Session 1
9:00 – 10:30 am, Friday 28 February

Towards a Realistic Neutron Star Binary Inspiral: Initial Data and Long Timescale Evolution

Mark Miller (Jet Propulsion Laboratory) 9:15

I present results produced by my fully consistent general relativistic hydrodynamics numerical relativity code. First, I analyze the conformally flat, quasiequilibrium (CFQE) sequence approximation by directly comparing it to solutions of the Einstein equations obtained numerically using CFQE configurations as initial data. In this way, I demonstrate how one can go about constructing astrophysically relevant initial data sets. I then perform the first detailed analysis of the characteristics of the orbital motion of finite sized compact objects in full 3+1 numerical relativity.

Exponential stretch rotation 3+1 formulation of GR

Alexei Khokhlov (Naval Research Laboratory) 9:30

by A.Khokhlov & I. Novikov

We study an exponential transformation of a three-dimensional metric of space-like hypersurfaces embedded in a four-dimensional space-time, where the 3-metric is expressed in terms of logarithms of eigenvalues and rotation angles. Evolution part of Einstein's equations, rewritten in terms of these variables describes time evolution as a continuous streth and rotation of a local coordinate system. The transformation may have advantages in dealing with non-linear instabilities of numerical integration.

Finding event horizons in numerical spacetimes

Peter Diener (Albert-Einstein-Institute, Golm, Germany) 9:45

"Einstein boundary conditions" for the 3+1 Einstein equations

Simonetta Frittelli (Duquesne University) 10:00

From the vanishing of the projection of the Einstein tensor along the direction normal to the boundary of the region of integration, we derive necessary conditions on the boundary values of the fundamental variables of the 3+1 Einstein equations, consistent with constraint propagation [Frittelli and Gomez, gr-qc/0302032]. Such conditions take the form of evolution equations along the boundary and can be used to calculate the boundary values of certain components of the extrinsic curvature. From a full analysis of the spherically symmetric Einstein-Christoffel formulation we show that, in the case of hyperbolic formulations, some of the conditions provide welcome boundary values for some of the incoming characteristic fields, whereas others constrain the values of some of the outgoing characteristic fields.

Dynamical Gauge Condtitions for the Einstein Evolution Equations

Lee Lindblom (Caltech) 10:15

Session 2
11:00 am – 12:30 pm, Friday 28 February

A search for true degrees of freedom in canonical gravity

Alok Laddha (University of Utah) 11:00

Octonions and Fermions

Tevian Dray (Oregon State University) 11:15

In previous work, Corinne Manogue and I showed how to use an octonionic description of the Dirac equation to reduce 10 dimensions to 4 without compactification, resulting in a particle spectrum consisting of exactly 3 generations of leptons, each containing one massive spin-1/2 particle and one massless spin-1/2 particle with a single helicity state. I will report here on our continuing efforts to extend this process to quarks.

If particles follow autoparallels, must then Electromagnetism couple to torsion?

William Pezzaglia (Physics Dept, Santa Clara University, CA) 11:30

Binary Black Holes and Boundary Value Problems of Mixed Type

Charles Torre (Utah State University) 11:45

Spacetimes admitting a helical Killing vector field have been used to describe relativistic binary systems in a quasi-stationary approximation. Following Price et al [Class. Quantum Grav. 17, 4895 (2000); 19, 1285 (2002)], we consider a toy model for this system: the helically-reduced wave equation with an arbitrary source in 2+1 dimensional Minkowski spacetime. The reduced equation is a second-order partial differential equation which is elliptic in a disk and hyperbolic outside the disk. We show that the reduced equation can be cast into first-order, symmetric-positive form. Using results from the theory of symmetric-positive differential equations, we show that the helically-reduced wave equation admits unique, strong solutions for any source and for a class of Robin boundary conditions which include ingoing and outgoing conditions in the hyperbolic region.

Strong-Field, Same-Side Magnification

Randy Dumse (New Micros, Inc.) 12:00

While much has been made of gravitational lensing by massive objects for focusing of rays passing them, as observed by distant observers, little has been said of the same side magnification near compact objects, such as black holes and neutron stars. This paper will discuss how the gravitational deflection of light derived from Binet's equation causes an apparent magnification as an infalling object approaches the horizon limit, the magnification factor approaching infinity. The result suggests our standard description of a far away observer's view of an infalling object needs to be modified to, "slows, reddens and is magnified as if exploding".

Four-Dimensional Lorentzian Geometry Via the Study of Families of Two Surfaces in 3-Space

Ezra (Ted) Newman (Dept of Physics & Astronomy, Univ. of Pittsburgh) 12:15

by E.T. Newman with Simonetta Frittelli and Pawel Nurowski

We describe how all 4-dimensional (or 3-dimensional) Lorenzian metrics can be encoded into information about families of two-surfaces in a 3-space (or, respectively, curves in a two-space). This constitutes a generalization of the work of the great geometer, K. Wuenschmann. For simplicity of presentation the details will be illustrated for the 3-dimensional case.

Session 3

2:30– 4:00 pm, Friday 28 February

Speed of Gravity and the Relativistic Time Delay

Clifford Will (Washington University, St. Louis) 2:30

We calculate the delay in the propagation of a light signal past a massive body that moves with speed v, under the assumption that the speed of propagation of the gravitational interaction c_g differs from that of light. Using the post-Newtonian approximation, we consider an expansion in powers of v/c beyond the leading ``Shapiro" time delay effect, while working to first order only in Gm/c^2, and show that the altered propagation speed of the gravitational signal has no effect whatsoever on the time delay to first order in v/c beyond the leading term, although it will have an effect to second and higher order. We conclude that recent measurements of the propagation of radio signals past Jupiter are not directly sensitive to the speed of propagation of gravity.

Torsional pendulum experiment for improving the photon mass upper limit

Frank Marcoline (CENPA, University of Washington) 2:45

Status of Short-Range Test of Newton's Inverse Square Law

Daniel Kapner (CENPA, University of Washington) 3:00

Development of a Cryogenic Torsion Pendulum for Gravitational Physics

Eric C. Berg (University of California Irvine) 3:15

A Search for non-Newtonian Forces Using a Torsion Pendulum

Jason Steffen (University of Washington) 3:30

We present an overview of a torsion pendulum experiment to detect the presence of non-Newtonian forces at a scale of 10cm. We expect our results to reduce the current limit on the strength of a putative non-Newtonian interaction by at least an order of magnitude. This is done by designing a null experiment sensitive to the horizontal gradient of the Laplacian of the vacuum interaction potential, which is non-zero for a non-Newtonian potential. At the same time, the leading systematic error is reduced by designing the source mass and pendulum so that the (Newtonian) gravitational coupling between them is strongly supressed. By eliminating both the low order Newtonian mass moments of the pendulum and the low order Newtonian field moments of the source mass, the gravitational interaction is limited by the coupling of fabrication errors in the pendulum with fabrication errors in the source. Thus, systematic errors due to the gravitational interaction occur only in second order in fabrication errors.

Planned Terrestrial Test of the Equivalence Principle with a Cryogenic Torsion Pendulum

Liam Cross (University of California Irvine) 3:45

Session 4
4:30 – 6:00 pm, Friday 28 February

Overview of the Periodic Standing Wave Approximation

Rachel Mary Costello (The University of Utah) 4:30

In the periodic standing wave method, a slow inspiral of two black holes is approximated by a solution to Einstein's equations describing two holes eternally circling each other in stationary orbits. This approach changes the computational problem from the evolution of initial data, to one with only boundary conditions. The exact solution computed will contain standing gravitational waves. The outgoing component of these standing waves will be an excellent approximation to the true outgoing solution, even for strongly nonlinear sources. The general scheme of this approach will be introduced and will be illustrated with animations of evolved and periodic solutions.

A Specialized Spectral Method for the Periodic Approximation

Richard Price (University of Utah) 4:45

The periodic standing waves approximation method for binary inspiral requires the solution of boundary value problems with very different size scales, small scales for the source and large scales for the radiative boundary conditions. A coordinate system ("Roswell coordinates") that naturally conforms to these different scales appears to reduce much of the computational burden of the problem, at the cost of analytic complexity. The method is introduced, and it is argued that in this method, only a very small number of multipoles is needed for excellent accuracy.

Numerical Results for the Periodic Standing Wave Approximation in 3D

Ben Bromley (University of Utah) 5:00

Two distinctly different methods are introduced for computing standing wave solutions in the periodic approximation: the standard finite difference approach, and a spectral approach in conforming ("Roswell") coordinates. For modestly relativistic orbits, it is demonstrated that with the spectral approach excellent accuracy is achieved when only the monopole and quadrupole terms are kept. Results and difficulties of the methods are briefly described.

Space-Time Coordinates for Stationary Quasi-Inspiral

Christopher Beetle (University of Utah) 5:15

The stationary quasi-inspiral approach to binary systems models an inspiral process using a stationary approximation in which the orbits do not degrade. To apply this approximation to general relativity, one must first fix the gauge (coordinate) freedom of the theory. I will discuss a natural way to do this.

Binary Black Hole Coalescence --The Lazarus Approach

John Baker () 5:30

The plunge of spinning binary black holes

Carlos Lousto (The University of Texas at Brownsville) 5:45

We present here the results of the numerical evolution of a series of binary black hole configurations with spins aligned and counter-aligned with the orbital angular momentum from the innermost stable circular orbit (ISCO) down to the final single rotating (Kerr) black hole. We also obtain complete waveforms, and estimates of plunging times, the energy, and momentum radiated to infinity. The remnant Kerr black formed at the end of an inspiral process have a rotation parameter $0.6<a/M<0.8$ suggesting it is difficult to get near maximally rotating holes for such scenarios. The resulting waveforms have still the same qualitative simple looking of the nonspinning binaries, supporting the idea that a total mass rescaling of the latter waveforms can produce an approximate description for the spinning binary case. We finally discuss the relevance of our results to assist detection and interpretation of forthcoming data from laser interferometric observatories.

Session 5
10:00 – 11:00 am, Saturday 1 March

Spatially homogeneous attractors for expanding cosmological spacetimes: Ringstrom's solution

Beverly Berger (NSF) 10:00

On Areal Coordinates for T^2 Symmetric Solutions

Jim Isenberg (University of Oregon) 10:15

Consistent discrete quantum gravity

Jorge Pullin () 10:30

Spacetime Canonical gravity

Karel V. Kuchar (University of Utah) 10:45

Session 6
11:30 am – 12:45 pm, Saturday 1 March

Scalar Field Critical Collapse in Axisymmetry

Frans Pretorius () 11:30

We present results from a continuing numerical study of critical gravitational collapse of the scalar field in axisymmetry. For the real, massless scalar field, we find threshold behavior that can be described by the spherically symmetric critical solution with axisymmetric perturbations. However, we see some indications of a growing non-spherical mode that eventually causes a near-critical solution, with some asymmetry in it, to bifurcate into what appears to be two new regions that each resemble the spherical critical solution. We also show preliminary results of the effects of angular momentum in axisymmetric threshold collapse, introduced via a complex scalar field.

Critical phenomena of gravitating sphalerons

R. Steven Millward (Brigham Young University) 11:45

Critical phenomena has been found for many matter configurations in general relativity. It is the purpose of this talk to explore the critical phenomena which exist in the gravitational collapse of Yang-Mills-Higgs fields in spherical symmetry. These phenomena are similar to those found previously for just the Yang-Mills field, but the overall phase space structure is fundamentally different in some regimes. Comments concerning how the endstates and critical solutions change as boundary conditions are modified will also be made.

Gravitational Collapse in 2+1 Dimensions with a Dilaton Coupled to a Cosmological Constant

Jay Call (Brigham Young University) 12:00

Gravitational collapse is considered in 2+1 dimensions with a dilaton coupled to a cosmological constant. Spherically symmetric, self-similar solutions are obtained. We examine the causal structure and consider their relation to critical collapse. We also consider the inclusion of electromagnetism into the model.

Late-time behavior of a scalar field in Kerr spacetime.

Mark Scheel (Caltech) 12:15

Wave packets, transients, and numerical relativity

Richard O'Shaughnessy (Caltech) 12:30

Session 7

2:15 – 3:45 pm, Saturday, 1 March

An instability of compact extra dimensions

Gary Horowitz (UCSB) 2:15

Bubbles and Black Holes

Henriette Elvang (University of California Santa Barbara) 2:30

Fat Branes in Infinite-Volume Extra Space

Chad Middleton (University of Tennessee) 2:45

Conformal Symmetry and Black Hole Horizons

Steven Carlip (UC Davis) 3:00

I will discuss the approximate conformal symmetry near a black hole horizon and its implications for the Bekenstein-Hawking entropy.

BTZ black hole entropy and boundary Liouville field theory

Yujun Chen (UC Davis) 3:15

The LISA Simulator

Louis Rubbo (Montana State University) 3:30

Using the results of Cornish and Rubbo (PRD 67, 022001, 2003) we have built a full simulation of the Laser Interferometer Space Antenna (LISA) that is valid at all frequencies and for arbitrary gravitational waveforms. The simulator takes an input waveform and returns the fully modulated LISA response,complete with realistic instrument noise. I will discuss the physics behind the simulator, and demonstrate its use by comparing the response of the detector to the standard low frequency approximation. The simulator codes are available for download from www.physics.montana.edu/LISA/

Session 8

4:15 – 6:00 pm, Saturday 1 March

Searching for gravitational waves from binary systems

Patrick Brady (University of Wisconsin - Milwaukee) 4:15

Eccentricity Distribution of Coalescing Black Hole Binaries Driven by the Kozai Mechanism in Globular Clusters

Linqing Wen (Caltech LIGO) 4:30

Searching for a stochastic background of gravitational waves

John Whelan (Loyola University New Orleans) 4:45

Template counting for extreme mass ratio inspirals observed by LISA

Jonathan Gair (Caltech) 5:00

Extreme mass ratio inspirals are likely to be one of the more important sources for the LISA gravitational wave detector. We are presently scoping out the data analysis problem for these sources using approximate numerical waveforms. Current progress and results will be described.

Zoom, Whirl, and Chirp: Listening for extreme-mass-ratio inspirals with LISA

Teviet Creighton (Caltech) 5:15

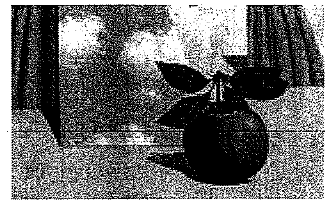
Do we really need the local self force for extreme mass-ratio inspirals?

Lior Burko (University of Utah) 5:30

The local self-force is needed for extreme mass-ratio inspirals for two reasons: (i) to determine the rate of change of Carter's constant, and (ii) to include conservative effects in the orbital evolution. There are two sources for forces which act at order m^2 on the companion of mass m of the central black hole: First, the self force. Second, the spin force, i.e., a force which comes about because the companion is not truly pointlike and has spin angular momentum. Typically, we expect the latter to overwhelm the former both in the context of finding the rate of change of Carter's constant and for finding conservative contributions to the orbital evolution. If that is indeed the case, the need for accurate self-force calculations might perhaps be less urgent than previously thought.

19th

PCGM • Program



Pacific Coast Gravity Meeting Program

The following is a list of the planned sessions and break periods at the PCGM. Speakers in each session are listed after the session number. To view details of speakers' planned titles and abstracts, click on the session number to view the appropriate session schedule page.

Friday, February 28, 2003

Friday's PCGM sessions will be held in the Gould Auditorium at the Marriott Library.

Time	Event	
9:00 - 10:30	Session 1	Miller Khokhlov Diener Frittelli Lindblom
10:30 - 11:00	Coffee Break	
11:00 - 12:30	Session 2	Laddha Dray Pezzaglia Torre Dumse Newman
12:30 - 2:30	Lunch Break	
2:30 - 4:00	Session 3	Will Marcoline Kapner Berg Steffen Cross
4:00 - 4:30	Coffee Break	
4:30 - 6:00	Session 4	Costello Price Bromley Beetle Baker Lousto

Saturday, March 1, 2003

Saturday's PCGM sessions will be held in room 102 of the James Fletcher Building.

Time	Event	
10:00 - 11:00	Session 5	Berger Isenberg Pullin Kuchar
11:00 - 11:30	Coffee Break	
11:30 - 12:45	Session 6	Pretorius Millward Call Scheel O'Shaughnessy
12:45 - 2:15	Lunch Break	
2:15 - 3:45	Session 7	Horowitz Elvang Middleton Carlip Chen Rubbo
3:45 - 4:15	Coffee Break	
4:15 - 6:00	Session 8	Brady Wen Whelan Gair Creighton Burko

PCGM
- Home
- Registration
- Program
- Links

PriceFest
- Home
- Registration
- Events

Travel
- Home
- Hotels
- Campus
- Parking
- Lunch
- Transportation
- Weather

Salt Lake
- Home
- Activities
- Dining

Family

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9:10 am	Kip Thorne California Institute of Technology	The Early Richard: Motorcycles, Karate Chops, Hair Loss, and Tails
10:10 am		Coffee Break
10:35 am	Jorge Pullin Louisiana State University	Richard Price, Car Talk and The American Journal of Physics
11:35 am		Coffee Break
12 noon	David Kieda University of Utah	The Hidden Side of Richard Price
12:45 pm		Lunch Break
2:30 pm	Bernard Schutz Albert-Einstein-Institut	Catching Flies and Journalists with Richard Price
3:30 pm		Coffee Break
4:00 pm	Carlos Lousto Univesity of Texas, Brownsville	The Late Richard Price

The Fest talks will be held in room 101 of the James Fletcher Building on the University of Utah campus. The lectures will begin promptly on Sunday morning and will be open to the public, so be sure to show up in time to ensure yourself a seat.

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