. Pisent and **J.P. Svenne**, "Few-Body Dynamics in Pion Absorption" on 3He," by L. Canton, invited paper at the "workshop on mathematical aspects of quantum scattering theory and applications," St. Petersburg, USSR.
5. **J.M. Vail**, B.K. Rao and J. Niu, "Overlap effects from the embedding region in the simulation of solids by small clusters," paper Tu-89, International Symposium on the Physics and Chemistry of Finite Systems: From Clusters to Crystals, a NATO Advanced Workshop, Oct. 8-12, 1991, at Richmond, VA.
6. **J.M. Vail** and Z. Yang, "A new method for simulating complicated electronic defects in insulators," paper 14-SI-92, in symposium on Bulk and Interfacial Electronic Structure of Ceramics, 94th Annual Meeting of the American Ceramic society, April 12-16, 1992 at Minneapolis, MN.
7. **J.G. Williams**, "Kinks in the general relativistic metric," presented at the Canadian Association of Physicists 1992 Congress held at the University of Windsor, 14-17 June 1992.
8. B.N. Singh and **C.H. Woo**, "Role of interstitial clustering and production bias in defect accumulation during irradiation at elevated temperatures," (Invited paper, *International Conference on Physics of Irradiation Effects in Metals*, Siofolk, Hungary, 1991). *Matter. Sci. Forum.* 97-99 (1992) 75.

5. ACTIVITIES OF INSTITUTE

1. VISITORS (Sept./91 - Aug./92)

Name	Affiliation	Period
R. Baier	University of Bielefeld	July 19 - Aug. 2
A.O. Barvinsky	University of Alberta	July 15-Oct. 1
M. Butler	Queens University	April 12-19
L. Canton	Padua University	Sept. 8-10
P. Carra	ESRF,Grenoble	Feb. 6-8/92
M. Carrington	I.T.P., Univ. of Minnesota	Jan.6-Jan.9
G. Cattapan	Padua University	Sept. 21-Oct. 5
Y. Fujiwara	Kyoto University	Sept. 9-14
J. Gegenberg	Univ. of New Brunswick	June 20- June 28
W. Israel	University of Alberta	Nov.18-20
V.I. Kukulin	Moscow State University	April 27-July 17
I. Lawrie	University of Leeds	July 2-July 20
J. Madore	L.P.T.H.E., Orsay	Sept.28-Oct.3
A. Slavin	Oakland University	Dec. 16-22
G.A. Vilkovisky	C.E.R.N. and Lebedev	March 28-April 3
J. Whitehead	Memorial University	March 30-April 4

2. SEMINARS

DATE	SPEAKER	TITLE
Sept. 13/91	Y. Fujiwara	*Mesonic Decay Widths of P-Wave Baryons in a Quark Cluster Model*
Sept. 25/91	A.O. Barvinsky	*Semiclassical Approximation in Quantum Cosmology*
Sept. 30/91	G. Cattapan	*Few Body Aspects of Pion Absorption on A = 3 Nuclei*
Oct. 1/91	J. Madore	*Non-Commutative Geometry Physics*
Nov. 19/91	W. Israel	*Black Holes: The Inside Story*
Nov. 27/91	A. Mogilner	*On the Question of Vanishing Gaps in 1D Bandstructures*
Dec. 17/91	A. Slavin	*Nonlinear Spin Wave Dynamics in Ferromagnet Films: Envelope Solitons, Modulational Instability & Transition to Chaos*
Jan. 8/92	M.Carrington	*The Effective Potential at Finite Temperature in the Standard Model*
Feb. 7/92	P. Carra	*X-ray Circular Dichroism as a Probe of Orbital Magnetisation*

2. Seminars (cont'd.)

DATE	SPEAKER	TITLE
Feb. 19/92	T.A. Osborn	*The Quantum Classical Interface in Curved Spacetime*
March 31/92	G.A. Vilkovisky	*Gravitational Collapse as a Problem in Expectation Values*
April 2/92	J. Whitehead	*A Mean Field Approach to Phase Transitions in Biological Membranes*
April 14/92	M. Butler	*Neutrino Mass Models & the Solar Neutrino Problem*
June 11/92	R. Epp	*Symmetries & the Extended vs. Reduced-Quantization Factor Ordering Ambiguity*
June 23/92	J. Gegenberg	*Gravity & Geometry: The New Eightfold Way*
July 9/92	I. Lawrie	*Dissipation in Non-Equilibrium Field Theory*
July 28/92	R. Baier	*Photons as a Signal for the Quark-Gluon Plasma*

3. WORKSHOPS AND CONFERENCES

Workshop on Perturbative Methods in Hot Gauge Theories

University of Winnipeg, 20-25 July 1992

Gauge theories at finite temperature have been of interest for around 30 years. This field has experienced a considerable increase in activity in recent years in connection with new heavy ion accelerators that are currently being built. Of particular interest is the possibility of seeing for the first time at these accelerators signals for the existence of a new state of matter: the quark-gluon plasma. Much of the theoretical work in high temperature gauge theories has therefore been directed at some of the problems and ambiguities that arise in calculations of specific properties of this plasma, and progress has been rapid and often controversial.

The workshop focussed on a recently developed perturbative scheme [E. Braaten and R. Pisarski, Phys. Rev. Letts. 64, 1338 (1990)], which goes a long way towards solving many of these problems. The aim of the workshop was to explore various aspects of these methods, and also to provide ideas and directions for further work in this area.

The workshop was attended by 20 experts from all over the world. The size and format of the workshop reflected the emphasis on discussions and working sessions: there were only two or three seminars per day, with the remainder of the time devoted to more informal discussion. A list of participants and seminar topics is given on the next page. The Proceedings of the workshop, including write-ups of seminars and contributions by participants, will be published in Canadian Journal of Physics, hopefully as a special issue. The organizers of the Workshop were R. Kobes and G. Kunstatter of the University of Winnipeg.

List of Participants

Name	Affiliation	Title of Talk
P. Aurenche	Annecy	
R. Baier	Bielefeld	*Gauge dependence of the gluon self energy (I)*
E. Braaten	Northwestern	*Effective field theory approach to thermal field theoric*
M. Carrington	Minnesota	
T. Evans	Imperial College	*Zero momenta Green functions at finite temperature*
J. Kapusta	Minnesota	*Screening of static electric fields in hot QCD*
P. Kelly	Winnipeg	
R. Kobes	Winnipeg	
G. Kunstatter	Winnipeg	*Gauge dependence of the gluon self energy (II)*
I. Lawrie	Leeds	
K. Mak	Manitoba	*Fermion damping in hot gauge theories*
H. Nakkagawa	Nara	*Gauge-dependence problem of the fermion damping r*
A. Niegawa	Osaka	*Calculational rules of reaction rates in a finite closed*
R. Pisarski	Brookhaven	*Z(N) domains in hot gauge theories*
D. Schiff	Orsay	
A. Smilga	Moscow	*Anomolous damping in Boltzmann plasma*
J. C. Taylor	Cambridge	*Hard hot loops in curved spacetime*
M. Thoma	Munich	*Hartree approximation for QCD at finite temperature*
M. van Eijick	Amsterdam	
H. A. Weldon	West Virginia	*Quantum mechanics of hard thermal loops*

6. Appendix: E-Mail Addresses and Telephone Numbers

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