ATLANTIC GENERAL RELATIVITY MEETING (AGR) AND THEORY CANADA 6 CONFERENCE (TC6) REPORT

Corner Brook, NL (June 10-12/11)

The AGR meeting and TC 6 conference were two very successful events which were jointly held at Grenfell campus of Memorial University. The events were held June 10-12/2011. In brief, the following topics where covered:

- General Relativity
- Advances in Nuclear and Particle Theory
- New Developments in Mathematical Physics and Field Theory
- Quantum Information
- Cosmology

The topics covered have initiated lively discussions and certainly had a strong educational value for attending students.

In total 41 participants have attended, with 25 presentations plus one public lecture. In details we had 18 students/postdoctoral fellows and 24 professors. We had 10 regional and 31 national participants attended. For more details please follow the link to the conference website: http://www.hep-atlantic.ca/TC6/

In terms to facilitate transportation for all arriving participants from Deer Lake airport to Corner Brook, as well as transportation to St. John's campus of MUN for the CAP Congress for 20 participants we had to charter a bus from "Buckle's Bussing" company. Associated cost corresponds to the item #2 of "Financial Report". We would greatly appreciate if AARMS could cover an invoice associated with that part of our conference expenses.

To this brief report, please find attached "Financial Report", "Book of Abstracts" and "Conference Photo".

On behalf of the organizing committee I would like to thank the Atlantic Association for Research in the Mathematical Sciences for generous support without which this conference would not be such a successful event.

Please let me know if you require any additional information.

Sincerely,

Dr. Aleksandrs Aleksejevs
Assistant Professor
Physics/Mathematics
Grenfell campus of Memorial University
Corner Brook, NL

Item	Date	Details	Amount	Sponsor
1	Jun 9/11	Bus transportation -Gros Morne Excursion	$1,000.00	DTP reserves
2	Jun 12/11	Bus transportation - Corner Brook to St. John's (CAP) and airport	$2,300.00	AARMS
3a	Jun 9-12/11	Dormitory accommodations for 7 participants (not students/postdocs)	$555.00	CITA
3b	Jun 9-12/11	Dormitory accommodations for 7 participants (not students/postdocs)	$555.00	PI
4	Jun 10/11	Bar services for reception	$542.34	DTP reserves
5	Jun 10/11	Catering services for reception	$794.44	PI
		Subtotal	**$5,746.78**	
		HST (13%):	**$747.08**	
6	Jun 9-12/11	Dormitory accommodations for 18 participants (students/postdocs)	$1,545.84	Grenfell VP
7	Jun 9-12/11	Six coffee breaks for AGR and TC6	$1,313.96	Grenfell VP
8	Jun 10/11	Gratuity (catering/bar services)	$91.62	DTP reserves
9	May 27/11	Office supplies (clip boards)	$197.75	Grenfell VP R
10	Jun 2/11	Conference supplies (mugs)	$224.87	PI
11	Jun 9/11	Conference registration fee (for participants not going to CAP)	-$80.00	
12	Jun 12/11	Conference services admin fee	$372.90	Grenfell VP
		Subtotal	**$3,666.94**	
		Total:	**$10,160.80**	

Item	Breakdown by sponsor:	Amount (CAD)
1	PI	$1,749.74
2	CITA	$627.15
3	AARMS	$2,599
4	DTP reserves	$1,834.46
5	Grenfell VicePresident	$3,232.70
6	Grenfell VP Research	$197.75
7	AGR + TC6 registration fee	-$80.00
	Total:	**$10,160.80**

Atlantic General Relativity Meeting

Theory Canada 6

Corner Brook

Newfoundland

June 10-12, 2011

Friday, June 10

The Atlantic General Relativity Meeting

Room LC301, Library and Computing Building

9:00-09:30am	*Registration, Coffee*
9:30-10:15am	Jack Gegenberg, University of New Brunswick "Holography and the Tomimatsu-Sato Spacetime"
10:15-11:00am	Tomas Liko, University of Alberta "The Area Theorem and Gauss-Bonnet Gravity"
11:00-11:45am	Tim Taves, University of Winnipeg/Manitoba "Gravitational Collapse using the RST Model"
11:45am-2:00 pm	*Lunch*
2:00-2:45 pm	Viqar Husain, University of New Brunswick "Gravitational Collapse and Cosmology with Dust Time"
2:45-3:15 pm	Aida Ahmadzadegan, Memorial University of Newfoundland "Perturbations of Large Ads Black Holes and the Fluid/Gravity Correspondence"
3:15pm-3:30 pm	*Coffee Break*
3:30-4:00 pm	Andrew Day, Memorial University of Newfoundland "External Matter Fields in Distorted Black Hole Spacetimes"
4:00-4:45 pm	Ivan Booth, Memorial University of Newfoundland "Trapped and Marginally Trapped Surfaces in Weyl-Distorted Schwarzschild Solutions"
8:30am-4:30pm	*Bus Tour to Gros Morne National Park for TC6 Delegates* *Meet at the front entrance of Fine Arts Building*

Saturday, June 11

The Theory Canada 6 Conference

Room LC301, Library and Computing Building

09:00-9:45 am	*Registration, Coffee*
9:45am-12:20pm	***Session I: Advances in Nuclear and Particle Theory*** Session Chair: Juris Svenne
9:45-10:00am	Welcoming Remarks
10:00-10:30am	Andrzej Czarnecki, University of Alberta "Exotic Decays of the Muon"
10:30-11:00am	Jim Cline, McGill University "Electroweak Baryogenesis and B Meson Anomalies"
11:00-11:20am	*Coffee Break*
11:20-11:40am	Gennady Chitov, Laurentian University "Quintessence Coupled to the Neutrinos and the Late-Time Acceleration of the Universe"
11:40-12:00pm	Matthew Williams, McMaster University "New Constraints (and Motivations) for Abelian Gauge Bosons in the MeV-TeV Mass Range"
12:00-12:20pm	Alexander Chigodaev, York University "Interparticle Forces in Scalar QFTs with Non-Linear Mediating Fields"
12:20-2:00pm	*Lunch*

2:00-4:00pm	***Session II: New Developments in Mathematical Physics and Field Theory*** Session Chair: Manu Paranjape
2:00-2:30pm	Arundhati Dasgupta, Lethbridge University "Time in Quantum Gravity"
2:30-3:00pm	Todd Fugleberg, Brandon University "Cutting Rules in Thermal Field Theory"
3:00-3:20pm	Alexandre Yale University of Waterloo/Perimeter Institute "Holographic Entanglement Entropy"
3:20-3:40pm	Sean Stotyn, University of Waterloo "Locally Stable Kaluza-Klein Bubbles"
3:40-4:00pm	*Coffee Break*
4:00-5:00pm	***Session III: Quantum Information*** Session Chair: Richard MacKenzie
4:00-4:30pm	Karl-Peter Marzlin, St. Francis Xavier "Single-photon Excitation of Atoms in the Presence of Surface Plasmons"
4:30-5:00pm	Mohammad Ansari, IQC Waterloo "Critical Current Noise in Josephson Junction"
8:00-10:00pm	*Joint AGR/TC6 Reception* *Atrium, Fine Arts Building*

Sunday, June 12

The Theory Canada 6 Conference

9:30am-12:20pm	***Session IV: General Relativity and Cosmology*** Session Chair: Arundhati Dasgupta
9:30-10:00am	Misha Smolkin, Perimeter Institute for Theoretical Physics "The Black Hole Dynamics from the Perspective of an Effective Field Theory"
10:00-10:20am	Manu Paranjape, Université de Montréal "Gravitational Waves in Conformal Gravity"
10:20-10:40pm	Louis Leblond, Perimeter Institute for Theoretical Physics "de Sitter Space at 1-loop"
10:40-11:00pm	*Coffee Break*
11:00-11:20pm	Sarah Shandera, Perimeter Institute for Theoretical Physics "New Observational Power in Halo Bias"
11:20-11:40am	Miok Park, University of Waterloo "Deformations of Lifshitz Holography in Higher Dimensions"
11:40-12:00pm	Paul McGrath, University of Waterloo "Rigid Quasilocal Frames and Time-Dependent Rotation"
12:00-2:00pm	*Lunch*
2:00pm	*Bus to St. John's* *Meet at the front entrance of Fine Arts Building*

Abstracts

Atlantic General Relativity Meeitng

Friday, June 10/2011
Location: LC301, Library and Computing building

9:30 - 10:15 a.m.

HOLOGRAPHY AND THE TOMIMATSU-SATO SPACETIME

Jack Gegenberg, *University of New Brunswick*

We analyze the $\delta = 2$ Tomimatsu-Sato spacetime in the context of the proposed Kerr/CFT correspondence. This 4-dimensional vacuum spacetime is asymptotically flat and has a well-defined ADM mass and angular momentum, but also involves several exotic features including a naked ring singularity, and two disjoint Killing horizons separated by a region with closed timelike curves and a conical singularity. We demonstrate that the near horizon geometry belongs to a general class of Ricci-flat metrics with $SL(2,\mathbb{R}) \times U(1)$ symmetry that includes both the extremal Kerr and extremal Kerr-bolt geometries. We calculate the central charge and temperature for the CFT dual to this spacetime and confirm the Cardy formula reproduces the Bekenstein-Hawking entropy. We find that all of the basic parameters of the dual CFT are most naturally expressed in terms of charges defined intrinsically on the horizon, which are distinct from the ADM charges in this geometry.

E-mail: geg@unb.ca

10:15 - 11:00 a.m.

THE AREA THEOREM AND GAUSS-BONNET GRAVITY

Tomáš Liko, *University of Alberta*

The area theorem, or second law of black-hole mechanics, asserts that the surface area of a black hole will increase in a physical process if the stress-energy tensor satisfies the dominant energy condition. For Gauss-Bonnet gravity, it is shown that there is a lower bound on the Gauss-Bonnet parameter α for which the area theorem will be violated when two black holes merge. For two Schwarzschild black holes, in particular, this implies that the area theorem will be violated if α is greater than the product of the masses of the black holes before merging minus a correction due to radiation that may be lost by gravitational waves during the merging process.

E-mail: tliko@math.ualberta.ca

11:00 - 11:45 a.m.

GRAVITATIONAL COLLAPSE USING THE RST MODEL

Tim Taves, *University of Winnipeg/Manitoba*

Gabor Kunstatter
University of Winnipeg

Supported by the University of Manitoba - Faculty of Science and the Natural Science and Engineering Research Council of Canada

*E-mail:*timtaves@gmail.com

2:00 - 2:45 p.m.

GRAVITATIONAL COLLAPSE OF QUANTUM MATTER

Viqar Husain, *University of New Brunswick*

I will describe exactly solvable models for gravitational collapse with classical and quantum matter. Both cases exhibit evolving and evaporating horizons. The case of polymer quantized matter, where a length scale enters the quantum theory, leaves flat spacetime as the end point of collapse – remarkably without quantum gravity.

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2:45 - 3:15 p.m.

GRAVITATIONAL COLLAPSE AND COSMOLOGY WITH DUST TIME

Aida Ahmadzadegan, *Memorial University of Newfoundland*

The canonical form of the perturbation metric of anti-de Sitter black holes in four dimensions is derived by choosing the 'Regge-Wheeler gauge' in the standard Schwarzschild coordinates (t, r, θ, ϕ). By assuming the perturbations to be small, the differential equations governing the perturbations are obtained from the equations $\delta R_{\mu\nu}(h) = 0$. Then, by taking the limit of $m >> R$ where R is the radius of AdS space, the perturbation metric and field equations of large AdS black holes are found. Finally, under the shadow of AdS/CFT correspondence, these perturbations can be compared to their corresponding three-dimensional theory of fluid dynamics in the dual space.

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3:30 - 4:00 p.m.

EXTERNAL MATTER FIELDS IN DISTORTED BLACK HOLE SPACETIMES

Andrew Day, *Memorial University of Newfoundland*

Ivan Booth
Memorial University of Newfoundland

We investigate the energies required to distort a Schwarzschild black hole to a distorted Weyl black hole through dipole and quadrupole distortions. The energies are found using the Dermois-Israel thin shell formalism by embedding a piece of the distorted spacetime into the exterior of the Schwarzschild spacetime and calculating the stress-energy tensor of the resulting thin shell.

Natural Sciences and Engineering Research Council of Canada
*E-mail:*w65acd@mun.ca

4:00 - 4:45 p.m.

TRAPPED AND MARGINALLY TRAPPED SURFACES IN WEYL-DISTORTED SCHWARZSCHILD SOLUTIONS

Ivan Booth, *Memorial University*

Terry Pilkington
Memorial University

To better understand the allowed range of black hole geometries, we consider Weyl-distorted Schwarzschild solutions. They always contain trapped surfaces, a singularity and an isolated horizon and so should be understood to be (geometric) black holes. However, we show that for large distortions the isolated horizon is neither a future outer trapping horizon (FOTH) nor even a marginally trapped surface: slices of the horizon cannot be infinitesimally deformed into (outer) trapped surfaces. We consider the implications of this result for popular quasilocal definitions of black holes.

NSERC
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The Theory Canada 6 Conference

Saturday, June 11/2011
Location: LC301, Library and Computing building

Session I: Advances in Nuclear and Particle Theory (10:00 - 12:20 p.m.)

10:00 - 10:30 a.m.

EXOTIC DECAYS OF THE MUON

Andrzej Czarnecki, *University of Alberta*

Recent results on the decay of a muon bound in an atom will be reviewed. High-energy electrons produced in such decays are a background in searches for the muon-electron conversion. Experimental plans for those searches will be discussed.

Supported by Science and Engineering Research Canada.

*E-mail:*andrzejc@ualberta.ca

10:30 - 11:00 a.m.

ELECTROWEAK BARYOGENESIS AND B MESON ANOMALIES

Jim Cline, *McGill University*

The D0 experiment at Tevatron has found preliminary evidence for new CP violation beyond the standard model, through an anomalous asymmetry in like-sign muons from $B_{s,d}$ decays. The observation can be explained in a two-Higgs doublet extension of the standard model, with minimally flavor violating couplings. We investigate whether this model can also lead to the observed baryon asymmetry of the universe through electroweak baryogenesis (EWBG). We find that because of stringent particle physics constraints, it is difficult to simultaneously get a large enough baryon asymmetry and like-sign dimuon excess. We implement significant improvements over previous studies of EWBG in two-Higgs doublet models.

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*E-mail:*jcline@physics.mcgill.ca

11:20 - 11:40 a.m.

QUINTESSENCE COUPLED TO THE NEUTRINOS AND THE LATE-TIME ACCELERATION OF THE UNIVERSE

Gennady Y. Chitov, *Laurentian University*

The origin of the neutrino mass, dark matter (DM), and dark energy (DE) are among the most challenging problems of fundamental physics. We address these questions from analyses of the Neutrino – DE interacting model (a version of the Mass Varying Neutrino scenario).

We assume the Ratra-Peebles quintessence potential represents the DE. The thermal/temporal evolution of the model is analyzed. Following the time arrow, the stable, metastable and unstable phases are predicted. The present Universe is below its critical temperature: it underwent a first-order phase transition from the metastable oscillatory to the unstable rolling regime of the quintessence field. Choosing $M \sim 10^{-3}\, eV$ to match the present DE density, we obtain the present neutrino mass in the range $m \sim 10^{-2} - 1\, eV$ and consistent estimates for other parameters of the Universe.

NSERC, LURF.

E-mail: gchitov@laurentian.ca

11:40 - 12:00 p.m.

NEW CONSTRAINTS (AND MOTIVATIONS) FOR ABELIAN GAUGE BOSONS IN THE MEV-TEV MASS RANGE

Matthew Williams, *McMaster University*

C.P.~Burgess

McMaster University, Perimeter Institute

Anshuman Maharana

University of Cambridge

F.~Quevedo

University of Cambridge, Abdus Salam ICTP

In this talk I'll give a brief overview of the work presented in hep-ph/1103.4556, where we survey the phenomenological constraints on abelian gauge bosons in terms of the three parameters that in general describe the low-energy properties of such bosons: their mass (taken to be in the MeV-TeV range) and their two possible types of dimensionless couplings (direct couplings to ordinary fermions and kinetic mixing with Standard Model hypercharge). We also argue that gauge bosons with very small couplings to ordinary fermions in this mass range are natural in string compactifications and are likely to be generic in theories for which the gravity scale is systematically smaller than the Planck mass – such as in extra-dimensional models – because of the necessity to suppress proton decay.

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12:00 - 12:20 p.m.

INTERPARTICLE FORCES IN SCALAR QFTS WITH NON-LINEAR MEDIATING FIELDS

Alexander Chigodaev, *York University*

We study the interparticle potentials for few-particle systems in a scalar theory with a non-linear mediating field of the Higgs type. We use the variational method, in a reformulated Hamiltonian formalism of QFT, to derive relativistic three and four particle wave equations for stationary states of these systems. We show that the cubic and quartic non-linear terms modify the attractive Yukawa potentials, which are dominant at small interparticle distances, by new terms that produce confining and quasi-confining interparticle potentials.

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Session II: New Developments in Mathematical Physics and Field Theory (2:00 - 4:00 pm)

2:00 - 2:30 p.m.

TIME IN QUANTUM GRAVITY

Arundhati Dasgupta, *University of Lethbridge*

I shall discuss the nature of time in quantum gravity and examine whether semiclassical time can be used to resolve the question.

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2:30 - 3:00 p.m.

CUTTING RULES IN THERMAL FIELD THEORY

Todd Fugleberg, *Brandon University*

In this talk I will discuss a set of rules for calculating the imaginary part of self-energy diagrams in real time thermal field theory. The imaginary parts of self-energy diagrams in thermal field theory are important chiefly because of the information they provide about the decay and production rates of particles in a medium. These cutting rules are most easily illustrated in a diagrammatic representation which relates self energy diagrams to tree-level scattering amplitudes by "cutting" propagators in the Feynman diagrams. Determination of cutting rules in finite-temperature field theory has been a topic of interest for some time. The main advantage of the cutting rule formulation that I will discuss is that it should be provable to arbitrary loop order and I will give an outline of this proof.

Funded by NSERC

E-mail: fuglebergt@brandonu.ca

3:00 - 3:20 p.m.

HOLOGRAPHIC ENTANGLEMENT ENTROPY

Alexandre Yale, *University of Waterloo / Perimeter Institute*

Robert C Myers
Perimeter Institute

Janet Hung
Perimeter Institute

Misha Smolkin
Perimeter Institute

In conformal field theories, one can show that a measure of entanglement, called entanglement entropy, can be mapped to the thermodynamic entropy of some thermal state by a conformal transformation. Through a holographic duality between generalized theories of gravity in asymptotically AdS spacetimes and large families of conformal field theories, this allows us to provide a holographic derivation of this entanglement entropy and its generalization, Renyi entropy.

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3:20 - 3:40 p.m.

LOCALLY STABLE KALUZA-KLEIN BUBBLES

Sean Stotyn, *University of Waterloo*

I present a new 2-parameter family of static topological solitons in 5D minimal supergravity which are endowed with magnetic charge and mass. The solitons are asymptotically $R^4 \times S^1$, where the radius of the S^1 has a lower bound $R > R_{min}$. Setting up initial data on a Cauchy slice at a moment of time symmetry, I demonstrate that these solitons correspond to a perturbatively stable “small" static bubble as well as an unstable “large” static bubble. The energetics of the magnetic black string are then discussed and it is shown that the locally stable bubble is the end point of a phase transition for an appropriate range of black string parameters.

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Session III: Quantum Information (4:00 - 5:00 pm)

4:00 - 4:30 p.m.

SINGLE-PHOTON EXCITATION OF ATOMS IM THE PRESENCE OF SURFACE PLASMONS

Karl-Peter Marzlin, *St Francis Xavier University*

Jeremie Choquette
University of Calgary

Surface plasmons on a metal film can increase the light intensity near the film by several orders of magnitude. Using quantum electrodynamics in the presence of absorbing dielectrics, we examine whether surface plasmons can be used to achieve a high excitation probability, if an atom is placed near the metal film. For the case that the atomic spontaneous decay rate is not modified, excitation probabilities close to 90% are possible. However, if the change of the decay rate near an absorbing dielectric is taken into account, the maximum probability is reduced to 30%. Our findings are of relevance for many fields, including nonlinear optics at weak intensities, quantum information, and plasmon-enhanced Raman spectroscopy.

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4:30 - 5:00 p.m.

CRITICAL CURRENT NOISE AND RESONATORS IN JOSEPHSON JUNCTION

Mohammad H. Ansari, *Institute for Quantum Computing, University of Waterloo*

Frank K. Wilhelm

Institute for Quantum Computing, University of Waterloo, Canada and University of Saarland, Germany

The impact of trap states in the oxide layer of superconducting tunnel junctions, on the fluctuation of the Josephson current thus on coherence in superconducting qubits is discussed. Two mechanisms are usually involved: 1) the current blockage due to repulsion at the occupied trap states, and 2) the noise from electrons hopping across a trap. Based on these machanisms we extend previous studies of noninteracting traps to the case where the traps have on-site electron repulsion. We use second order perturbation theory which allows to obtain analytical results limited to small and intermediate repulsions. Remarkably, second order perturbation theory reproduces the main features of the model as identified from the Numerical Renormalization Group. We present analytical formulations for the subgap bound state energies, the singlet-doublet phase boundary, and the spectral weights. We show that interactions can reverse the supercurrent across the trap. We finally work out the spectrum of junction resonators for qubits in the presence of on-site repulsive electrons and analyze its dependence on microscopic parameters that may be controlled by fabrication.

IARPA, Institute for Quantum Computing, University of Waterloo (UW)

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The Theory Canada 6 Conference

Sunday, June 12/2011
Location: LC301, Library and Computing building

Session IV: General Relativity and Cosmology (9:30 - 12:00 p.m.)

9:30 - 10:00 a.m.

THE BLACK HOLE DYNAMICS FROM THE PERSPECTIVE OF AN EFFECTIVE FIELD THEORY

Michael Smolkin, *Perimeter Institute for Theoretical Physics*

The experimental program in the gravitational wave detection has brought heightened attention to the problem of obtaining high accuracy predictions for the evolution of binary systems in General Relativity. In this regard, over the past few years a Classical Effective Field Theory approach was developed and introduced into GR. This formalism has been proved to be a very efficient and systematic analytical tool which is relevant to the understanding of a broad class of problems, e.g. gravitational radiation power spectra, dynamics of the binary constituents, thermodynamics of the Kaluza-Klein black holes and etc. In my talk I will review recent developments in the field as well as present instructive examples that make the power of this approach manifest.

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10:00 - 10:20 a.m.

GRAVITATIONAL WAVES IN CONFORMAL GRAVITY

Manu Paranjape, *Université de Montréal*

We consider plane fronted, monochromatic gravitational waves on a Minkowski background, in a conformally invariant theory of general relativity. By this we mean waves of the form: $g^{\mu\nu} = \eta^{\mu\nu} + \epsilon^{\mu\nu}F(k\cdot x)$, where $\epsilon^{\mu\nu}$ is a constant polarization tensor, and k_μ is a light like vector. We also assume the harmonic gauge condition $g^{\mu\nu}\Gamma^\rho_{\mu\nu} = 0$. Requiring additionally the conformal gauge condition $\mathrm{Det}\,[g^{\mu\nu}] = -1$ surprisingly implies that the waves are both transverse and traceless. Although the ansatz for the metric is eminently reasonable when considering perturbative gravitational waves, we show, without any perturbative approximation that $\epsilon^{\mu\nu}$ be small, that the metric is reducible to the metric of Minkowski space-time via a sequence of coordinate transformations which respect the gauge conditions. This implies that we have in fact, exact plane wave solutions, however they are simply coordinate/conformal artifacts. As a consequence, they carry no energy. Our result does not imply that conformal gravity does not have gravitational wave phenomena. A different, more generalized ansatz for the deviation, taking into account the fourth order nature of the field equation, which has the form $g^{\mu\nu} = \eta^{\mu\nu} + B^{\mu\nu}(n\cdot x)G(k\cdot x)$ indeed yields waves which carry energy and momentum, [**?**]. It is just surprising that transverse, traceless, plane fronted gravitational waves, those that would be used in any standard, perturbative, quantum analysis of the theory, simply do not exist.

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10:20 - 10:40 p.m.

DE SITTER SPACE AT 1-LOOP

Louis Leblond, *Perimeter Institute*

Cliff Burgess
McMaster University, Perimeter Institute

Rich Holman
Carnagie Mellon

Sarah Shandera
Perimeter Institute

We observe that the rate of expansion of the Universe has been accelerating as if there was a positive cosmological constant. This indicates that the geometry is nearly de Sitter on large scales. The behavior of quantum fields in such a geometry are plagued with infrared divergences reminiscent to the ones seen in thermal field theory. Recently, there has been a lot of activity in understanding the quantum behavior of fields in this spacetime better by doing explicit loop computations. In this talk, I will summarize the salient features of infrared physics in de Sitter drawing analogies with thermal field theory. I will also discuss the recent claims that de Sitter space could be unstable.

Perimeter Institute
*E-mail:*lleblond@pitp.ca

11:00 - 11:20 p.m.

NEW OBSERVATIONAL POWER IN HALO BIAS

Sarah Shandera, *Perimeter Institute*

Neal Dalal
CITA

Dragan Huterer
University of Michigan

Non-Gaussianity is a powerful means of testing and constraining broad classes of inflationary models. The cosmologist's favorite ansatz for non-Gaussianity, the local model, will be particularly well constrained by large scale structure through measurements of the power spectra of collapsed objects. However, this local ansatz can be modified to capture properties of the particle physics inflation scenarios that would generate it. Motivated by early universe scenarios that produce observationally large local non-Gaussianity, we suggest a generalized local ansatz and perform N-body simulations to determine the signatures in the bias of dark matter halos. The ansatz introduces two bispectral indices that characterize how the local non-Gaussianity changes with scale and these generate two new signals in the bias. While analytic predictions agree qualitatively with the simulations, we find numerically a stronger observational signal than expected, which suggests that a better analytic understanding is needed to fully explain the consequences of primordial non-Gaussianity.

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*E-mail:*sshandera@perimeterinstitute.ca

11:20 - 11:40 p.m.

DEFORMATIONS OF LIFSHITZ HOLOGRAPHY IN HIGHER DIMENSIONS

Miok Park, *University of Waterloo*

Robert Mann
University of Waterloo

$(n+1)-$dimensional Lifshitz spacetime is deformed by logarithmic expansions in the way to admit a marginally relevant mode in which z is restricted by $n = z + 1$. According to the holographic principle, the deformed spacetime is assumed to be dual for quantum critical theories, and then thermodynamics of generic black holes in the bulk describe the field theory with a dynamically generated momentum scale Λ. This is a basically UV-expanded theory considered in higher dimensions of the Lifshitz holography from the previous works. By finding the proper counterterms, the renormalized action is obtained and by performing the numerical works, the free energy and energy density is expressed in terms of T/Λ^2.

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*E-mail:*m7park@uwaterloo.ca

11:40 - 12:00 p.m.

RIGID QUASILOCAL FRAMES AND TIME-DEPENDENT ROTATION

Paul McGrath, *University of Waterloo*

We introduce the concept of a rigid quasilocal frame (RQF), which opens up the possibility of rigid motion in both special and general relativity with the full six time-dependent degrees of freedom we have in Newtonian space-time. Additionally, as a proof of principle, we present a resolution to the problem of time-dependent rotation in special relativity afforded by the RQF formalism.

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List of AGR/TC6 Participants:

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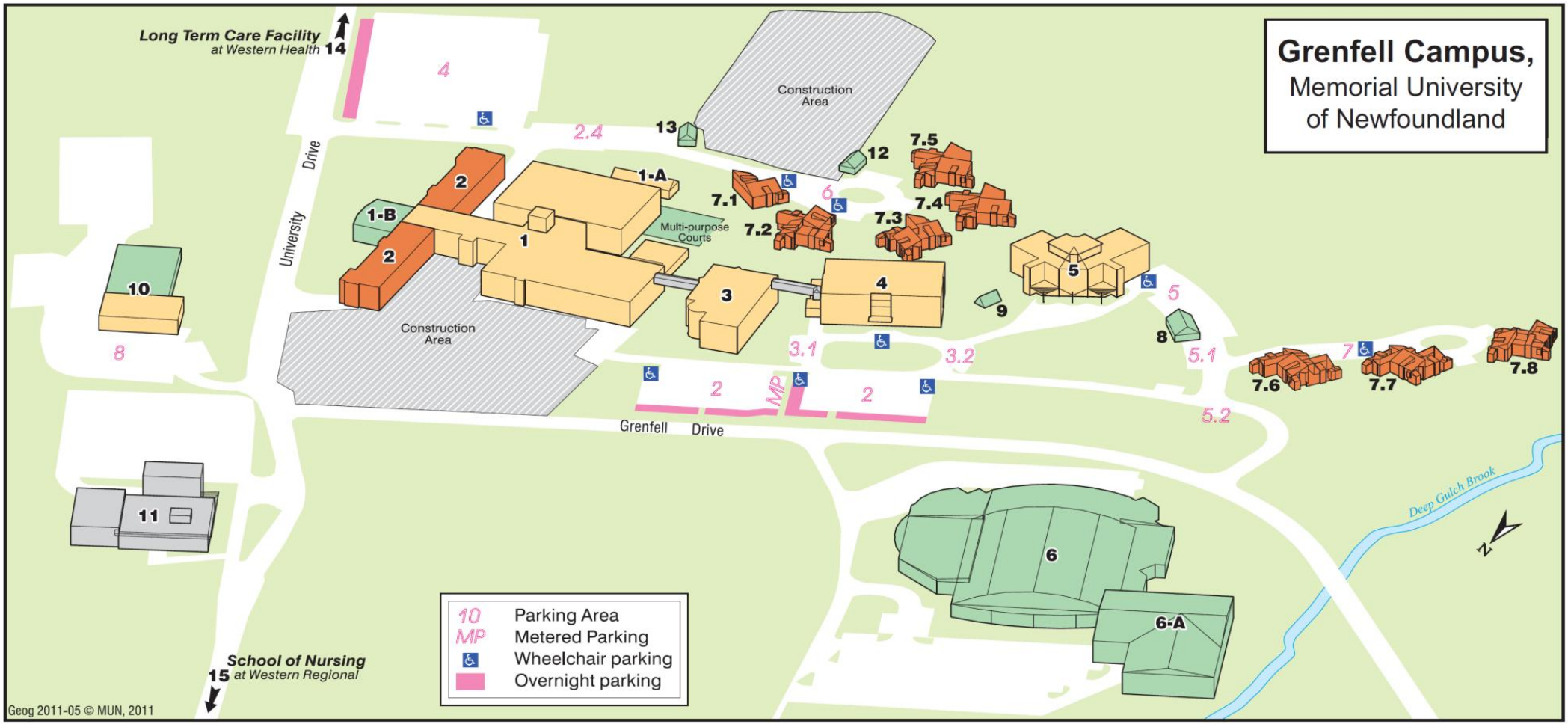

Academic Building - Primarily academic purposes

Service Building - Services and storage

Student Housing

Other Building - Located nearby, but not managed by the university

Building Index

1. Arts and Science Building (AS)
1-A. Recruitment Office/GIS Lab
1-B. Grenfell Campus Student Union Student Centre
2. Student Residence (R)
3. Library and Computing Building (LC)
4. Fine Arts Building (FA)
5. Forest Centre (FC)
6. Pepsi Centre
6-A. Pepsi Studio
7. Chalet Apartments (C)
8. Forest Centre Storage Unit
9. Greenhouse
10. RecPlex (RP)
11. Arts and Culture Centre
12. Storage Unit
13. Storage Unit
14. Long Term Care Centre
15. Western Regional School of Nursing

Offices and Services

ACAP (Atlantic Coastal Action Plan)	5	Bookstore	1	Clubs and Societies	1-B
Administration and Finance	1	Box Office (theatre)	4	Community Education and College Relations	1
Arts Division	1	Business Administration Program	1	Computing and Communications	1
Art Gallery	4	Bursar's Office	1	Computer Labs	1, 3, 5
Atlantic Salmon Federation	1	Campus Enforcement and Patrol	1	Conference Services	1
Backlot (GCSU pub)	1-B	Canadian Forest Service (NR-Can)	5	Counselling	1
Bank Machines	1, 1-B, 4, 6	Career Planning Centre	1	Education Program	1, 10
EMERGENCY	**709-637-2888**	Health and Safety	10	Registrar	1
English as a Second Language	1	Historical Studies Program	1	Research	1, 5
English Program	1	Humanities Program	1	Resource Centre	1
Environmental Policy Institute	5	Ice Rinks	6	Science Division	1
Environmental Science Program	1	Institute for Biodiversity, Ecosystem Science and Sustainability	5	Social/Cultural Studies Program	1
Environmental Studies Program	1	International Student Programming	1	Social Science Division	1
Facilities Management	1	Lost and Found	1	Student Housing	2
Faculty/Staff Lounge	1	Marketing	1	Student Services	1
Ferriss Hodgett Library	3	Mailroom	1	Sustainable Resource Management Program	1
Fine Arts Division	4	NaviGate	1	Tourism Studies Program	1
Food Court	1-B	Nursing Program (Western Regional School of Nursing – Western Memorial Regional Hospital)	15	Theatre – Fine Arts	4
Forever Young Fitness Centre	6	Pool	1	Theatre Program	4
General Science Program	1	Psychology Program	1	Vice-President (Grenfell Campus)	1
Grenfell Campus Student Union	1-B	Recruitment	1-A	Visual Arts Program	4
GIS Lab	1-A			Wellness Centre	1
Gymnasium	1				

Legend is accurate as of May 1, 2011.

Arrivals – "Pool Entrance", AS (Bld#1)
Residence Registration – Main Floor, AS (Bld#1)
Conference Registration (June 9) – Main Floor, AS (Bld#1)
Conference Registration (June 10 and 11) – LC301 (Bld#3)
Lecture Room – LC301 (Bld#3)
Reception (June 11) – Atrium, FA (Bld#4)
Bus to Gros Morne (June 10) and Bus to St. John's (June 12) – Front Entrance, FA (Bld#4)