Friday, November 21, 2014 8:30PM - 9:30PM –
Session A1 Plenary Session  Melliger Commons - Christopher Fasano, Monmouth College

8:30PM A1.00001 Small but Surprising: The Curious Magnetic Fields of the Moon
JASPER HALEKAS, University of Iowa —

Saturday, November 22, 2014 8:00AM - 9:12AM –
Session AB1 Interdisciplinary  CSB 100 - Pattee - Timothy Stiles, Monmouth College

8:00AM AB1.00001 Super-Resolved Microscopy: Brief History and Recent Results
, KISHOR T. KAPALE, Western Illinois University —

8:36AM AB1.00002 Experimental investigation of the Malkus-Lorenz waterwheel.
GEORGE RUTHERFORD, RICHARD MARTIN, Illinois State University — The Malkus waterwheel is well-known as a simple mechanical system that can exhibit chaotic behavior. Our experimental version of this wheel consists of 36 cylindrical cells placed around the edge of the tilted wheel. Water leaks from each cell through a long outlet of small diameter. A thin aluminum ring at the periphery of the wheel passes through variable gap magnets, allowing for adjustable eddy-current braking that is used as the control parameter. We acquire angular time series data with a rotary encoder, and we then smooth the data and calculate angular velocity and acceleration using Fourier transforms. Experimental results are compared with a model by Strogatz, and significant differences will be discussed. We will also show the results of the application of Gottwald’s 0-1 test for chaos to the data, which indicate that all data at brake strengths higher than the period doubling cascade are chaotic. Preliminary data will also be presented that indicate that the total mass of water in the wheel does not approach a constant as assumed in the model.

8:48AM AB1.00003 Exact solution to kinetic Monte Carlo simulations and its application to energy materials
, ANGEL YANGUAS-GIL, Energy Systems Division, Argonne National Laboratory — In many circumstances kinetic Monte Carlo simulations are used to determine the probabilistic outcome of a process. However, one of the challenges of this method is the need to accumulate enough statistics to reduce errors to a manageable level. Here we show how for this set of problems it is possible to formally extract the exact solution for the probabilistic outcome of a kinetic Monte Carlo process by presenting the kinetic Monte Carlo problem in terms of a master equation. This reduces the solution method to the inversion of a single sparse matrix, from which all the relevant data can be extracted. We have applied this method to tackle two cross-cutting problems in the area of energy applications: the simulation of particle-surface interaction during wide band gap semiconductor epitaxy and the transport of charged species in nanostructured electrodes.

9:00AM AB1.00004 Analysis of gravity wave perturbations observed in the centroid profiles of polar mesospheric clouds during tomographic reconstruction of AIM satellite imagery
, VERN HART, William Woods University, MICHAEL TAYLOR, Utah State University, TIMOTHY DOYLE, Utah Valley University, YUCHENG ZHAO, Utah State University, AIM COLLABORATION — NASA’s Aeronomy of Ice in the Mesosphere (AIM) satellite is the first with a sole commission of studying polar mesospheric clouds (PMCs). These clouds, which are being observed with increasing frequency, are of interest due to their sensitivity to climate changes. Three-dimensional (3D) tomographic reconstructions of PMCs will be presented which were rendered from a series of AIM satellite images. An intensity-weighted centroid was calculated to form surface plots showing altitude variability of the mean albedo. Evident in these plots were coherent wave fronts propagating through the layer, suggesting the presence of gravity wave perturbations in the data. FFT analysis was performed and results showed a strong contribution from ∼60-90km wavelengths. It was also found that high centroid altitudes generally corresponded well with low-intensity regions in the albedo images. This correlation indicates that the presented method could be applied to particle size investigations as denser particles are found at lower altitudes and scatter light more strongly than lighter particles. Results from five different AIM orbits will be presented and discussed as they apply to investigating wave-induced dynamics when resolution is limited.

Saturday, November 22, 2014 10:00AM - 11:36AM –
Session B1 Particle and Nuclear Physics  CSB-100 - Pattee Auditorium -

10:00AM B1.00001 A Brief History Of Neutrino Physics
, CHRISTOPHER WHITE, Illinois Tech University —

10:36AM B1.00002 The Discovery of the Higgs Boson and the Future of Particle Physics
, PUSHPALATHA BHAT, Fermilab —

11:12AM B1.00003 Dark Matter May Indicate Several Standard Models Exist
, RICHARD KRISKE, University of Minnesota — Recently Matter was ejected from Neutron Stars at Relativistic Velocities (.3 the Velocity of Light). This Author proposed that this matter could be Super Heavy Hydrogen (Hydrogen with more that 2 Neutrons). The Neutron Star is evidence that extremely large Nuclei can exist in that it has Billions upon Billions of Neutrons in it. This author proposes that those Neutrons are in a Crystal formation, a Quasi-Crystal of Neutrons and Mesons and when the Matter is ejected it gets its energy from the breaking of that crystal, the subsequent decay of some of the Neutrons to Hydrogen, with the expulsion of a Neutrino and a Nuclear Electron. The ejected matter maintains its Quasi-Crystal structure and creates Gamma Ray and lightning. The surviving Hydrogen combines with Oxygen and winds up in the Deepest areas of the Oceans. Most of the “Dark Matter” does not come to Earth as Cosmic Rays, but rather comes to rest in Outer Space. Neutron Stars and Black Holes may create a large amount of “Dark Matter” whose structure is greatly different from Normal Matter in that it is Super Massive, there may be many series of “Magic Numbers” amongst the Stable Nuclei and it be that there are many “Standard Models” that have a Crystal Structure (Obeys Group Theory) due to the nature of the Graviton.
11:24AM B1.00004 Rotational and Vibrational as Well as Linear Kinetic Energies Should Be Included In Pair Production and Annihilation Energy Calculations. STEWART BREKKE, Northeastern Illinois University(former grad student) — Including rotational and vibrational as well as linear kinetic energies in pair production and annihilation calculations may produce a better reconciliation between theoretical and experimental values. The creating photon may produce particle vibration and/or rotation as well as possibly linear motion besides mass: \( h\nu = [(m_c^2)_{+} + (m_c^2)_{-} + (1/2)\omega^2)_{+} + (1/2)\omega^2)_{-} + (1/2k_x^2)_{+} + (1/2k_x^2)_{-} + (1/2k_y^2)_{+} + (1/2k_y^2)_{-} + (1/2k_z^2)_{+} + (1/2k_z^2)_{-}] \). In pair annihilation at least two photons may be produced: \( h\nu_1 + ... + h\nu_m = (m_c^2)_{+} + (m_c^2)_{-} + (1/2)\omega^2)_{+} + (1/2k_x^2)_{+} + (1/2k_x^2)_{-} \).
C1.00006 Computational and Physical Analysis on Biomedical Imaging Using Alternative Method for Higher Resolution, RICHARD WU, KYUYEOL KIM, SEWON PARK, Choice Research Group — An MRI (magnetic resonance imaging) scan is a technique that uses magnets, computers, and radio waves to produce images of the intended subject. This is a common medical imaging technique used to determine the anatomy and physiology of the subject in multiple areas. The technique is widely used in medical diagnosis, disease, staging of diseases and subject studies etc. To get the image from MRI, frequency has to be transferred to image using mathematical and computational transformations. Since the low spatial frequencies contain the most of the information about the image, not all of the data is necessary in producing the required image. A proper function can be multiplied by original k-space to get reduced size of frequencies which will be used to determine output image. In this research, new computational MRI physics experiments were carried out with several modified filters to reduce the ringing effect, to improve the resolution of an MRI image to a degree, and to propose an efficient function as a new filter.

C1.00007 Improving Capacitances and Supercapacitors with Metal-Organic Frameworks, JAE JUNE LEE, KYUYEOL KIM, RICHARD KYUNG, Choice Research Group — If the space between the plates of a capacitor is filled with an insulator, the capacitance of the capacitor will be improved. A supercapacitor can hold hundreds of times more electrical density than a standard capacitor. In this research, we considered two cases of capacitors to improve capacitances in the electric device. First, considering the effective capacitance of a capacitor filled with multiple slabs of dielectrics with different dielectric constants, we showed the influence of the multiple dielectric slabs inserted in one capacitor on the electric field distribution in the capacitor system. Also changing energy stored in the capacitor is observed when the dielectric slab is withdrawn from the capacitor. And second, this study shows how metal-organic frameworks (MOFs) in the supercapacitors can be incorporated into electrical devices to generate high capacitance; in particular, a MOF with a transitional metal exhibits exceptionally high capacitance and charge/discharge cycles.

C1.00008 Optical Exploration of Cellular Microenvironments, JOSHUA WEBER, KEVIN ELICEIRI, University of Wisconsin - Madison, LABORATORY FOR OPTICAL AND COMPUTATIONAL INSTRUMENTATION TEAM — Cell function and behavior are influenced by various local factors. The cellular microenvironment includes surrounding cells and the extracellular matrix, molecules and proteins that provide structural and functional support. In addition to the local chemistry, the physical properties of these environs affect cell behavior, as do the mechanical forces they exert. At the Laboratory for Optical and Computational Instrumentation, we use multiple optical imaging modalities to explore cellular microenvironments. A principle tool is multiphoton fluorescent excitation microscopy. Based on non-linear effects, this technique reduces scatter and allows for deeper optical exploration. This is particularly useful in 3D tissue imaging, as it permits optical sectioning of intact tissues. Fluorescence lifetime microscopy reveals environmental effects through variations in the delay between excitation and decay. With spectral discrimination, multiple fluorophores, and thus multiple aspects of the environment, can be examined concurrently. We also experiment with high-speed time-of-flight techniques based on indirect scattering, which permit imaging of otherwise inaccessible regions. With these imaging modalities, we explore cellular microenvironments in a range of biological samples.

Saturday, November 22, 2014 12:45PM - 1:57PM — Session D1 Astrophysics, Cosmology and Astronomy I — CSB 100 - Pattee Auditorium —

12:45PM D1.00001 The Cosmology of Primordial Black Holes, JAMES CHISHOLM, Sauk Valley Community College — Ever since their theoretical “discovery” more than 40 years ago, black holes created in the earliest stages of the universe with masses below the Chandrasekhar limit — or Primordial Black Holes (PBHs) — have continued to be investigated for their influence in a number of cosmological contexts. In this talk, I will review some of the ways PBHs have been invoked in the past to resolve cosmological mysteries, as well as mechanisms for their continued influence in the universe today.

1:21PM D1.00002 The Early University (FF) Model of Primordial Magnetic Field at Large Field Inflation1, ANWAR ALMUHAMMAD, University of Texas at San Antonio — Primordial magnetic fields (PMF) are detected in almost all astrophysical systems and scales from planets to superclusters of galaxies. They also have been detected in very low density intergalactic medium with $B_0 > 10^{-16}$G. The simple inflation model, $(F^2F)^4$ becomes more attractive because it leads to a scale invariant (spectrum $P(k) k^{-2}$) and a detection of the tensor mode (B-mode) of the polarization of temperature anisotropy in CMB. The tensor to scalar ratio reported was $r = 0.2 \pm 0.07$, which, if confirmed, raises the scale of inflation to GUT scale, $10^{4/3}/G$. The chaotic inflationary models with such large field inflation (LFI) fit the new result more than the standard models. We calculate both magnetic and electric spectra generated by the $F^2F$ model in the LFI for all possible values of model parameter, $p$. We show that the necessary scale invariance property of PMF cannot be obtained in LFI under the first order of slow roll limits. Furthermore, if the limits were released to achieve the scale invariance, the model would suffer from backreaction problems.

1Thanks to physics department of UTSA which support this research.

1:33PM D1.00003 Inflation and Blowing to eliminate irregularities, AHMAD AL-TAHAN, Ahmad Al-Tahan — We determine that it is possible for cosmological inflation to occur without leaving behind irregularities and unresolved infinite results. We suggest that inflation should be followed by a blowing of matter instead of a slow expansion, which would be a viable way of forming galaxies and resolving the issue of having everlasting irregularities left from inflation. We accordingly propose a late inflation of the Gravity Attraction Sky—the center of gravity attraction in the universe—to reduce irregularities, increase the influence of gravity upon the matter and bring the universe energies into zero balance. We also suggest that fast, late inflation ended with expansion that maintained the zero-energy balance. Expansion was followed by acceleration, a process related to the influence of the expansion of the Gravity Attraction Sky on matter. Gravitational attraction to matter inside the Gravity Attraction Sky increases environmental effects through variations in the Gravity Attraction Sky. The increase in acceleration would lead to the end of the universe because of its increasing mass. We suggest that dark energy is a kind of wind energy that initiated and decayed when matter and anti-matter annihilated. The results, should help scientists resolve several obstacles.

1:45PM D1.00004 Fractal boundaries in chaotic scattering of charged particles from a magnetic neutral line field, RICHARD MARTIN, DANIEL HOLLAND, JAMIE SVETICH, Illinois State Univ — In this talk we examine chaotic scattering of charged particles in magnetotail-like fields in the Earth’s magnetosphere. We focus on a two-dimensional magnetic neutral line field and compare results with published studies using magnetic field reversal current sheet field. Both of these Hamiltonian systems exhibit chaotic scattering over a wide range of parameter values. In the current sheet there is a well defined energy resonance that governs the dynamics, and we show that the neutral line model has no such resonance. We investigate the fractal behavior of the final state exit region boundaries when particles are injected far from the neutral line or field reversal region. Both models have fractal exit region boundaries, and we compare their behavior.
2:00PM E1.00001 Fractional Quantum Hall Effect in the Second Landau Level

ASHHWANI KUMAR, Monmouth College — A magnetic field applied perpendicular to the plan of a two-dimensional electron gas (2DEG) resolves the energy spectrum into discrete Landau levels. At low temperatures strong electron-electron interactions lead to the condensation of the 2DEG into the quantum fluid ground state responsible for the fractional quantum Hall effect (FQHE) and other exotic states. The nature of the FQHE states in lowest Landau level can be understood using conventional Laughlin-Jain theory. However the nature of FQHE states forming in second landau level (SLL) remains unknown. Our recent measurements of energy gap in SLL further raise the possibility of the non-conventional origin of these states. In this presentation I will talk about the transport studies of the newly established FQHE state at the Landau level filling factor $\nu = 3 + 1/3$. This and other odd-denominator states in SLL unexpectedly break particle-hole symmetry. Specifically, we find that the relative magnitudes of the energy gaps of the $\nu = 3 + 1/3$ and $3 + 1/5$ states from the upper spin branch are reversed compared to the $\nu = 2 + 1/3$ and $2 + 1/5$ counterpart states in the lower spin branch. Our findings raise the possibility that the former states have a non-conventional origin.

In collaboration with Ethan Kleinbaum, Purdue University; L.N. Pfeiffer, Princeton University; K.W. West, Princeton University; and Gabor Csathy, Purdue University.

2:30PM E1.00002 Effect of Cadmium Selenide Nanoparticles on the Optical Band Gap of Lead Borate Glasses

NICHOLAS BRESLIN, SAISUDHA MALLUR, P.K. BABU, Western Illinois University — The study of the variation of the optical band gap with composition in glasses gives information about the structure and electronic properties. Glasses containing nanoparticles is an interesting system to study due to its fundamental importance in mesoscopic physics and potential for technological applications. We studied lead borate glasses with the composition xPbO:(100-x)B$_2$O$_3$:1CdSe varying x between 29, 39, 49, 59, and 69 mol%. Glasses were prepared by the usual melt-quench method. Starting materials were melted at 1000°C and the melt was poured onto a brass plate. Glass pieces obtained through this quenching process were annealed for one hour at 400°C. Annealed glass pieces were polished using a lapping machine. Optical absorption measurements were carried out using a UV-VIS absorption spectrometer. The optical energy band-gaps were determined from the absorption edge data using Mott-Davis model. The optical band gap values are smaller and show unusual variation with PbO content compared to the binary lead borate glasses. In binary lead borate glasses, the absorption edge is due to direct forbidden transition whereas CdSe nanoparticles doped system initially shows indirect forbidden transition and with higher PbO content, it changes to indirect allowed transition.

2:42PM E1.00003 Near-field spatial mapping of strongly interacting multiple plasmonic infrared antennas

YOHANNES ABATE, Georgia State University — Near-field dipolar plasmon interactions of multiple infrared antenna structures in the strong coupling limit are studied using scattering-type scanning near-field optical microscope (s-SNOM) and theoretical finite-difference time-domain (FDTD) calculations. We monitor in real-space the evolution of plasmon dipolar mode of a stationary antenna structure as multiple resonantly matched dipolar plasmon antennas are closely approaching it. Interparticle separation, length and polarization dependent studies show that the cross geometry structure favors strong interparticle charge-charge, dipole-dipole and charge-dipole Coulomb interactions in the nanometer scale gap region, which results in strong field enhancement in cross-bowties and further allows these structures to be used as polarization filters. The nanoscale local field amplitude and phase maps show that due to strong interparticle Coulomb coupling, cross-bowtie structures redistribute and highly enhance the out-of-plane (perpendicular to the plane of the sample) plasmon near-field component at the gap region relative to ordinary bowties. Preliminary results on using VO$_2$ film to tune infrared plasmonic antenna resonances will be presented.

1This work was supported by the U.S. Army Research Office, Agreement Number: W911NF-12-1-0076

2:54PM E1.00004 Molecular Dynamics of a Series of Self-Assembling Organic Monolayers: Selective Adsorption and Catalysis on 2D Molecular Sieves

ALEXANDER ST. JOHN, CARLOS WEXLER, Univ. of Missouri-Columbia — Spontaneous molecular self-assembly is a promising route for bottom-up manufacturing of two-dimensional (2D) nanostructures with specific topologies on atomically flat surfaces. Of particular interest is the possibility of selective lock-and-key interaction of guest molecules inside cavities formed by complex self-assembled host structures. Our host structure is a monolayer consisting of interdigitated 1,3,5-tristyrylbenzene substituted by alkoxy peripheral chains with specific topologies on atomically flat surfaces. Of particular interest is the possibility of selective lock-and-key interaction of guest molecules inside cavities formed by complex self-assembled host structures. Our host structure is a monolayer consisting of interdigitated 1,3,5-tristyrylbenzene substituted by alkoxy peripheral chains containing $n_1 = 6, 8, 10, 12,$ or 14 carbon atoms (TSB3,5-C$_n$) deposited on a highly ordered pyrolytic graphite (HOPG) surface. Using ab initio methods from quantum chemistry and molecular dynamics simulations, we construct and analyze the structure and functionality of the TSB3,5-C$_n$ monolayer as a molecular sieve. Supported by ACS-PRF 52696-ND5.

3:06PM E1.00005 Interfering effects of localized electronic and nuclear spins on carrier transport in organic semiconductors

KEYSER SAHIN TIRAS, YIFEI WANG, NICHOLAS J. HARMON, MARKUS WOHLGENANNT, MICHAEL E. FLATTE, University of Iowa — Spin and magnetic-field effects in organic semiconductors have been intensively studied over the recent years. An interaction between electronic and nuclear spins (hyperfine interaction) is responsible for these magnetic-field effects. In organic semiconductor solid-state devices, a variety of such magnetic field effects have been observed. For example, magnetoresistance effects may be used for magnetic random-access-memory (MRAM). We experimentally and theoretically study the influence of radical doping on the transport characteristics in a conjugated polymer MEH-PPV in terms of mageto conductance (MC) and power conversion efficiency (PCE). We find that for initial doping the radical spins relax the mobile spins, thus reducing the magnetic field effect on magnetoresistance. For intermediate doping a dopant spin interacts with only one component of the radical pair. In this region, the MC is independent of the doping level and is reduced to half its undoped value. For further doping a galvinolx molecule interacts with both carriers that form a radical pair, the MC is completely quenched. We will also discuss the effect of galvinolx doping on photovoltaic PCE in the different regimes.
Here by means of the first-principles (KKR Green’s function method + CPA + Kubo linear response formalism) we show that one can take
account for the important effects of broken translational symmetry, possible constructive role of disorder has been largely overseen.

STANISLAV CHADOV, LUKAS WOLLMANN, SUNIL D’SOUZA, CLAUDIA FELSER, Max Planck Institute for Chemical Physics of Solids,
University —

Conductors Utilizing a Tunnel Diode Resonator Circuit

RYAN GORDON, Western Illinois University — Utilizing a Tunnel Diode Resonator Circuit.

Newly discovered iron-based superconductors may be the key to understanding how the general mechanism of high-temperature superconduc-
tivity is possible. One way to gain insight into how this phenomenon works is to experimentally probe the superconducting gap structure in
these materials, which is closely tied to the electronic interactions that give rise to this state. The experimental probe that has been used in
this study to look at the superconducting gap structure is the London penetration depth, which characterizes the rate at which externally
applied magnetic fields are screened from the interior of a superconductor. The London penetration depth in various members of the iron-based
superconductors has been measured in this study utilizing a tunnel diode resonator (TDR) circuit. This is a specially designed LC oscillating
resonance circuit that is powered by a tunnel diode with a radio frequency resonance having parts-per-billion sensitivity to sense changes in its
natural resonance frequency induced by a sample. The resulting data for the iron-based superconductors will be shown and compared to other types of
superconductors that have been measured with the same technique.

Entanglement dynamics of capacitively coupled spin qubits in the presence of stray inductance

MICHAEL WOLFE, SHAWNA CHISHOLM, JASON KESTNER, None — A pair of spin qubits formed by electrons confined in a pair of double quantum dots can be entangled at distances on the order of microns via a floating metallic top gate that mediates capacitive coupling [1]. The double-well biases, and hence the coupling through the top gate, can be controlled through voltage leads connected to an arbitrary waveform generator. We theoretically examine how the entanglement dynamics of the system are affected by inductance of the coupling element when the biases are driven at high frequencies. We numerically simulate the von Neumann density matrix as a function of time in various parameter regimes. In particular, we examine the behavior when the qubits are driven near the resonance frequency of the coupling element.


in situ Electron Holography for Electromagnetic Analysis at Nanoscale

ARTURO PONCE, FERNANDO MENDEZ, JESUS CANTU, JOHN EDER SANCHEZ, Univ of Texas, San Antonio, MICROSCOPY OF SOLIDS TEAM — Electron holography provides powerful information about not only morphology and size of individual nanostructures but electromagnetic behavior around and within the structures. Quantitative measurements can be done to characterize the magnetic and electric properties in these structures. In addition, be stimulating with external signals we can study their response and important characteristics of the structures. We are currently using electron holography to study how the holography evolves in time after the application of a signal. Our results show that the holography signal changes as a function of the applied signal strength.

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5:02PM F1.00005 Sub-nanoscale Microscopy via Coherent Population Oscillations .

KISHOR KAPALE, Western Illinois Univ, GIRISH AGARWAL, Oklahoma State University — We present a microscopy scheme to attain sub-nanoscale resolution based on the phenomena of coherent population oscillation (CPO). We build on the success of our earlier super-resolution methods based the phenomena of coherent population trapping (CPT). For successful application to microscopy, the effect being employed for super-resolution needs to be attainable in a large class of materials. In this context, it becomes necessary to resort to a phenomena-which is similar to CPT but can be potentially observed in a larger class of materials including gases, liquids, and room-temperature solids—such as CPO. The CPO based schemes involve two-level atoms coupled to two optical fields slightly different in frequency. The CPT-like nonlinear effects such as group velocity manipulations within the CPO schemes have been observed in room temperature solids and biological samples as opposed to in atomic vapors and cold atomic gases in the case of CPT. This parallel allows us to extend our CPT-based work to CPO-based microscopy schemes and makes them attainable in much larger class of materials including solids and biological samples. We show that the CPO-based schemes offer similar resolution as the CPT-based schemes and are attainable in a larger class of materials.

Saturday, November 22, 2014 5:10PM - 5:46PM —
Session G1 Astrophysics, Cosmology and Astronomy II CSB 100 - Pattee Auditorium - Christopher Fasano, Monmouth College

5:10PM G1.00001 The Mass of the Higgs Boson and an Unstable Vacuum in the Context of the GEM Unification theory . JOHN BRANDENBURG, Morningstar Applied Physics LLC — The Higgs Boson at \( m_{\text{Higgs}} =126 \text{GeV} \), it has been said, leads to the potential for ‘cosmic catastrophe.’ However, in the context of the GEM unification theory (1) the Higgs Boson mass can be seen as part of a system of particle masses that creates a Big Bang fireball of hydrogen in its later stages (2). In this talk the GEM theory will be discussed with the Higgs Boson in its role as the manifestation of a compact Kaluza-Klein 5th dimension. In the GEM context, compactification of a 5th dimension leads to the Big Bang (2) and afterward leads to merely a gentle ‘external inflation’ with \( \Omega \approx 1 \) and a vacuum unstable to production of proton-electron pairs (3). The unstable vacuum fluctuations of quantum masses associated with a hidden dimension size leads to an approximate Dirac Condition: \( T_H \approx \left( \frac{9 m_{\text{Higgs}}}{m_p}\right)^{1/3} \left( \frac{\pi}{2}\right)\frac{(e^2/Gm_p m_e)}{r_e} = 12 \text{ Gyr} \) (in cgs) where \( m_p \) and \( m_e \) are the proton and electron masses respectively, \( e \) is the electron charge, \( T_H \) is the Hubble time and \( r_e \) is the electron classical radius, and \( G \) is the Gravitation constant and \( c \) is the speed of light. (1) J.E. Brandenburg (2012) “An Extension of the GEM Unification Theory to Include Strong and Weak Nuclear Forces and an Estimate of the Higgs Boson Mass” STAIF II Conference Albq. NM (2012) also Jou. Space Expl. Vol 1, issue 1. (2) J.E. Brandenburg (2013) 27th Texas Symposium on Relativistic Astrophysics, Dallas TX. (3) J.E. Brandenburg (1995) “A Model Cosmology Based on Gravity Electro-Magnetism Unification”, Astrophysics and Space Science, Vol 277, p133-144

5:22PM G1.00002 Generalizing Newton’s Laws to achieve a better understanding of gravitation . JOHN LAUBENSTEIN, Charitable Management Systems, Inc. — According to General Relativity (GR), what we spatially observe as nature is the projection of events occurring on a curved four-dimensional space-time manifold projected back onto the three-dimensional world in which our senses perceive. As such, an object that appears in three dimensions to accelerate due to the influence of gravity is in actuality experiencing no external force and is following a straight line as defined by a curved four-dimensional geometry. This insight was a brilliant way to preserve Newton’s First Law. Yet, even in three-dimensions we are aware that the observer in free fall feels no acceleration and therefore cannot truly be classified as being under the influence of a force. This is generally described as transforming away the force through free fall, but the reality remains that an observer in free fall never feels acceleration. This suggests that it is equally valid — and perhaps preferential - to generalize Newton’s Laws to accommodate our three dimensional spatial observations. Using this approach, it is valid to generalize Newton’s Laws from the special case of a balanced distribution of mass-energy in the universe to the general case where the mass-energy distribution of the universe is unbalanced. In the general case, the motion of a test particle may increase in velocity without the presence of an external force in agreement with observation. Generalizing Newton’s Laws can be shown to sharpen our understanding of gravity and sheds a significant new perspective on the century long influence of the Equivalence Principle.

5:34PM G1.00003 Evidence of Massive Thermonuclear Explosions in Mars Past, The Cydonian Hypothesis, and Fermi’s Paradox . JOHN BRANDENBURG, Morningstar Applied Physics LLC — Analysis of recent Mars isotopic, gamma ray, and imaging data supports the hypothesis that perhaps two immense thermonuclear explosions occurred on Mars in the distant past and these explosions were targeted on sites of previously reported artifacts. Analysis rules out large unstable “natural nuclear reactors” [1], instead, data is consistent with mixed fusion-fission explosions [2]. Imagery at the radioactive centers of the explosions shows no craters, consistent with “airbursts.” Explosions appear correlated with the sites of reported artifacts at Cydonia Mensa and Galaxias Chaos [3]. Analysis of new images from Odyssey, MRO and Mars Express orbiters now show strong evidence of eroded archeological objects at these sites. Taken together, the data requires that the hypothesis of Mars as the site of an ancient planetary nuclear massacre, must now be considered. Fermi’s Paradox, the unexpected silence of the stars, may be solved at Mars. Providentially, we are forewarned of this possibility by the study of gravity and sheds a significant new perspective on the century long influence of the Equivalence Principle.