Scientific Program

18th Midwest Relativity Meeting
University of Notre Dame, Jordan Hall of Science
October 24-25, 2008

Friday, October 24

Session I: Gravity Waves and Neutron Stars

9:10 Optimal Strategies for Gravitational Wave Stochastic Background Searches in Pulsar Timing Data
Melissa Anholm University of Wisconsin-Milwaukee

A low frequency stochastic background of gravitational waves may be detected by pulsar timing experiments in the next five to ten years. Using methods developed to analyze interferometric gravitational wave data, the optimal techniques to detect a background of gravitational waves using a pulsar timing array are laid out. It can be shown that for pulsar distances and gravitational wave frequencies typical of pulsar timing experiments, neglecting the effect of the metric perturbation at the pulsar does not result in a significant deviation from optimality.

9:30 Can We Detect Intermediate-Mass-Ratio Inspirals?
Ilya Mandel Northwestern University
Jonathan R. Gair Cambridge University

Gravitational waves emitted during intermediate-mass-ratio inspirals (IMRIs) of intermediate-mass black holes (IMBHs) into supermassive black holes could represent a very interesting source for LISA. Similarly, IMRIs of stellar-mass compact objects into IMBHs could be detectable by Advanced LIGO. At present, however, it is not clear what waveforms could be used for IMRI detection, since the post-Newtonian approximation breaks down as an IMRI approaches the innermost stable circular orbit, and the perturbative solution is only known to the lowest order in the mass ratio. We discuss the expected mismatches between approximate and true waveforms, and the choice of the best available waveform as a function of the mass ratio and the total mass of the system. We also comment on the significance of the spin of the smaller body and the need for its inclusion in the waveforms.

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9:50 Astrophysical constraints on the parameter space of the neutron-star equation of state

Benjamin D. Lackey University of Wisconsin-Milwaukee
Jocelyn S. Read University of Wisconsin-Milwaukee
Benjamin J. Owen Penn State University
John L. Friedman University of Wisconsin-Milwaukee

Although the neutron-star equation of state is largely unknown above nuclear density, we find that it can be accurately parameterized by only 4 free parameters. The parameter space may be constrained with observations of neutron stars, and we obtain the constraint surfaces associated with causality and with observed limits on masses, radii, redshift, moment of inertia, and spin frequency. There are only a few hard (model-independent) constraints; of these, the most stringent is associated with the largest observed neutron-star masses, and this constraint only restricts the parameter space to one side of a constraint surface. Anticipated future observations of moments of inertia of stars with known masses can more sharply constrain the parameter space, and combining this with mass observations and causality constraints can confine the allowed parameter space to a significantly smaller volume.

10:10 Compact Star Superfluid Turbulence

Gregory L. Comer Saint Louis University

Pulsars are supernova remnants about twenty kilometers across, and a typical mass about one and a half times that of the sun. Pulsar timing data record a steady growth in the rotational period, due to continual energy loss via electromagnetic radiation. Ocassionally, a pulsar will experience a glitch, which is a quick decrease in the period, followed by a recovery to a new, steady period increase. The best description of the process is a neutron superfluid in the outer core/inner crust region of the pulsar. Superfluids mimic rotation via the creation of an array of quantized vortices; a glitch occurs when the superfluid neutron vortices, initially pinned to nuclei in the crust, undergo a catastrophic unpinning and transfer angular momentum to the crust. While vorticity can be created in such a way that the vortex array is modified only slightly, we consider the prospect of superfluid turbulence: tangles are formed in the vortex array. A model for the tangles is given, and the coefficients for the damping force are evaluated for pulsars. It is found that superfluid turbulence may in fact operate in their inner core/outer crust.

Session II: Cosmology

11:00 Smoothing at the big crunch

David Garfinkle Oakland University

Numerical simulations are presented of the approach to the singularity where the matter is a scalar field with a negative exponential potential. Though the simulation starts out highly inhomogeneous and anisotropic, as the singularity is approached spacetime becomes homogeneous and isotropic.

11:20 Big Bang Production of ^{6,7}Li via the SUSY NLSP

Motohiko Kusakabe University of Tokyo and NAO Japan
T. Kajino University of Tokyo and NAO Japan
G. J. Mathews University of Notre Dame

The 6Li and 7Li abundances observed in metal poor stars exhibit possible plateau levels as a function of metallicity. However, the inferred primordial abundance of 6Li is about 1000 times larger and that of 7Li is about 3 times smaller than the prediction by standard big bang nucleosynthesis (BBN) model for the baryon-to-photon ratio from WMAP. We calculate the BBN assuming the existence of long-lived negatively-charged massive particles (CHAMP) that would bind to the light nuclei, but would decay long before it could be detected. A candidate for the long-lived negatively-charged massive particles is the stau when the next-to-lightest supersymmetric particle (NLSP) is the stau and the lightest supersymmetric particle (LSP) is the gravitino in SUGRA model. We present the result of the calculation and the possibility of the CHAMP solution to Li problems.

11:40 Early Universe Evolution Characterizes Three Regimes of Spectral Perturbations

Matthew M. Glenz University of Wisconsin – Milwaukee
Leonard Parker University of Wisconsin – Milwaukee

Cosmological Inflation is the theory that the early universe went through a short period of rapid expansion. During this time, quantum fluctuations on the smallest scales were stretched to lengths that exceeded the observable size of the inflationary universe. After the end of Inflation, the size of the observable universe expanded faster than did the inflated quantum fluctuations, so these perturbations then began to re-enter our observable universe. These perturbations due to Inflation were imprinted in the temperature fluctuations of the Cosmic Microwave Background and led to the seeding of large-scale structure. I will focus on the creation of inflaton particles, which are the quanta that correspond to the fluctuations of the inflaton field. I will relate the spectrum of particle production to the energy of the particles created, the effective mass of the inflaton, and to the total amount of inflation.

12:00 Some Alternative Views on Dark Matter and Dark Energy

Grant Mathews University of Notre Dame, Center for Astrophysics
Xinghai Zhao University of Notre Dame
Nguyen Q. Lan Hanoi Univ. Education

The simple fact that the present closure contributions in dark matter and dark energy are nearly equal begs the question as to whether they could be different aspects of the same physical phenomenon. Here, we review constraints several postulates as to how this coincidence could be achieved. These include: 1) The possibility that the dark matter decays producing a bulk viscosity in the cosmic fluid; and 2) cosmic acceleration produced by the inflow of dark matter from a bulk dimension in brane-world cosmology; Constraints and observational tests of each of these cosmologies are proposed.

Session III: Field Theory – I

1:40 Breakdown of Lorentz Invariance for Spin-1/2 Particle Motion in Curved Space-Time with Applications to Muon Decay

Dinesh Singh Department of Physics, University of Regina
Nader Mobed Department of Physics, University of Regina

This paper explores the properties of the Pauli-Lubanski spin vector for the general motion of spin-1/2 particles in curved space-time. Building upon previously determined results in flat space-time, it is shown that the associated Casimir scalar for spin possesses both gravitational contributions and frame-dependent contributions due to non-inertial motion, where the latter represents a possible quantum violation of Lorentz invariance that becomes significant at the Compton wavelength scale. When applied to muon decay near the event horizon of a microscopic Kerr black hole, it is shown that its differential cross section is strongly affected by curvature, with particular sensitivity to changes in the black hole's spin angular momentum. In the absence of curvature, the non-inertial contributions to the decay spectrum are also identified and explored in detail, where its potential for observation is highest for large electron opening angles. It is further shown how possible contributions to noncommutative geometry can emerge from within this formalism at some undetermined length scale. Surprisingly, while the potential exists to identify noncommutative effects in muon decay, the relevant terms make no contribution to the decay spectrum, for reasons which remain unknown.

2:00 Addressing Underdetermination between Massless and Massive Gravity Numerically in Spherical Symmetry?

J. Brian Pitts University of Notre Dame, Dept of Philosophy

It is known that Einstein's GTR and some massive variants thereof can be derived assuming the universal coupling of a symmetric potential to the total stress-energy tensor. I prove that all of the 2-parameter family of Ogievetsky-Polubarinov massive gravities can be derived in this fashion. A longstanding question about the resulting massive spin 2-spin 0 theories pertains to the positivity of energy and hence the stability of the theories. The spin 0 field has the wrong sign of K^2 in the kinetic term, but there is reason to suspect that nonperturbative effects might occur and perhaps ensure positive energy. The monopole character of the spin 0 field implies that substantive probing of the theories' radiative behavior should be possible even in spherical symmetry, a context for which interesting problems are scarce in GTR. By examining questions such as the positivity of the radiated energy and the positivity of the remaining mass, numerical relativists can either disprove or confirm the viability of massive variants of GTR. Because massive GTR might approximate GTR empirically while differing radically on foundational questions, it is especially interesting to study and perhaps resolve this possible case of the underdetermination of theories by data.

2:20 A Rigorous Derivation of Electromagnetic Self-force

Samuel Gralla University of Chicago
Abraham I. Harte University of Chicago
Robert M. Wald University of Chicago

We analyze the issue of the particle motion in classical electromagnetism in a rigorous and systematic way by considering a one-parameter family of solutions corresponding to having a body that is ``scaled down" to zero mass, charge, and size in an appropriate manner. In this limit, ratio of the charge of the body to its mass (including electromagnetic self-energy) goes to a well defined value, even though both the charge and mass go to zero. We show that the limiting worldline satisfies the Lorentz force equations of motion in the external field. We then calculate the first order corrections to this motion, and find that these corrections include dipole forces, a spin-jerk interaction, and the Abraham-Dirac self-force. We show that, when the dipole and spin forces can be neglected, the ``reduced order" version of the Abraham-Lorentz-Dirac equation is an appropriate self-consistent perturbative equation corresponding to our perturbative result.

2:40 Gravitational self-force in radiation gauge for a particle orbiting a Schwarzschild black hole

Abhay Gunvant Shah University of Wisconsin, Milwaukee
John L. Friedman University of Wisconsin, Milwaukee
Larry R. Price University of Wisconsin, Milwaukee

In this talk, I report our progress in computing the the self-force in the radiation gauge for a particle orbiting a Schwarzschild black hole. We find the renormalized spin-2 Weyl scalar for a particle in circular orbit in a Schwarzschild geometry, subtracting from the retarded field an expression for the the singular field to subleading order. Remarkably, only one term in a lengthy expression for the singular field contributes at this order, and that term coincides up to an overall factor (associated with a boost) with the perturbed Weyl scalar of a static field. We use a numerical matching procedure to remove the singular field to one additional order. Finally, following the procedure outlined in KFW (Phys Rev D, 75, 2007) we calculate the renormalized Hertz potential (from the renormalized Weyl scalar), from which one finds the renormalized perturbed metric and hence the conservative part of the self-force.

Session IV: Field Theory – II

3:20 Purely affine formulation of F(R) gravity

Nikodem Poplawski Indiana University

The purely affine, metric-affine, and purely metric formulation of general relativity are dynamically equivalent: the relation between them is analogous to the Legendre relation between the Lagrangian and Hamiltonian dynamics. Metric-affine and metric F(R) gravity models are currently of physical interest because they can explain phenomenologically inflation and current cosmic acceleration. We show that one cannot construct a purely affine Lagrangian which is dynamically equivalent to an F(R)

Lagrangian, unless F(R) is linear in R. We also show that this equivalence is restored if we transform conformally the metric tensor to the Einstein frame, in which F(R) gravity turns into general relativity with a scalar field. This peculiar behavior of general relativity, among relativistic theories of gravitation, could indicate that nonlinear F(R) gravity models are unphysical.

3:40 Lorentz Violation in Matter-Gravity Couplings
Jay Tasson Indiana University
V. Alan Kostelecky Indiana University

Although violations of Lorentz symmetry are tightly constrained by numerous experiments, a class of relatively large violations may still exist. The suppressed effects of such violations are observable in current and upcoming high-sensitivity gravitational tests. In this talk I will discuss the theoretical nature of these potential violations, present a single constraint on a combination of the 12 possible effects in ordinary matter, and discuss the prospects for obtaining additional sensitivities in existing and proposed experiments.

4:00 Self-forces and generalized symmetries
Abraham Harte University of Chicago

A non-perturbative formalism is developed that greatly simplifies the understanding of self-forces and self-torques acting on compact bodies. New notions of effective linear and angular momentum are identified, and a simple law of motion is derived for extended scalar and electromagnetic charges in curved spacetimes. The Detweiler-Whiting axiom that a body's overall motion should only be influenced by the so-called ``regular'' component of its self-field is shown to follow very easily in an appropriate limit. Corrections to this result are related to the failure of Newton's third law for the remaining ``bound'' portion of the self-field. Alternatively, excess forces and torques are shown to arise from deformations of a particular Green function under the action of generalized Killing fields.

4:20 Causal Boundary for Non-Product Static Spacetimes
Steven Harris Saint Louis University

Previous work has shown that for a standard-static spacetime V (conformal to a product, MxL, Riemiann factor and the Lorentz line), future null infinity is a line bundle over the Busemann boundary B on M; and if the topology of future null infinity is Hausdorff, then it is a simple product, BxR.

The current work extends these results, in essentially unchanged form, to general static-complete spacetimes (i.e., with complete Killing field). If V is static-complete, with Q the space of static observers, then the universal cover of V is a standard-static MxL, where M is the universal cover of Q. Future null infinity is a line bundle over a modified Busemann boundary B' for Q; and if the topology of future null infinity is Hausdorff, then it is a simple product B'xR.

To date, there I have found no instance in which the modified Busemann boundary for Q is any different than the standard Busemann boundary, which means that the difference between between standard and non-standard static is not detectable at infinity. I conjecture this is generally the case.

Session V: Alternative Gravity

5:00 Supergravity on an Atiyah-Hitchin Base
Sean Stotyn University of Waterloo

Higher dimensional supergravity solutions continue to receive a lot of attention because such solutions describe low-energy supersymmetry-preserving states of string theories. Gauntlett et al. have set forth a prescription for constructing minimal supergravity solutions in 5d using a hyper-Kaehler metric as a base space and performing a fibration over time. In this talk I will discuss the solution generated when one considers the Atiyah-Hitchin metric as the base, radially dependent metric functions and an appropriate ansatz for the 1-form connection. By examining the behaviour of null geodesics I will show that the solution typically exhibits a velocity of light surface (VLS) which the null geodesics are unable to cross and inside of which closed timelike curves (CTC's) exist. In looking at curvature invariants, such solutions generically contain curvature singularities hidden inside the VLS. I will show that the spacetime exterior to the VLS is CTC-free, geodesically complete and asymptotically a twisted U(1) fibration over 4d Minkowski spacetime. As such this solution may possess a well-defined holographic dual despite the CTC's present in the bulk.

5:20 Issues with dimensional reduction of higher dimensional theories
Stephen Green University of Chicago

In the past decade, many models have been proposed in which spacetime has dimension greater that 4. In Kaluza-Klein models, it is clear that one can obtain an effectively 4-dimensional theory by postulating symmetries in the compact extra dimensions, and that this 4-dimensional theory should describe "low energy" phenomena. However, it is not obvious that similar results hold in a Randall-Sundrum model with matter described by bulk fields. The issues involved in obtaining effectively 4-dimensional physics from a higher dimensional theory will be discussed and analyzed.

5:40 Lorentz symmetry breaking in TeVeS
Michael Seifert Indiana University

TeVeS, a covariant theory of MOND proposed by Bekenstein, breaks Lorentz symmetry spontaneously via a vector field which has unit timelike norm in the vacuum. This type of dynamical Lorentz symmetry breaking can, using a framework developed by Bailey and Kostelecky, be tested via laboratory experiments and lunar laser ranging. This framework allows us to place bounds on the background field values in TeVeS.

6:00 Posts in transitive percolation: First results from Dq/Dg
Luca Bombelli University of Mississippi
Itai Seggev Knox College
Sam Watson University of Mississippi

A random graph order is a partial order achieved by independently sprinkling relations on a vertex set (each with probability p) and adding relations to satisfy the requirement of transitivity. In the physics literature this process is known as transitive percolation and is the simplest of the dynamics proposed by Rideout and Sorkin for causal set dynamics. A post is an element in a partially ordered set which is related to every other element. It has been known for 15 years that posts occur with probability one in transitive percolation on an infinite set, and that average number of posts in an n-element subset of a two-way infinite set is proportional to n. However, the behavior of transitive percolation on a finite set has received considerably less attention. Inspired by numerical solutions, we prove that the expected number of posts is linear in the size of the percolation set but with a non-zero offset. This offset does not vanish in the n->infinity limit, indicating that edge effects continue to play a role even for very large percolation sets.

6:20 Effective field interactions and the non-local interaction term
Bojan Tunguz Department of Physics, Wabash College

I investigate mathematical form of the effective interaction term in theories with derivative couplings. I conclude that this term is in a most general case a four-point function in the momentum space, and it correspond to a propagator of non-local intermediate field. This approach allowes us to remove the dimensionful constant from the interaction term and place it in the propagator of the intermediate field. There is an analogy here with the historical development of the Weak interaction, which has eventually led to a successful program of quantization of that theory. I give some plausibility arguments for extension of that approach to quantum gravity.

Saturday, October 25

Session VI: Numerical Relativity/Formulation

9:00 Israel Layers
Edward N. Glass Physics Department, University of Michigan
Israel layers are discussed as a general tool for modeling shells that lie between 2 manifolds.

9:20 Self Coupled Gravity: A Toy Field Theoretic Model of Gravity
James P. Crawford Penn State University

In 1960, Arnowitt, Deser, and Misner published a paper arguing (in the context of General Relativity) that if one includes the gravitational self-energy in the total energy of a point charge, the total energy is rendered finite. This paper is also discussed in Ashtekar's

book where he gives a more “simple-minded calculation.” Motivated by this work, I consider a “toy field theoretic model” of gravity where the gravitational energy density is assumed to be in electrostatic form and where this (negative) energy density contributes as a gravitational source. In the case of a charged point particle, the additional gravitational energy density renders the total energy finite. In addition, the self coupling results in a non-Newtonian form for the gravitational field of a massive body, giving rise to perihelion precession. The amount of precession depends on the precise form of the relativistic force law, but for a theoretically reasonable choice it gives a result which is three-quarters the General Relativistic value. Finally, I comment on the form that a fully relativistic version of this model should take.

9:40 Parabolized-ADM (PADM) formulation of GR
Vasileios Paschalidis University of Illinois at Urbana Champaign

A new 3+1, well-posed, formulation of GR based on the first-order ADM formulation is introduced. We call this system the Parabolized-ADM (PADM) formulation. Unlike other formulations this system adds derivatives of the constraints to the RHS of the ADM evolution equations. As a result the constraints are forced to evolve according to parabolic equations, hence the name of the system. Parabolic equations possess very efficient damping and smoothing properties and for this reason the PADM system turns the constraint surface into a local attractor. To demonstrate the potential of the PADM system we present a series of numerical tests where we contrast the performance of the PADM formulation to that of the ADM and KST formulations of GR and show that PADM has better control of the constraint violations.

10:00 Kerr de Sitter Universe
Sarp Akcay University of Texas at Austin
Richard Matzner University of Texas at Austin

A survey of the Kerr de Sitter spacetime is given. With an appropriate coordinate transformation, this spacetime can be cast into Kerr-Schild form where the background now is de Sitter universe given in a somewhat `twisted' coordinate system. We investigate the physical properties of the principal null outgoing vectors, look at the horizon structure of this spacetime and comment on superradiant scattering with respect to the Kerr black hole at the center.

Session VII: Numerical Relativity-II

11:00 General Relativistic Simulations of Compact Binary Mergers: Overview
Yuk Tung Liu University of Illinois at Urbana-Champaign
Zachariah B. Etienne University of Illinois at Urbana-Champaign
Stuart L. Shapiro University of Illinois at Urbana-Champaign
Keisuke Taniguchi University of Illinois at Urbana-Champaign and University of Wisconsin-Milwaukee
Thomas W. Baumgarte University of Illinois at Urbana-Champaign and Bowdoin College

Mergers of compact binaries (BHBH, NSNS and BHNS) are among the most promising sources of gravitational waves detectable by ground-based gravitational wave detectors. Mergers of binary neutron stars (NSNS) and black hole-neutron stars (BHNS) may also be short-hard gamma-ray burst projenitors. We are now able to evolve all three of these compact binary systems through the inspiral, merger and ringdown phases in full general relativity. We use the BSSN formalism in 3+1 to evolve the metric, and a high-resolution shock-capturing scheme to evolve (magneto)hydrodynamics. We use adaptive mesh refinement (AMR) to focus resolution around the compact stars, and place the outer boundary far into the wave zone to extract gravitational waves. A substantial test suite is implemented to check the validity and robustness of the code. Some representative merger simulations of BHBH, BHNS, and magnetized NSNS systems will be presented.

11:20 Simulations of Black Hole-Neutron Star Binary Mergers: Effects of Black Hole Spin, Mass Ratio, and Neutron Star Compaction

Zachariah B. Etienne University of Illinois
Yuk Tung Liu University of Illinois
Stuart L. Shapiro University of Illinois
Keisuke Taniguchi University of Illinois and University of Wisconsin-Milwaukee
Thomas Baumgarte University of Illinois and Bowdoin College

Binary black hole-neutron star (BHNS) binary mergers are candidate engines for both short-hard gamma-ray bursts and detectable gravitational radiation. Using the most recent conformal thin-sandwich BHNS initial data of Taniguchi et al. and our fully general relativistic hydrodynamics code, which is now AMR-capable, we are able to efficiently and accurately simulate these binaries through inspiral, merger, and ringdown. We will outline preliminary results from our latest simulations, which explore the effects of BH spin (aligned with the orbital angular momentum) between a/M=-0.5 to 0.75, NS compactions of 0.1-0.15, and BH:NS mass ratios between 1:1 and 5:1. After merger, we find that very little mass is left behind to form a disk around the BH for the range of BH spins treated here.

11:40 Relativistic Radiation Magnetohydrodynamics in Dynamical Spacetimes

Brian Farris University of Illinois
Tsz Ka Li University of Illinois
Yuk Tung Liu University of Illinois
Stuart Shapiro University of Illinois

Many systems of current interest in relativistic astrophysics require a knowledge of radiative transfer in a magnetized fluid evolving in a strongly-curved, dynamical spacetime. Such systems include stellar core collapse, GRBs, binary NSNS and BHNS mergers, etc. To model these phenomena, all of which involve general relativity, radiation (either photons and/or neutrinos), and magnetohydrodynamics, we have developed a general relativistic code capable of evolving MHD fluids and radiation in dynamical spacetimes. Our code solves the coupled Einstein-Maxwell-MHD-Radiation system of equations both in axisymmetry and in full 3 + 1 dimensions. We evolve the metric by integrating the BSSN equations, and use a conservative, high-resolution shock-capturing scheme to evolve both the MHD and radiation moment equations. For our initial study, we treat optically thick gases and assume grey-body opacities. We perform a suite of tests to verify our code. In this talk, we summarize tests involving radiating shocks and nonlinear waves propagating in Minkowski spacetime with planar symmetry.

12:00 Radiation Magnetohydrodynamics in Dynamical Spacetimes: \`Thermal' Oppenheimer-Snyder Collapse

Tsz Ka Li University of Illinois at Urbana-Champaign
Brian D. Farris University of Illinois at Urbana-Champaign
Yuk Tung Liu University of Illinois at Urbana-Champaign
Stuart L. Shapiro University of Illinois at Urbana-Champaign

We have constructed a new general relativistic code capable of evolving magnetohydrodynamic fluids and radiation fields in a dynamical spacetime. In order to test our code's ability to handle radiation in a strong-field dynamical spacetime, we simulate the collapse from rest of a spherical dust ball, slightly perturbed by a small fluctuation of thermal radiation. For a sufficiently small perturbation, the matter and metric evolve according to an Oppenheimer-Snyder solution, while the radiation propagates according to the general relativistic diffusion approximation. Adopting a grey-body opacity law, and an optically thick medium, we evolve the metric, hydrodynamics and radiation fields self-consistently using our new code. We find good agreement between the numerical result and the analytic solution found by Shapiro (1989).

Session VIII: New Ideas/ Novel Approaches

1:30 Gravitational Insights from Less Than Ten Percent the Speed of Light

John R. Laubenstein IWPD Research Center, Inc.
Kandi M. Cockream IWPD Research Center, Inc.

The motivation of this talk stems from the work of the IWPD Scale Metrics team in exploring relativistic effects under conditions generally classified as non-relativistic (less than 10% the speed of light). Our approach has been to fully explore the relativistic effects of motion at “non-relativistic” speeds; to then determine – in a general sense – the relativistic momentum, energy and force behind such motion; and then specifically apply this knowledge to gravitation. This approach has lead to very interesting modeling of gravitation with similarities; yet, modifications to some of the basic constructs of String Theory and Loop Quantum Gravity. Since this modeling was originally based on relativistic principals it seamlessly extends to more extreme relativistic conditions and appears to naturally point toward a quantum model of gravitation.

1:50 Gravitational Modeling using IWPD Scale Metrics

Kandi M. Cockream IWPD Research Center, Inc.
John R. Laubenstein IWPD Research Center, Inc.

The motivation of this talk is to discuss the gravitational modeling that directly follows from the work of the IWPD Scale Metrics team. We use an exact solution for

relativistic kinetic energy that can be expressed in the form xmv2, where the value of x can be shown to have significance in a number of applications involving force, momentum and energy. Specifically, three fundamental scales emerge as direct functions of the value of x. Through modeling, these scales can be shown to separate from the beginning of time resulting in local scales (gauges) that define gravitational effects. IWPD Scale Metrics can describe gravity as a change in geometry; or, equivalently as the exchange of fundamental particles defined by the value of the Scale Metric. This finding provides an intriguing connection between General Relativity and Quantum Theory and may well suggest a path for their ultimate unification.

2:10 Our Static Universe: Einstein's Math Error
David E. Pressler Primary Nuclear Research

There are two astronomical cause of redshift; Motion, which implies the Big Bang Theory and the presence of an Ubiquitous Gravity Field which leads to a Static Universe Theory. Every observer is considered to be at the center of his universe and this position is in a null vector condition, where all of the net vectors of all the gravity field components equal zero. This position having no or an undefined direction is not related to the concept of potential energy. Every observer is being equally accelerated in all directions simultaneously. Herein lies the secret of redshift; the wavelength or frequency of light is altered while traveling great distances from the emission source through 3-directional, gravitationally strained or deformed space, C-space. Einstein's math error is that he treats time as a vector. Time has no direction associated with it; it is a scalar, it only has magnitude and is specified completely by giving it a number or units. To mathematically equate time with direction is ambiguous and commits a Fallacy of Ambiguity. Any theory where time is represented as a forth direction does not represent reality, i.e., (x, y, z, t). Time is defined as the rate of physical process.

2:30 Analysis of vector current coupling
Douglas Sweetser

Rank 1 field theories for gravity are not seriously considered in the literature. A reason has to do with the vector current coupling term. Feynman provides a lucid analysis of the phase of a current-current interaction if the motion is along one axis which demonstrates the transverse current has spin 1 symmetry. Forces mediated by particles with odd spin have like charges repel.

The analysis is repeated without restricting the motion along an axis. The general approach shows the transverse terms have the expected symmetry. The other terms contain a symmetry consistent with a spin 2 particle. Forces mediated by particles with even spin have like charges attract. A complete analysis of vector current coupling suggests a rank 1 field theory for gravity should be considered with more care.

2:50 Big Bang Fuel Discovered & Demonstrated
Charles Sven

I will provide the four major components, with demonstration and documentation, necessary to understand how our universe arrived at its current state.
These four components are:
1st A scenario explaining the Big Bang.
2nd. A scenario explaining the distribution of all celestial objects.
3rd A scenario explaining Earth's location in our universe.
4th Observations supporting all the above, from NASA, Stanford Labs, and other equivalent sources.

3:10 Dark Energy and the Age of the Universe
James Donovan Shimer College

Most attempts to explain the nature and behavior of Dark Energy propose some yet undiscovered scalar field to supply the energy, such as a cosmological constant, quintessence, phantom energy, tracker, and other scalar fields.

The work described in this talk takes an entirely different tack, using a semi-classical approach to derive the dark energy from a previously unnoticed consequence of quantum mechanics. Because of the observed finite age of the universe, it follows that this finite lifetime causes a very small increase in the energy of quantum systems in the universe. This small value, along with an estimation of the net sum of all quantum numbers in the universe (which overwhelmingly arise from gravity), allows the calculation of the sum total of these small added energies. The result is surprisingly close to the accepted value for the universe's Dark Energy content. The equation of state of the energy from this preliminary model, however, does not match that observed for Dark Energy, and the model needs to be extended to incorporate General Relativity.