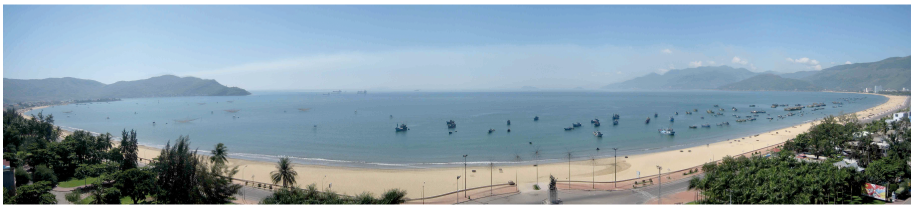
Les Rencontres du Vietnam

Quy Nhon, December 17th - December 22nd, 2011



Xth International Conference on Gravitation, Astrophysics and Cosmology
ICGAC10

Abstracts
(in alphabetical order of speaker)

Equations of motion of rotating bodies system with inner structure in GR mechanics

Abdildin M.M., Abishev M.E., Beissen N.A., Toktarbay S. Al Farabi Kazakh National University

presented by: Abishev M.E. email-abishevme@mail.ru, phone-+77273754358, fax-

Poster

We consider extended expressions for contravariant and covariant components of metric tensor of external field of N rotating bodies in GR taking into account terms corresponding to the terms of Lagrange function $L\ mq^2(R^3/D^3)$, $L\ mq^2(v^4/c^4)$ and $L\ mq^2(R^4/D^4)$ derivation. On base of this metric obtained corresponding Lagrange function and equations of rotational and translational motion of system by the second Fock's method.

Representing the Massive Graviton in the Metric Tensor g(u,v)

Andrew Beckwith Chongqing University department of physics

presented by: andrew Beckwith email-rwill9955b@yahoo.com, phone-, fax-

Poster

We quantify the h10 , h20 , and h30 contributions to massive gravitons in the g(u,v) metric tensor, with h10 representing (1+1) geometry, and 1/50,000 in magnitude to h30 of (3+1) geometry. The non vanishing of the h10 term representing (1+1) geometry, and h20 term for (2+1) contravenes predictions of no relic gravitational waves and makes predictions if the prior universe was a single event a la Steinhardt or a multiverse in the form suggested by Tegmark. I.e. change in the application of the 2nd derivative of the inflation = 0 of inflation. To perhaps a non zero 2nd derivative of the inflaton (modification of some of the slow roll condition).

The fate of Cyg X-1: an empirical lower limit on BH-NS merger rate

Chris Belczynski Warsaw University

presented by: Chris Belczynski email-kbelczyn@astrouw.edu.pl, phone-, fax-

Oral parallel

The recent distance determination allowed precise estimation of the orbital parameters of Cyg X-1, which contains a massive 14.8 solar mass BH with a 19. solar mass O star companion. This system appears to be the clearest example of a potential progenitor of a BH-NS system. We follow the future evolution of Cyg X-1, and show that it will soon encounter a Roche oe overflow episode, followed shortly by a Type Ib/c supernova and the formation of a NS. It is demonstrated that in majority of cases ($\gtrsim 70\%$)) the supernova and associated natal kick disrupts the binry due to the fact that the orbit expanded significantly in the Roche lobe overflow episode. In the reminder of cases ($\lesssim 30\%$) the newly formed BH-NS system is too wide to coalesce in the Hubble time. Only sporadically ($\sim 1\%$) a Cyg X-1 like binary may form a coalescing BH-NS system given a favorable direction and magnitude of the natal kick. If Cyg X-1 like channel (comparable mass BH-O star bright X-ray binary) is the only or dominant way to form BH-NS binaries in the Galaxy we can estimate the empirical BH-NS merger rate in the Galaxy at the level of $\sim 0.001\ \mathrm{Myr}^{-1}$. This rate is so low that the detection of BH-NS systems in gravitational radiation is hiighly unlikely, generating Advanced LIGO/VIRGO detection rates at the level off only ~ 1 per century. If BH-NS inspirals are in fact detected, it will indicate that the formation of these systems proceeds via some alternative and yet unobserved channels.

Accretion into black holes, and relativistic jets.

G.S. Bisnovatyi-Kogan Space Research Inst. Rus. Acad. Sci.

presented by: G.S. Bisnovatyi-Kogan email-gkogan@iki.rssi.ru, phone-+7-495-3334588, fax-+7-495-3334588

Oral plenary

The problem of the formation of a large-scale magnetic field in the accretion disks around black holes is reconsidered, with account the non-uniform vertical structure of the disk. The high electrical conductivity of the outer layers of the disk prevents the outward diffusion of the magnetic field. The solution for a stationary state with a large magnetic field in the inner parts of the accretion disk, and strong vertical stratification is analyzed. Global solution of advective accretion disk structure around a black hole is constructed numerically. At high luminosity there is a continuous transition between the optically thick outer and optically thin inner disk regions. Models of accretion flows with large mass accretion rates are considered using a bridging formula for radiative losses at high and low effective optical depths. Contrary to the models neglecting advection, the global solutions have been found for all investigated range of accretion rates. The presence of the effectively optically thin regions in the innermost part of accretion disks results in a significant increase of the plasma temperature in those regions and this increase can be discriminated in observations in the form of the observed hard radiation tails. The temperature of the inner region is increasing with a growth of the angular momentum of the black hole, and may reach pair formation conditions for rotating black holes. Modelsof aa magnetic jet collimation are constructed.

Gravitation theory and dark matter

Luc Blanchet Institut d'Astrophysique de Paris

presented by: Luc Blanchet email-blanchet@iap.fr, phone-33-1-44-32-81-77, fax-

Oral plenary

The modified Newtonian dynamics (MOND) is very successful in reproducing the phenomenology of dark matter at the scale of galaxies. The usual interpretation of MOND is that there is no dark matter and we witness a violation of the Newtonian law of gravity. In this presentation we review the phenomenology of MOND and the existing proposals for modifying gravity in a consistent extension of general relativity. Then we suggest that MOND could also be due to some exotic property of dark matter itself. We propose a natural interpretation of MOND in terms of a mechanism of "gravitational polarization" of a medium made of dipole moments playing the role of dark matter. We present a relativistic model of dipolar dark matter and we discuss its viability in cosmology. Finally we address the problem of testing MOND in the Solar system using the best planetary ephemerides.

Regular black holes and the stability problem

Kirill Bronnikov VNIIMS PUUR

presented by: Kirill Bronnikov email-kb20@yandex.ru, phone-+7-495-3321148, fax-+7-495-7812878

Oral plenary

We compare different types of regular static, spherically symmetric black holes and discuss their particular type, black universes which contain an expanding, asymptotically de Sitter T-region, able to model the observed Universe; such models exist in the presence of phantom matter. Thus our Universe could originate from phantom matter collapse in some mother universe, with isotropization after passing the event horizon and further expansion according to the Standard cosmological model. Next, we consider the stability of configurations supported by scalar fields with different potentials V(ϕ), including regular black holes as well as wormholes with flat or AdS asymptotics. A problem in such studies is that the effective potential W for perturbations is singular at a throat, if any. We show that W generically admits regularization, and solutions obtained using the regularized potential lead to regular perturbations of the metric. As examples, we consider some kinds of wormholes, cold black holes and black universes. For the latter, stability is proved at least in a certain part of the parameter space.

On the theoretical description of dark matterés halo

Leonid Chechin V.G.Fesenkov Astrophysical Institute

presented by: email-chechin-lm@mail.ru, leonid.chechin@gmail.com, phone-, fax-

Oral parallel

We argued that the standard field scalar potential couldn't be widely used for getting the adequate galaxies curve lines and determining the profiles of dark matter their halo. For discovering the global properties of scalar fields that can describe the observable characteristics of dark matter on the cosmological space and time scales, we propose the simplest form of central symmetric potential celestial of mechanical type, i.e. . It was shown that this potential allows get rather satisfactorily dark matter profiles and rotational curves lines for dwarf galaxies. The good agreement with some previous results, based on the N-body simulation method, was pointed out. A new possibility of dwarf galaxies masses estimation was given, also.

Three limits to the physical world

Pierre Darriulat, Hanoi University of Sciences and VATLY/INST, 179 Hoang Quoc Viet, Cau Giay, Hanoi, Vietnam

Presented by: Pierre Darriulat, email-darriulat@mail.vaec.gov.vn

Oral parallel

A diagram is presented that summarizes much of our current knowledge of the physical world and illustrates the constraints imposed by gravity, quantum physics and the presence of dark energy in the form of a cosmological constant.

Determination of the gravitational anomaly sources in the Mekong delta using teh wavelet transform with the optimal resolution

Duong Hieu Dau, Tran Thanh Phuc and Dang Van Liet College of Natural Science - Cantho University, College of Natural Science - University of HCM city

presented by: Duong Hieu Dau email-dhdau@ctu.edu.vn, phone-00 84 7103 832061 , fax-00 84 7103 832062

Poster

The inverse potential field problem for determination of the gravitational anomaly boundaries (3D) in the Mekong delta was carried out by continuous wavelet transform. The data filters with the parameters were chosen appropriately for Line-weight function (LWF) that have improved the resolution for the proposal method of analysis. The relative shape and size of the geophysical source was estimated from contour lines of the wavelet transform modulus maxima. The analytic results by multiscale edge detection method (MED) using experimental data of the Mekong delta show that there were 19 gravitational anomaly sources of different sizes in this region. The result of the location, depth and size of these source is consistency to the traditional methods before, but the level of detail for this technique is much higher.

AMIGA infill of the Pierre Auger Observatory

Luis del Peral for the Auger Collaboration Space & Astroparticle Group

presented by: Luis del Peral email-luis.delperal@gmail.com, phone-+34918855050, fax-+34918854942

Oral parallel

The AMIGA project (Auger Muons and Infill for the Ground Array) is developed to investigate Extensive Air Showers at lower energies than standard Auger array in order to explore the region were the transition from galactic to extragalactic sources is expected. The paper presents the project and the actual status of development.

Weyl gravity and Cosmology

Nathalie Deruelle APC, Paris

presented by: Nathalie Deruelle email-deruelle@ihes.fr, phone-, fax-

Oral plenary

We consider the evolution of linear cosmological perturbations during inflation when a Weyl term is added to the action. The presence of the ghost degrees of freedom implies that vector perturbations can no longer be ignored and that scalar modes diverge in the newtonian gauge but remain bounded in the comoving slicing. We hn show thhat these ghost degrees of freedom can be eliminated by a simple mechanism that invokes spontaneous Lorentz symmetry breaking. As a result the kinetic term of the tensor perturbations is corrected at short wave lengths. This leads to a redefinition of the quantum vacuum state, which could be imprinted on the amplitude of the spectrum of primordial gravitationalwwaves.

Recent results on measurements and iterpretattion of CMB fluctuations

Doroshkevich Andrey Astro Space Center of the Physical Institute of RAS

presented by: Doroshkevich A. **email-dorr@asc.rssi.ru, phone-+7 495 3332523, fax-+7 495 3332378**

Oral plenary

During last years observations of the relic radiation gave exclusive information in respect to the fundamental cosmological problems. Main observational results of the WMAP satellait and observations of several radio telescops are discussed. We consider the separation between fluctuations of the relic radiation and galactic foregrounds, measurements of polarization, determination of the power spectrum of pertrbations aand properties of the cosmological models, nature of observed anomalies and some other accompanied problems.

Particular solutions of Einstein equation related with Ramanujan, Chazy and Lorentz oscilator equations and their cosmological applications

N.A.Myrzakulov, K.R.Esmakhanova, Y.M.Myrzakulov, G.N.Nugmanova, R.Myrzakulov Eurasian National University

presented by: K.R.Esmakhanova **email-rmyrzakulov@csufresno.edu, phone-+7-7172-342221, fax-**

Poster

Abstract: The Einstein equation for the Friedmann-Robertson-Walker metric plays a fundamental role in cosmology. The direct search of the exact solutions of the Einstein equation even in this simple metric case is sometime a hard job. Therefore, it is useful to construct solutions of the Einstein equation using a known solutions of some other equations which are equivalent or related to the Einstein equation. In this work, we establish the relationship the Einstein equation with three other famous equations namely the Ramanujan equation, the Chazy equation and the Lorentz oscilator equation. Both these three equations play an imporatant role in mathematics in particular in the number theory. Using the known solutions of the Ramanujan and Chazy equations, we find the corresponding solutions of the Einstein equtiion.

Critical collapse and solitons in classical conformal field theory

Andrei Frolov Simon Fraser University

presented by: Andrei Frolov **email-frolov@sfu.ca, phone-1(778)782-3787 , fax-1(778)782-3592**

Oral plenary

I will talk about the fate of a localized wavepacket in a classical conformal field theory with attractive interaction $V(phi) = -lambda/4phi^4$. As potential is unbounded from below, homogeneous field collapses to singularity in finite time. However, finite size wavepacket can disperse before it collapses. Competition between the two outcomes results in a critical behavior, much like the one seen in gravitational collapse. We calculate the critical exponents, and show that there are static regular soliton-like solutions in the theory.

Astrophysics, cosmology and fundamental physics with space-based gravitational wave detectors

Jonathan Gair University of Cambridge

presented by: Jonathan Gair **email-jgair@ast.cam.ac.uk, phone-+441223339071, fax-**

Oral parallel

The European Space Agency is currently formulating plans for a European space-based gravitational wave detector, eLISA, to be launched at the end of this decade. Such an instrument, operating in the miliHertz frequency range, will herald the beginning of a new era of gravitational wave astronomy. It is expected that eLISA will detect several tens of mergers between pairs of massive black holes in the hundred thousand to one million solar mass range, a few tens of extreme-mass-ratio inspirals of compact stellar remnants into such black holes, thousands of white-dwarf binaries in the Milky Way and perhaps even gravitational wave bursts from cosmic string cusps. These observations will provide measurements of black hole masses and spins of unprecedented precision that can be used for astrophysics. Very precise tests of fundamental physics will be possible by comparing the observed GW phase evolution to the predictions of relativity. In addition, luminosity distance measurements! from the observed GWs could be used to constrain cosmological parameters. I will discuss the current status of the eLISA project and our present expectation of the number and types of sources that such an observatory will detect and I will describe how these observations will be used to transform our understanding of various aspects of astrophysics, cosmology and fundamental physics.

Radiation in theories with extra dimensions

D.V.Gal'tsov Department of Theoretical Physics, Mscow State Unniversity, Moscow, Russia

presented by: D.V.Gal'tsov email-galtsov@physics.msu.ru, phone-+7495 9395389, fax-+74959523293

Oral plenary

We investigate classical (Kaluza-Klein) gravitational radiation in the TeV-scale gravit within the ADD model with toroidal compactification. In the transplanckian regime, tentativelyacccessible at LHC, gravitational radiation is one of the dominant processes cometing with creation of black holes. The existing estimates based on analytical and numerical calculations are still incomplete in the ultrahigh energy limit. We explore ultrarelativistic gravitational bremssrahlung in the second order in gravitational constant for collision of two pointlike particles at large impact parameters and show that most of the energy is depleted during the collision contrary to the case of small impact parameters, when the radiation efficiency is estimated between 10 and 50

An ermakov invariant and temperature fluctuations in the early uniiverse

Debashis Gangopadhyay, S.N.Bose National Centre For Basic Sciences, JD-Block, Sector-III, Salt Lake, Kolkata-700098, India

Oral parallel

k-essence scalar field models are usually taken to have Lagrangians of the form $\mathbf{L} = -\mathbf{V}\ (\varphi)\ \mathbf{F(X)}$ with $\mathbf{F}$ some general function of $\mathbf{X} = \nabla\ \ \mu\ \varphi\ \nabla^{\mu}\ \varphi$. In an epoch , when the scale factor was very small compared to the present epoch but very large compared to the inflationary epoch (so that one is already in an expanding and flat universe) $\mathbf{L}$ takes the form of an oscillator with time-dependent frequency. The Ermakov invariant for a time-dependent oscillator in a cosmological scenario then leads to an invariant quadratic form involving the Hubble parameter and a logarithm of the scale factor. In principle, this invariant can lead to further observational probes for the early Universe. Expansion is naturally built into the theory with the existence of growing classical solutions of the scale factor. One can estimate fluctuations of the temperature of the background radiation in these early stages (compared to the present epoch) of the universe. If the temperature at time $\mathbf{t_a}$ is $\mathbf{T_a}$ and at time $\mathbf{t_b}$ is $\mathbf{T_b}$ $(\mathbf{t_b} > \mathbf{t_a})$, then for small times , the probability for the logarithm of inverse temperature evolution can be estimated to be given by

$$\mathbf{P(b,\ a) = |<\ln\ (1/T_b),\ t_b\ |\ln\ (1/T_a),\ t_a >|^2}$$

$$\approx \mathbf{[3m_{P\,l}^2\ /\pi^2\,(t_b - t_a)\ ^3\ ]\ (\ \ln\ T_a\ )^2\ (\ln\ T_b)^2\ [\ 1\ \ \ -\ 3\ \gamma\ (t_a\ \ \ +\ t_b)\ ]}$$

where $\mathbf{0} < \gamma < \mathbf{1},\ \mathbf{m_{P\,l}}$ is the Planck mass and Planck's constant and the speed of light has been put equal to unity. There is the further possibility that a single scalar field may suffice for an inflationary scenario as well as the dark matter and dark energy realms.

SPONTANEOUS SYMMETRY BREAKING IN HORAVA-LIFSCHITZ GRAVITY

Subir Ghosh Indian Statistical Institute

presented by: Subir Ghosh email-subir_ ghosh2@rediffmail.com, phone-+(91)(33)25753362, fax-+(91)(33)25773026

Oral parallel

The recnly foormulated Horava-Lifschitz gravity is a non-relativistic theory with higher (spatial) derivative terms. We show that, in a Hamiltonian formulation, presence of higher derivative terms can lead to a Spontaneous Symmetry Breaking. It can be interpreted as a Landau type of liquid-solid phase transition leading to a vacuum condensate. From general arguments we show that the condensate can induce a periodic nature in the metric on top of the conventional Minkowski vacuum. This type of metric with an inherent length scale might be relevant in Quantum Gravity context. There has beeen a lot of excitement in studying propagation of electromagnetic waves in recently constructed exotic form of matter called Metamaterial where one can control the anisotropic permittivities to mimic spacetime metrics. It will be interesting to consider developing Metamaterials that can mimic the spacetimes with a length scale mentioned aboe..

Higgs field as the main character in the early Universe

Dmitry Gorbunov INR RAS

presented by: Dmitry Gorbunov email-gorby@ms2.inr.ac.ru, phone-+7 499 7839291, fax-+7 499 1352268

Oral plenary

The Higgs sector of the Standard Model of particle physics still remains idden:: neither the Higgs boson, nor its self-coupling or coupligs to otther SM particles have been observed. Meanwhile it plays a crucial role in the Model, being responsible for the spontaneous breaking of hee electroweak symmetry, emerging of fermion and vector boson msses annd restoration of the unitarity in scatterings with massie vector bosons in a final state. The Higgs bsonn is the only fundamental scalar in the SM. Quite remarkably, hee scalars are believed to play an important role in the very erly Univverse providing the inflationary expansion before the Ho Big Bang sttage. It is tempting to adopt the Higgs boson to do the inflaton's jb.. This idea was realized with non-minimal Higgs coupling to grvity and called as the Higgs inflation. Howevr the annalysis of theories with non-minimal coupling of Higgs feld to gravitty revealed that they enter into a strong coupling egime above ceertain Higgs-dependent cutoff, which may be considerably below thePlancck scale. Assuming that the effective theory, complementingtthe Standard Model (or its minimal extension with stable partices to bee dark matter) contains a set of higher dimensional opertors supprressed by the Higgs-dependent cutoff, we analyze the rheating of thhe Universe after the Higgs inflation. We show that extra terms do not spoil the Higgs inflation, but can lead to bryogenesis annd dark matter production at the reheating stage of the Universe exanssion. Likewise they can also result in neutrino mass generatin and favor the proton decay at the rate to be probed by the upoming experiiments. Hence, in the suggested setup the Higgs field can be the main character in the play "the youth of the Universe", which detais aare obscured at present by ten billion years of cosmological xxpansion. The main three phenomenological problems of the SM – neuttrino oscillations, baryon asymmetry of the Universe and dak matter —- may spring from the strong dynamics in the Higgs-gavity sseooor

Measurements of the Cosmic Microwave Background with WMAP and ACT

Mark Halpern University of British Columbia

presented by: Mark Halpern email-halpern@physics.ubc.ca, phone-604 822 6709, fax-604 822 5324

Oral plenary

I will survey the present status and very near term prospects for what we can learn from measurements of the temperature and polarization anisotropies of the cosmic microwave background, concentrating on the experiments I know best, WMAP and ACT. Even hugh tthee anisotropy data now extend past the ninth acoustic peak, the simplest six parameter model still does very well. I will talk about a few problems these measurements have not resolved and present recent ACT lensing data which for the first time, allow measurement of a cosmological constant from CMB data alone

Proposed test of the equivalence principle with rotating cold polar molecules

Zhong-Kun HU and Jun LUO School of Physics, Huazhong University of Science and Technology, Wuhan 430074, People's Republic of China

presented by: Zhong-Kun HU email-zkhu@mail.hust.edu.cn, phone-086-27-87556650, fax-086-27-87542391

Oral parallel

We propose a novel scheme for testing the equivalence principle with rotating cold polar molecules whose angular momentum are polarized at different states. The proposed experiment consists of three key steps: cooling down the polar molecules, rotating cold polar molecules to polarize the angular momentum states and comparing the free fall accelerations of molecules with different angular momentum polarization state in the gravitational field. Molecules in specific rotational states can be selected out using hexapole state-selection technique, and then are cooled down using electrostatic Stark deceleration technique. Microwave fields are explored to manipulate the molecular rotational states. Molecules with the same spatial angular momentum orientation are detected by taking advantage of the Doppler effect of the molecules free falling in the gravitational field.

Instanton Representation of Plebanski Gravity

Eyo Ita United States NAval Academy

presented by: Eyo Ita email-ita@usna.edu, phone-001-410-293-6663, fax-001-410-293-6663

Oral parallel

The instanton representation of Plebanski gravity (IRPG) is a gauge-invariant, diffeomorphism-invariant formulation of General Relativity (GR). It uses a SO(3) gauge connection and the self-dual Weyl tensor as dynamical variables, and is equivalent to GR for spacetimes of Petrov Types I, D and O. The IRPG has provided a new method for constructing solutions to the Einstein equations, as well as some properties of quantization. In this talk we will provide the basic background of the theory and some solutions thus constructed, in addition to the Hilbert space of states in the temporal gauge.

Oral parallel

Bianchi Type-III Space-Time with Bulk Viscosity and Magnetic Field

Sharad P. Kandalar, A.P. Wasnik Government Vidarbha Institute of Science and Humanities, Amravati (India)-444604

presented by: Sharad P. Kandalar email-spkandalkar2004@yahoo.com, phone-9423426316, fax-07212531706

Poster

We investigate some locally rotationally symmetric (LRS) Bianchi type-III string cosmological model in the presence of bulk viscosity and magnetic field, where an equation of state and relation between metric potential are considered. The solution describes a shearing and non-rotating model with big-bang start. In the absence of magnetic field it reduces to a string model with bulk viscosity, where the relation between the coefficient of bulk viscosity and the energy density is used.

Casimir Effect in Schwarzschild Metric

Munawar Karim, Ashfaque Bokharii St. John Fisher College

presented by: Munawar Karim email-mkarim1@earthlink.net, phone-, fax-

Poster

I am proposing an experiment to measure the effect of gravitational curvature on the Casimir force. I will provide the design of the apparatus, the measurement method and the expected sensitivity. The experiment is a differential measurement of the effect of two elements of the Riemann tensor of Earth's Schwarzschild metric on the Casimir force between two pairs of parallel plates. The result is a ratio, independent of coordinates and the coupling constants of the Einstein equation and the Casimir force. It is a null experiment. I will describe the theoretical calculation that I use to estimate the magnitude of the effect - if it exists. The result will provide an empirical evidence whether or not virtual quantum excitations follow geodesics.

Extended Bargmann-Wigner equations in flat and curved space-time

Masakatsu Kenmoku Nara Women's University

presented by: Masakatsu Kenmoku email-kenmoku@asuka.phys.nara-wu.ac.jp, phone-+81-742-23-6478, fax-

Oral parallel

Bargmann-Wigner equations are extended to include lower spin states as well as higher spin states. Lagrangian formalism is developed for the extended Bargmann-Wigner equations in flat and curved space-time. One of applications is radiance problem for Fermion and Boson in black hole geometry.

Bianchi Type V String Cosmological Models With Constant Deceleration Parameter In General Relativity

S. P. Kandalkar[1], P. P. Khade[2] and S. P. Gawande, 1: Government Vidarbha Institute of Science and Humanities, Amravati., 2: Vidyabharati Mahavidyalaya, Amravati

presented by: Pramod P. Khade email-pra_m04@yahoo.com, phone-9421829832, fax-

Poster

We have investigated two classes of exact solutions to the Einstein's field equations by assuming the expansion scalar in the models is proportional to one of the components of shear tensor and applying a special law of variation of Hubble's parameter for a Bianchi type V cosmological model in presence of massive string source. We have analyzed a comparative study of accelerating and decelerating models in the presence of string scenario. Some observational parameters for the models have also been discussed.

Generalized Peres plane wave-like solution of Einstein-Maxwell equations in presence of a null currents and nullf fluids

G.U. Khapekar , V.R. Patil1 , A.G. Deshmukh2 , D.D. Pawar3 Department of Mathematics, Jagadamba Mahavidyalaya, Achalpur Dist Amravati-444805(India). 1Arts, Science and Commerce College, Chikhaldara Dist Amravati-444807(India), 2 Ex.Reader and Head,Dept of Mathematics, G.V.I.S.H Amravati-444604(India) & Joint Director, (H.E.), Nagpur division, Nagpur-440022(India), 3 Dept of Mathematics, G.V.I.S.H Amravati-444604(India).

presented by: G.U.Khapekar email-guk_ maths@rediffmail.com, phone-919822428339, fax–

Oral parallel

Abstract: The purpose of the present paper is to obtained the generalized Peres plane wave-like solutions of Einstein-Maxwell equation in the presence of null fluids and null currents for -type wave and also discussed some particular cases.

Lessons from Schwinger Effective Action for Black Hole

Sang Pyo Kim Kunsan National University

presented by: Sang Pyo Kim email-sangkim@kunsan.ac.kr, phone-, fax-

Oral plenary

Quantum structure of spacetime may be probed by an external gauge field or spacetime curvature or both. Heisenberg-Euler and Schwinger QED effective action in a constant electromagnetic field has provided a tool to investigate and to understand the vacuum structure of QED. Further, strong laser sources to be built in the near future may directly measure electron-positron production and photon-photon scattering. On the other hand, the nonperturbative effective actions in the sense of QED effective actions have not been found yet in curved spacetimes except for de Sitter and anti-de Sitter with constant scalar curvatures. In thi talk, tthe in-out formalism is used to find the effective actions in some configurations of electromagnetic fields and spacetimes. It is shown that not only the separability of the field equations but also the existence of the algebraic stucture of the mode equation are necessary for finding the nonperturbative effective actions in the in-out formalism. Sauter electromagnetic fields, constant curvature spacetimes, and a constant electric field in constant curvature spacetimes will be shown as models. Finaly, the noonperturbative effective action on the black hole horizon of a Schwarzchild black hole is presented, which has a similar structure with QED effective action in a constant electric field. The vacuum polarization has a relation with the stress-energy tensor while the vacuum persistence explains the Hawking radiation via the gravitational anoaalies.

Cosmological Perturbation of Expanding Universe with a Black Hole

Sung-Won Kim Ewha Womans University

presented by: Sung-Won Kim email-sungwon21@gmail.com, phone-+82-2-3277-2698, fax-+82-2-3277-2684

Oral plenary

In this paper, we studied the dark energy accretion onto a black hole in perturbed universe. We reviewed several solutions of cosmological model with a black hole. Amon the modells of a black hole in the expanding universe, we adopt the Faraoni-Jacques model with imperfect fluid and radial flow, which is the generalized McVittie solution. It is shown that the quasi local mass is constant of motion and that the perturbed part of mass change rate is determined by the perturbed radial flow.

Quantum gravity corrections to the cosmological term

Takeo Inami, Yoji Koyama Chuo University, Chuo University

presented by: Yoji Koyama email-koyama@phys.chuo-u.ac.jp, phone-+81-3-3817-1767, fax-+81-3-3817-1792

Poster

The cosmological constant problem is a sort of hierarchy problem; the Λ is huge at high energy scale and quite small at low energy. We study the graviton loop corrections to the cosmological term Λ in de Sitter space as an approach to the cosmological constant problem. Since gravitons couple the Λ through $\sqrt{-g}$, the Λ can be regarded as a coupling constant. Hence the graviton tadpole diagrams correspond to the loop corrections to the Λ. We are partiicularly interested in the possible infrared divergences present in the loop corrections and its interpretation for the purpose of finding the screening mechanism of the Λ in the infrared region. In de Sitter space due to the presence of the interaction terms with the Λ, the infrared divergences may arise at two-loop and higher orders. We calculate the graviton two-loop contributions to the tadpole diagrams and evaluate the infrared efeects.

How to search for gravitational wave signals from rotating neutron stars?

Andrzej Krolak, for the LIGO Scientific Collaborationa and the Virgo Collaboration Institute of Mathematics, Polish Acadmey of Sciences

presented by: Andrzej Krolak email-krolak@impan.pl, phone-, fax-

Oral parallel

We briefly review mechanisms of gravitational radiation from rotating neutron stars. We present data analysis methods to search for gravitational wave signals from rotating neutron stars in the data of ground based detectors. We cncentrate on two types of searches: all-sky, wide parameter searches and targeted searches. We present coherent, optimal search methods: F and statisttics and Bayesian approach. We show how these methods are being applied to searches for gravitational waves from known pulsars. We explan diffficulties in applying optimal methods to wide parameter searches because of the computational limitations. We present several suboptimal methods which allow to reduce the computational burden. We showthat thhe most effective methods are hierarchical methods consisting of a coherent searches followed by suboptimal searches. W ive exampplees of the applications of the presented data annalysis methods to searches for graviational waves signals in LIGO ad VIIRGO detectors atta.

Revisit to Bubbles and Walls

Bum-Hoon Lee Sogang University

presented by: Bum-Hoon Lee email-bhl@sogang.ac.kr, phone-82-2-705-8427, fax-82-2-704-9031

Oral plenary

The vacuum bubbles in the curved spacetime are analyzed. We classify the true and false vacuum bubbles with the cosmological constants with the minimum of the potential being either positive, zero, or negative. The evolution after the tunneling and the cosmological implications are also discussed. We introduce new type of solutions with Z2 symmetry when the potential has degenerate vacua.

On M2 and M5 Branes

Kimyeong Lee Korea Institute for Advanced Study

presented by: Kimyeong Lee email-klee@kias.re.kr, phone-82-2-958-3729, fax-

Oral plenary

M theory has the 11-dim supergravity as the low energy effective theory. This theory has M2 and M5 branes as electric and magnetic BPS objects of three form tensor field. Recently, there has been a considerable progress in our understanding of superconformal field theory on M2 branes. However there were a less progress on the physics of M5 branes. In this talk, I review some of these progresses, focusing on our recent work on M5 branes.

New determination of the gravitational constant G with time-of-swing method

Liang-Cheng Tu, Qing Li, Qing-Lan Wang, Cheng-Gang Shao, Shan-Qing Yang, Lin-Xia Liu, Qi Liu, and Jun Luo* The center of Gravitational Experiment, School of Physics, Hua Zhong University of Science and Tecnology

presented by: Qing Li email-qlllp45@163.com, phone-+86-13277973334, fax-+86-27-87542391

Poster

A new determination of the gravitational constant G had been presented by using a torsion pendulum with the time-of-swing method. Several improvements greatly reduced the uncertainties. We had performed two independent G measurements, and the two G values differ by only 9 ppm. The combined G value is 6.67349(18)m3kg-1s-2 with a relative standard uncertainty of 26 ppm. The anelastic effect of the tungsten fiber (Q is 1800) was first measured directly by using two disk pendulums with the help of a high-Q silica fiber. At present, we are measuring G with the time-of-swing method by using the high-Q silica fiber, which extremely suppresses the anelastic effect. Besides, some improvements are used to reduce the potential systematic uncertaities. To reduce the electrostatic effect, the silica fiber will be coated with a thin layer of Ge and Bi (about 3-10 nm thick). The prospective uncertainties of the G value obtained by the high-Q silica fiber will be $<$20 ppm.

Richard V. E. Lovelace

Cornell University

Oral Plenary

Recent radio emission, polarization and Faraday rottation maps of the radio jet of the galaxy 3C 303 have show that the component or knot of this jet has a *galactic*-scale electric current ($\sim 3 \times 10^{18}$ A) flowing along the jet axis. We develop the theory of relativistic Poynting-flux jet which are odeled as a ttransmission line carrying a DC current I_0, having a potential drop V_0, and a definite impedance $\mathcal{Z}_0 = 90(u_z/c)\Omega$, where u_z is the bulk velocity of the jet plasma. The electromagnetic energy flow in the jet is $calZ_0 I_0^2$. Thus the osserved current in 3C 303 can be used to calculte the eelectromagnetic energy fow in this magnetically dominated jet. Time-dependent perturbaions oof a Poynting-flux jet are described by th Telgrapher"s equations. Propagating disturbances on the jet ca producee the observed knots of enhanced synchrotron emission. The formation of a Poynting-flux jet can b traced back to the dynamics of a large-scale mgnetic field threading the accretion disk around a black hole. This magnetic field can arise for from the dynamo processe in thhe disk triggered by a star-disk collisio. The field may be sufficiently strong that it suppresses te magneto-rotational instability with the resut thatt the disk is non-turbulent and without viscosity. Thedisk willl however continue to accrete owing to the angular mometum outfloow in the Poynting-flu j...

Test of Newtonian inverse square law in short distance

Jun Luo Huazhong University of Science and Technology

presented by: Jun Luo email-junluo@mail.hust.edu.cn, phone-+86-27-87558393, fax-+86-27-87542391

Oral plenary

Many theoretical physicists are trying to find a universal unified theory to cover the four fundamental interactions, but up to now they can not answer the question that why gravitation is so weak compared with the other forces? Therefore, experimental research on the essential nature of gravitation, especially the validity of the inverse square law (ISL) of gravity in short ranges, is still one of the most profound questions in fundamental physics. Thi talk will expand from three parts: motivation, experiments, and prospect. After the general motivation for testing ISL in short range is discussed, a brief review of the current status of test Newtonian inverse square law at short ranges will be discussed. Then, our tests of ISL in sub-millimeter/millimeter ranges will be introduced. We used the torsion balance with gap modulation and the goal accuracy is to improve the current sensitivity by at least one order. Finally, the future experimental schemes, testing ISL in sub-millimeter/micro ranges with density modulation by using torsion balance and AFM, will be presented.

Gravitational Galaxy Clustering in an Expanding Universe

Manzoor A. Malik Department of Physics, University of Kashmir, Srinagar

presented by: Manzoor A. Malik email-mmalik@kashmiruniversity.ac.in, phone-+91 9596256448, fax-

Poster

Statistical mechanical approach is shown to provide an elegant description of various aspects of gravitational galaxy clustering. The galaxy distribution function derived from statistical mechanical considerations shows excellent agreement with observations and N-body simulation results. Applicability of statistical mechanics to gravitating systems, motivation for pursuing it further and a roadmap for future is presented.

Astrophysics, Cosmology and Fundamental Physics with ground-based gravitational-wave detectors

Ilya Mandel University of Birmingham

presented by: Ilya Mandel email-ilyamandel@chgk.info, phone-+44-7429-135040, fax-

Oral parallel

The ground-based gravitational-wave telescopes LIGO and Virgo approach the era of first detections. In this talk, I will review the current knowledge of the coalescence rates and parameter distributions of merging neutron-star and black-hole binaries. I emphasize the bi-directional connection between gravitational-wave astronomy and conventional astrophysics. I report on ongoing efforts to develop a framework for converting gravitational-wave observations into improved constraints on astrophysical parameters and discuss future developments necessary to the success of gravitational-wave astronomy. I also highlight some exciting recent investigations into the use of gravitational waves as probes of cosmology and tests of general relativity.

Inhomogeneous loop quantum cosmology: Approximated FRW cosmologies from the hybrid Gowdy model with matter.

Mercedes Martin-Benito, Daniel Martin de Blas, Guillermo A. Mena Marugàn Albert Einstein Institute, Instituto de Estructura de la Materia IEM-CSIC, Instituto de Estructura de la Materia IEM-CSIC

presented by: Daniel Martin de Blas email-daniel.martin@iem.cfmac.csic.es, phone-, fax-

Poster

The linearly polarized Gowdy T^3 model with a minimally coupled massless scalar field with the same symmetries of the metric is quantized by applying a hybrid approach. A loop quantum cosmology (LQC) quantization is used for the homogeneous degrees of freedom and a Fock quantization for the inhomogeneities. Owing to the inclusion of the massless scalar field the homogenous secctor admits classical Friedmann-Robertson-Walker (FRW) solutions. Therefore, this quantum model is a perfect scenario to study the quantum back-reaction between the inhomogeneities and a polymeric quantized FRW background. To further study the Hamiltonian constraint and seek for physical solutions we deal, for simplicity, with the model with local rotational symmetry. With the aim at obtaining (approximated) physically interesting solutions of the Hamiltonian constraint we use the eigenstates and the spectral properties of the FRW operator in LQC. We obtain that, with certain natural conditions, the Hamiltonian constraint can be approximated by a solvable one.

The Tianshan Radio Experiment for Neutrino Detection

Olivier Martineau-Huynh for the TREND collaboration IN2P3-CNRS, Chinese Academy of Science

presented by: Olivier Martineau-Huynh email-omartino@in2p3.fr, phone-, fax-

Oral parallel

The Tianshan Radio Experiment for Neutrino Detection (TREND) is an antenna array performing the autonomous detection of high energy Extensive Air Showers (EAS) on the site of the 21CMA radio observatory. The project has been running for nearly 3 years now, and is presently composed of 50 antennas covering a total area of 1.2 km^2. The autonomous detection and identification of EAS was achieved by TREND on a prototype array, and confirmed by the observation of coincidences between the self-triggered antenna array and an independent EAS detection by 3 additional particle detectors. This is an important milestone for TREND, and more generally, for the maturation of the EAS radiodetection technique. In a long term perspective, TREND is designed to use both radiodetection intrinsic characteristics and the additional target provided by the mountains surrounding the experiment site to search for high energy tau neutrinos of cosmic origin.

The Telescope Array Project: Ultra High Energy Cosmic Ray Observations in the Northern Hemisphere

John Matthews, University of Utah

presented by: John Matthews, email-jnm@cosmic.utah.edu

Oral parallel

The Telescope Array (TA) is the largest Ultra-High Energy (UHE) cosmic ray detector in the northern hemisphere. The Telescope Array is a follow up to the High Resolution Fly's Eye and AGASA experiments. It is ocated near Delta, Utah, about 200 kilometers southwest of Salt Lake City. The detector consists of 507 three square meter scintillator counters distributed in a square grid with 1.2 km spacing and three fluorescence detector stations (12, 12, and 14 telescopes) sitting on the corners of a 30 km triangle overlooking the surface array. The telescope stations view 108, 108, and 114 degrees in azimuth and 3-31 degrees in elevation. They provide full hybrid coverage with the scintillator array above 10 EeV. The Telescope Array underwent commissioning in 2007 and began routine data collection operations at the beginning of 2008. A low energy extension to TA (TALE) will add 11 new telescopes to the Middle Drum site and increase the elevation angle view up to about 60 degrees, providing for cosmic ray observation down to about 10^17 eV. In conjunction with the new telescopes, a graded array of infill scintillator counters will be added. An overview of the experiment and its measurements will be presented.

Exact Solutions in Gravity and Cosmology with Extra Dimensions

V.N. Melnikov Center for Gravitation and Fundamental Metrology, VNIIMS, and Institute of Gravitation and Cosmology, PFUR.

presented by: Vitally Melnikov email-melnikov@phys.msu.ru, phone-, fax-

Oral plenary

New challenges to theoretical physics and the role of gravity and cosmology are discussed. Problems of gravitation as the fundamental interaction are analyzed. Integrable gravitational and cosmological models with extra dimensions with scalar fields, forms and other matter sources are presented and their role in solving basic problems of modern cosmology and black hole physics, suc aas the present acceleration of the Universe, nonsingular initial state, stability of fundamental constants etc. are investigated. Multidimensional models with a billiard behavior near the singularity are presented and discussed also. The results are compared with existing experimental and observational dat.

The Newtonian Gravitation Constant: Modern Status of Measurement

Vadim Milyukov Sternberg Astronomical Institute, Moscow University

presented by: Vadim Milyukov email-vmilyukov@yandex.ru, phone-+7-916-634-24-34, fax-

Oral plenary

Measurement of the Newtonian constant of gravitation in laboratory experiment has more, than two hundred year's history. Progress in the measurement of G occurs slowly enough: the error value decreases approximately 10 times per century, and the knowledge of the absolute value of G is still rather poor. Value of the gravitational constant, which

is recommended by CODATA (Committee on Data for Science and Technology) to use in a science and technics, is published once in 4 years. The new CODATA value of the Newtonian gravitational constant, $G = (.67384 \pm 0.00080) \times 10^{-11}\ m^3 kg^{-1} s^{-2}$, became available on 2 June 2011 and replaced the 2006 CODATA value. New value is based on all of the data available through 31 December 2010. Though curaacyy of the best experimental results of G measurement reaches 15-40 ppm, the scattering of G absolute values is enough big. The scattering of results surpassing value expected in usual experiments in 2-3 standard deviations, it is difficult to explain. Most likely, it is connected with systematic errors, therefore it is very important to measure G in the experiments using different techniques. The situation, which was developed last decade in the field of measurement of the Newtonian gravitational constant, is reported.

A new theory of relativistic reference frames: the case of an accelerated observer in Minkowski's space-time

Olivier Minazzoli, Slava Turyshev, Viktor Toth NASA-JPL, Caltech

presented by: Olivier Minazzoli **email-olivier.l.minazzoli@jpl.nasa.gov, phone-+1 818 393 1498, fax-+818 364 1004**

Oral parallel

We study accelerating relativistic reference frames in Minkowski space-time under the harmonic (isotropic) gauge. The method employed allows one to get the accelerated metric, and the two sets of coordinate transformations: from the inertial to the accelerated frame and vice versa. The transformation between those coordinates and the Fermi coordinates is given. However, more than just giving the accelerated metric and its corresponding coordinate transformations; our method allows, under some assumptions, a generalization of those in the case of the presence of a uniform external potential. The methd is bbased on analytical solutions of sets of both gauge and dynamical conditions that define uniquely the local accelerated system of reference. The method ca directly be extended to the General Relativity case (and possibly to any other theory of space-time) and represents an alternative to the usual theories of reference frames (Brumberg & Kopeikin, Nuovo Cimento B Serie 103, 63 (1989) and Damour, Soffel & Xu, Phys. Rev. D 43, 3273 (1991)).

The Present Status of LCGT Project

Shinji Miyoki and LCGT Collaboration Institute for Cosmic Ray Research, University of Tokyo

presented by: Shinji Miyoki **email-miyoki@icrr.u-tokyo.ac.jp, phone-+81-4-7136-5107, fax-+81-4-7136-3128**

Oral plenary

Large-scale Cryogenic Gravitational wave Telescope (LCGT) project has started in 2010 in Japan not only for direct gravitational wave (GW) detection but also forming a GW detection network with Advanced LIGO, Advanced VIRGO, GEO-HF and other planned detectors. LCGT takes two characteristic adoptions to observe gravitational waves at the rate of several times per a year. One is underground construction for stable operation. The other is usage of cryogenic mirrors and cryogenic mirror suspension system to reduce thermal noises. We will present detail designs of LCGT tunnel, vacuum, seismic noise isolator, mirror and length control scheme, digital system, cryostat and cryogenic suspension.

Characterizing the average properties of an inhomogeneous universe

Masaaki Morita Okinawa National College of Technology

presented by: Masaaki Morita **email-morita@okinawa-ct.ac.jp, phone-+81 980 55 4243, fax-**

Oral parallel

In standard cosmology, the global dynamics of the universe is assumed to be described by a homogeneous and isotropic FLRW universe model, but a realistic universe model should include local inhomogeneities, and the physical properties of such a realistic model averaged over a sufficiently large scale do not necessarily coincide with those of the FLRW universe. This fact is now widely noticed in the context of dark energy, because the effect of inhomogeneities may be an alternative to introducing an exotic matter for the cosmic acceleration. In this talk, we give an overview of works which explore how local inhomogeneities affect the global expansion, and discuss the possibility of inhomogeneities as 'effective dark energy', along the formulation developed by Buchert. We also point out that a natural measure of inhomogeneity arises in the formulation, which is identical to the relative information entropy, and show its temporal increase.

Quantum Origin of the Universe Structure

V. Mukhanov ASC, LMU, Munchen

presented by: Viatcheslav Mukhanov email-, phone-, fax-

I will talk about robust predictions of the theory of quantum origin of the universe structure which do not depend on the particular scenario of the phase of earlier cosmic acceleration. I will compare these predictions with the current results on the measurement sof the cosmic microwave background fluctuations and will discuss the future CMB experiments.

Cosmology and GR limit of Horava-Lifshitz gravity

Shinji Mukohyama IPMU, University of Tokyo

presented by: Shinji Mukohyama email-s.mukohyama@gmail.com, phone-, fax-

Oral plenary

In this talk I will discuss some cosmological implications of a power-counting renormalizable theory of gravitation recently proposed by Horava. We show that (a) the anisotropic scaling with the dynamical critical exponent z=3 solves the horizon problem and leads to scale-invariant cosmological perturbations even without inflation; and that (b) at low energy this theory mimics general relativity plus dark matter. We also discuss (c) the fate of an extra scalar degree of freedom called scalar graviton in the lambda->1+0 limit, where lambda is a parameter in the kinetic action and general relativity has the value lambda=1. In particular, we prove non-perturbative continuity of the lambda->1+0 limit for simple cases: (c-1) spherically-symmetric, static, vacuum configurations; and (c-2) superhorizon cosmological perturbations with or without a scalar matter field.

Dark energy in some integrable and nonintegable FFRW models

K.R.Esmakhanova, N.A.Myrzakulov, O.V.Razina, Y.M.Myrzakulov, G.N.Nugmanova, R.Myrzakulov Eurasian National University

presented by: Ratbay Myrzakulov email-rmyrzakulov@csufresno.edu, phone-+7-7172-342221, fax-

Oral parallel

Thee Friedmann - Robertson - Walker (FRW) spacetime plays an important role in modern cosmology. In particular, the most popular models of dark energy work in the FRW spacetime. In this work, a new class of integrable FRW cosmological models is presented. These models induced by the well-known Painlevé equations. Some nonintegrable FRW models are also considered. These last models are constructed with the help of Pinney, Schrödinger and hypergeometric equations. Scalar field description and two-dimensional generalizations of some cosmological models are presented. Finally some integrable and nonintegrable $F(R)$ and $F(G)$ gravity models are constructed.Some artificial two-dimensional FRW models were also proposed. Finally, we extend the obtained results for g-essence models and for its two reductions: k-essence and f-essncce

On the choice of reference for the covariant Hmiltonian bouundary trmm

James M. Nester Department of Physics, National Central University

presented by: James M. Nester email-nester@phy.ncu.edu.tw, phone-886-3-422-7151 x65322, fax-886-3-4251175

Oral parallel

The Hamiltonian generating the evolution of a spatial region along a time-like vector field includes a boundary term, which determines both the boundary conditions and the value of the Hamiltonian, and hence the quasi-local quantities: energy-momentum, angular-momentum/center-of-mass. The boundary term depends on some reference values, which determine the ground state (having vanishing quasi-local values). For our preferred boundary term for Einstein's GR we propose isometric matching and energy optimization to determine the reference metric and connection values. The resultant quasi-local energy values for spherically symmetric metrics are presented.

Cosmic formation and interacting dark matter

Khanh Van Nguyen, Lan Quyh Nguyen Hanoi National University of Education

presented by: Khanh Van Nguyen email-, phone-, fax-

Poster

We study the effects of the self interacting dark matter on the formations of galaxies and simulations of the galactic systems while using MCMC approach. In this work we propose to place constraints upon specific parameters of our theoretical self-interacting dark matter particle by comparing with specific cosmic structures

MCMC analysis of experiment data within the effective decaying dark matter.

N.Q. Lan(1), G.Mathews(2), I. Suh(2), N.V. Khanh(1), N.A.Vinh(1), 1. Hanoi National University of Education, 136 Xuan Thuy, Cau Giay, Vietnam 2. Uiversity of Notre Dame, USA

presented by: Lan Quynh Nguyen email-nquynhlan@hnue.edu.vn, phone-, fax-

Poster

The simple coincidence that both dark matter and dark energy currently contribute comparable mass energy toward the clssure of the universe begs the question as to whether they couldbe ddifferent manifestations of the same physical phenomenon. Wediscuss the flat cosmological model with initially dark matter ominated, and stable dark matter decaying at recent epoch. We sow that a cosmological model with bulk viscosity from late time dark matter decay can lead to an improved fit to the suppernovae magnitude reashift relation and CMB power spectrum of Cosmic Microwave Backgrond dataa by using Monte Carlo Markov Chain analysis and contrastto thee effective decaying cold dark matter, and argue that it is likely satissfy other constrains awwwell.

Origin and Evolution of Structure and Nucleosynthesis for galaxies

N. V. Khanh, N. A. Vinh Hanoi National University of Education

presented by: Vinh A. Nguyen email-lnq1993@yahoo.com, phone-, fax-

Poster

We study the formation and evolution of galaxies with chemodynamical model that includes the various physical processes with the formation of stellar systems: radiative cooling, star formation, feedback from SNIa, and chemical enrichment.

Equivalence Principle, Gravity Probe B Experiment, and Solar-System and Cosmological Tests of Modern Gravitational Theories

Wei-Tou Ni Shanghai United Center for Astrophysics, Shanghai Normal University, and Center for Grvvitation and Cosmology, Departmnt of PPhysics, National Tsing Hua Unieersity

presented by: Wei-Tou Ni email-weitou@gmail.com, phone-, fax-

Oral plenary

After first review the empirical status for modern gravitational theories, we focus on (i) Equivalence Principle [Rep. Prog. Phys. 73, 056901 (2010)]; (ii) Gravity Probe B experiment; (iii) Solar-System and Cosmological Tests. The ultra-precise Gravity Probe B experiment measured the frame-dragging effect and geodetic precession on four quartz gyros. We emphasize its importance in astrophysics, especially black holes and quasars. We use this result also to test WEP II (Weak Equivalence Principle II) which includes rotation in the universal free-fall motion [PRL 107, 051103 (2011)]. The free-fall Eétvés parameter η; together with other parameters λ; κ; for rotating body is improved with four-order improvement over previous results. In the lab and in astrophysical situation, experiments and observations on spin and polarization will be a major focus in the coming decade together with more precise solar-system experiments. The relevance for the future development of gravitational theories will be addressed.

Highlights of GeV and TeV gamma-ray astronomy and the indirect dark matter searches.

Eric Nuss LUPM, Université de Montpellier II, France

presented by: Eric Nuss email-eric.nuss@univ-montp2.fr, phone-, fax-

Oral plenary

In the past few years, gamma-ray astronomy has entered in a moment of great advancement, led by the full operation of ground-based arrays (H.E.S.S., MAGIC, and VERITAS) and the launch and operations of Fermi and Agile. This moder suiite of telescopes is now scanning the sky over both hemispheres and over six orders of magnitude in energy. I will present a snapshot of the current census of astrophysical gamma-ray sources and highlight some recent discoveries relevant to fundamental physics. I wil focus inn particular on results related to the field of indirect search for Dark Matter and the constraints on dark matter particle models derived from GeV to TeV gamma-ray observations.

Can string theory resolve space-time singularities?

Martin O'Loughlin University of Nova Gorica, Slovenia

presented by: Martin O'Loughlin email-martin.oloughlin@ung.si, phone-+38653315225, fax-+38653315385

Oral parallel

After a discussion of the general status of space-time singularities in string theory we will concentrate on the case of a singular space-time as seen by an observer moving at the speed of light and we will demonstrate that the resulting metric has a very simple universal structure provided that the original space-time had a stress-energy source that satisfies the dominant energy condition. We then demonstrate that string theory in such singular homogeneous plane wave backgrounds is exactly solvable and the essential details can be described by matrix quantum mechanics with a time-dependent potential. We discuss in some detail the regularisation of this matrix quantum mechanics and the original singularity.

On the unitarity and renormalizability of higher derivative gravity in 3D and higher

Nobuyoshi Ohta Kinki University

presented by: Nobuyoshi Ohta email- ohtan@phys.kindai.ac.jp, phone-+81-6-6721-2332 ext. 4071, fax-+81-6-6727-4301

Oral plenary

We study the condition that the theory is unitary and stable in three-dimensional gravity with most general quadratic curvature, Lorentz-Chern-Simons and cosmological terms by examining the quadratic fluctuations around these classical vacua. We give the complete classification of the unitary theories around flat Minkowski and (anti-)de Sitter spacetimes. We also discuss if the theory is renormalizable, and extend these considerations to higher dimensions.

A Proposal for Measuring the Speed of Propagation of Gravitational Phenomena

M. B. Paranjape Groupe de physique des particules, Département de physique, Université de Montréal

presented by: Manu Paranjape email-paranj@lps.umontreal.ca, phone-(1)5143436775, fax-(1)5143437357

Oral parallel

We propose an experiment to directly detect the consequence of the finite speed of propagation of changes in the gravitational field and to measure this speed. Our analysis is based on the idea that a moving body induces changes in the gravitational field that propagate to a detector with a finite delay. With two or more bodies moving in the presence of a detector, it is easy to conceive of a situation where the changes in the gravitational field at the position of the detector will contribute constructively or destructively. Observing this interference should allow for measuring the speed of propagation of gravitational disturbances.

Thick domain walls coupled with viscous fluid and electromagnetic field in Lyra geometry

V R Patil, D D Pawar[1] AND G U Khaperar[2] -1 Department of Mathematics, Arts, Science & Commerce College, Chikhaldara Dist Amravati 444807, (India), Department of Mathematics, Govt. Vidarbha Institute of Science and Humanities, Amravati-444604, -2 Departmentof Mathematics, Jagdamba Mahavidyalaya, Achalpur Dist. Amravati-444805, (India)

presented by: V R Patil email-vrpatil2004@rediffmail.com, phone-919423610313, fax–

Poster

In thispaper, we have obtained plane symmetric cosmological models of thick domain walls with viscous field coupled with electromagnetic field in the framework of Lyra geometry, by using equation of state. Physical and geometrical implications of the models are also discussed in the presence of magnetic field.

String dust magnetized cosmological model with bulk viscosity in Lyra manifold

Dnyaneshwar D. Pawar, Vasudeo R. Patil Department of Mathematics, Govt. Vidarbha Institute of Science and Humanities, Amravati-44 6004 (India), Department of Mathematics, Arts, Science & Commerce College, Chikhaldara Dist Amravati - 444807 (India)

presented by: Dnyaneshwar D. Pawar email-dypawar@yahoo.com, phone-919423124662, fax-917212531706

Poster

In this paper we study the plane symmetric cosmological models with string dust magnetized bulk viscosity in the frame work of Lyra geometry. The physical and geometrical properties of the models are briefly discussed.

NUCLEOSYNTHESIS IN THE R-PROCESS: IMPACT OF ASTROPHYSICAL AND NUCLEAR INPUT PARAMETERS

Ilka Petermann University of Malaya GSI Helmholtzeentrum fur Schwerionenforschung

presented by: Ilka Petermann email-ilka@um.edu.my, phone-, fax-

Poster

The production of elements beyond iron is at least half due to the r-process,a sequence of neutron-captures and beta-decays in astrophysical scenarios with high neutron densities. Based on this scenario, nucleosynthesis network calculations were performed to analyze different aspects in the final elemental and isotopic distributions. One part of this work was to study the appearance of the observed robustness of the abundance distribution in the spectra of old stars under the aspect of the presence of the most relevant fission processes, such as neutron-induced, beta-delayed and spontaneous fission. Another topic was to study the production paths of the extremely long-lived isotopes of Th and U, to derive results for cosmochronometric studies. Moreover, the possible production of longlived superheavy elements in the context of the r-process applying different mass-models is analyzed.

Recent results from the Pierre Auger Observatory on ultra-high energy cosmic rays

Pham Tuyet Nhung [for the Pierre Auger Collaboration] Institute for Nuclear Science and Technology

presented by: Nhung Tuyet Pham email-ptnhung@mail.vaec.gov.vn, phone-+84 4 37910017, fax-+84 4 38393295

Oral plenary

The Pierre Auger Observatory is the largest observatory ever built to study ultra high energy cosmic rays. Its hybrid detector system covers 3000 km^2 in the Argentinean pampas and consits of 24 fluorescence telescopes and of a ground array of 1660 water Cherenkov detectors. The construction of the Observatory was completed in 2008 but it has been taking data since January 2004 and accumulated the world's largest data set of ultra high energy cosmic rays. Recent results, including measurements of the energy spectrum, mass composition, and the anisotropy in the arrival directions, are presented.

The coldest stars in the Universe

Ngoc Phan-Bao HCM International University - Vietnam National University

presented by: Ngoc-Bao Phan email-pbngoc@hcmiu.edu.vn, phone-84-8-22115751, fax-84-8-37244271

Oral parallel

In this talk, I will review basic physical properties of the coldest stars in our universe, clled brown dwwarfs. These objects with masses between that of stars and planets are not massive enough to maintain stable hydrogen-burning fusion reactions during most of their lifetime. Whilerecent diiscoveries of "Y" dwarfs with estimated temperatures as cool as the human body are expected to completely fill the gap between stars and planets, the origin of these objects is still unclear. We present here our first discoveries of molecular outflows in young brown dwarfs that might allow us to answer the crucial question of how brown dwarfs fom..

The Origin of Cosmic Fireworks

Tsvi Piran The Hebrew University, Jerusalem Israel

presented by: Tsvi Piran email-tsvi@phys.huji.ac.il, phone-+972548820032, fax-

Oral plenary

Gamma-Ray Bursts are the most remarkable explosions observed in our Universe. For a few seconds the burst's luminosity is comparable to the luminosity of the rest of the Universe combined. I describe the basic properties of Gamma-Ray Bursts and I examine the nature of their progenitors. It is generally accepted that long GRBs are produced via Collapsars when a jet penetrate the envelope of a collapsing massive star, while neutron star mergers produce short bursts. I examine how jets propagate within star and use this to show that Collapsars cannot produce low - luminosity bursts. This establishes the existence of a third group of low luminosity GRBs that must be produced by a different mechanism. Surprisingly related arguments, show that most other regular long GRBs arise from Collapsars! This provides the first direct proof for the Collapsar model.

The JEM-EUSO Space Mission: Frontier Astroparticle Physics @ ZeV range from Space.

Maria D. Rodriuez-Frias, JEM-EUSO collaboration Space & Astroparticle Group.

presented by: Mar a D. Rodr guez Fr as email-dolores2.frias@gmail.com, phone-+34 91 8854975, fax-+34918854942

Oral parallel

The JEM-EUSO space mission, is being conducted by RIKEN and the Japan Aerospace eXploration Agency (JAXA) and is the Extreme Universe Space Observatory (EUSO) which will be located at the Japanese Experiment Module (JEM/EF) on the International Space Station (ISS) and thus this downward looking telescope will allow a full-sky monitoring capability to watch for UHECR and Extremely High Energy Cosmic Rays (EHECR) with unprecedented statistic. One of the main JEM-EUSO scientific goals is to open the charged-particle Astronomy channel in the Extremely High Energy Cosmic Rays (EHECR) and aiming to get the ZeV range, by sampling a huge EHECR statistics with 1000 CR events in 3-5 years of operation. The JEM-EUSO telescope can reconstruct the incoming direction of the UHECR & EHECR with an accuracy better than several degrees. Its observational aperture of the ground is nearly a circle with roughly a 250 km radius and its fiducial atmospheric volume above it with a 60° FoV ! is about 1 Tera-ton or more while the target atmospheric volume for upward neutrinos events exceeds 10 Tera-tons. The increase in effective area is realized by inclining the telescope from Nadir, which is named as "tilted mode", where the threshold energy increases since the mean distance to EAS and atmospheric absorption both increase and therefore the first half of the mission lifetime is devoted to observe the lower Cosmic Ray energy domain in Nadir mode and the second half of the mission to observe the high energy Cosmic Ray region by "tilted mode".

Double neutron stars as sources of gravitational waves: astrophysical point of view

Dorota Rosinska IA, University of Zielona Gora Luska 2, 65-2265 Zielona Gora, Poland

presented by: Dorota Gondek-Rosinska email-dorota@astro.ia.uz.zgora.pl, phone-+48 68 3287360, fax-+48 68 3287360

Oral parallel

Coalescing neutron star binaries are expected to be among the strongest sources of gravitational radiation to be seen by laser interferometers. I will summarize our studies on properties of double neutron stars observable in gravitational waves and in the radio taking into account the selection effects specific to each method of detection. I will also review recent relativistic numerical results on late inspiral of neutron star binaries showing how we can impose constraints o the equation of state of dense nuclear matter with gravitational wave observations. The realistic equations o state lead to gravitational wave signal that is distinguishable from point-particle inspirals by Advanced Virgo/LIGO detectors.

The Planck early results and perspective

C. Rosset APC

presented by: C. Rosset email-cyrille.rosset@apc.univ-paris-diderot.fr, phone-+33 1 57 27 69 29, fax-+33 1 57 27 60 71

Oral parallel

Launched in May 2009, Planck is the third-generation satellite dedicated to the measurement of the cosmic microwave background (CMB) anisotropies. This ESA mission yielded its first results early 2011. Although centered on non-CMB aspects, they show the excellent quality of the data acquired so far. We show highlights of some early results and in particular the harvest of nearly 200 clusters of galaxies detected via the Sunyaev-Zel'dovich. Other studies include the galactic dust emission and the Cosmic Infrared Background anisotropies, two components among the main foregrounds to be removed before the CMB analysis can start.

Black holes in loop quantum gravity

Hanno Sahlmann Asia Pacific Center for Theoretical Physics, and hysics Departmment, Pohang University of Science and Technology, Pohang (SouthKKorea)

presented by: Hanno Sahlmann email-sahlmann@apctp.org, phone-+82 54 279 1345, fax-+82 54 279 8679

Oral plenary

I will first review some aspects of loop quantum gravity, and describe the the quantum theory in the presence of a black hole horizon. This involves coupling a Chern-Simons theory on the horizon to loop quantum gravity in the bulk. I will then report on some new developments that seem to allow to derive and describe both, bulk and boundary theory, fully within loop quantum gravity.

AdS Black Hole Solutions in Dilatonic Einstein-Gauss-Bonnet Gravity

Kei-ichi Maeda, Nobuyoshi Ohta and Yukinori Sasagawa Waseda University

presented by: Yukinori Sasagawa email-yukinori@gravity.phys.waseda.ac.jp, phone-81352863442, fax-

Poster

We find that AdS spacetime with a non-trivial linear dilaton field is an exact solution in the effective action of string theory, which is described by gravity with the Gauss-Bonnet curvature terms coupled to a dilaton field in the string frame. The AdS radius is determined by the spacetime dimensions and the coupling constants of curvature corrections. We also construct the asymptotically AdS black hole solutions with a linear dilaton field numerically and discuss their thermodynamical properties. We discuss the extension of the model to the case with the even-order higher Lovelock curvature terms and with higher order terms of dilaton field.

Open inflation in the string landscape

Misao Sasaki Yukawa Institute for Theoretical Physics

presented by: Misao Sasaki email-misao@yukawa.kyoto-u.ac.jp, phone-+81-75-753-7043, fax-+81-75-753-7043

Oral plenary

Open inflation is receiving renewed interest in the context of cosmic string landscape. Since there are a large number of metastable de Sitter vacua in the string landscape, tunneling from one vacuum to another occurs frequently through the bubble nucleation and open inflation is naturally realized. We argue that though the universe appears to be very flat, a small deviation of Ω_0 from unity can be detected in the near future, and evidence of the string landscape may be seen in the large angle CMB anisotropy.

Energy spectrum estimation of axion radiation from topological defects

Toyokazu Sekiguchi, Takashi Hiramatsu, Masahiro Kawasaki, Ken'ichi Saikawa, Masahide Yamaguchi, Jun'ichi Yokoyama Nagoya University, Yukawa Institute for Theoretical Physics, Institute for Cosmic Ray Research, Institute for Cosmic Ray Research, Tokyo Institute of Technology, Research Center for the Early Universe

presented by: Toyokazu Sekiguchi email-toyokazu.sekiguchi@gmail.com, phone-81-52-789-2441, fax-81-52-789-2841

Oral parallel

We present results of our simulation of axionic strings and domain walls generated in the early Universe. While the scale of our field theoretic simulation is the largest so far, we also developed new methods for identification of global strings and estimation of energy spectrum of axions in the presence of topological defects. By estimating the abundance of axions radiated from the strings and domain walls, we present a constraint on the axion decay constant. We also discuss implications for the early Universe.

Search for axion with a torsion pendulum experiment at submillimeter range

Chenggang Shao and Jun Luo Department of Physics, Huazhong University of Science and Technology, Wuhan 430074, Poples Republiic of China

presented by: Chenggang Shao email-cgshao@mail.hust.edu.cn, phone-086-27-87542391, fax-086-27-87542391

Oral parallel

The concept of axion was introduced to explain the absence of CP violation in the strong interaction. It is one of the most possible candidates for the cold dark matter. Many experiments for detecting axions are based on the coupling of axions and photons. However, the axion would also lead to a weak Yukawa-type gravitational force between macroscopic bodies separated at short distances. An improved torsion pendulum will be used to test the Newtonian inverse-square-law at the level of Yukawa-type parameter 10^-3 at 0.2mm, which corresponding to the present axion model with the CP-violating parameter $3 * 10^-9$.

Holographic QCD and nuclear symmetry energy

Sang-Jin Sin Hanyang University

presented by: Sang-Jin Sin email-sjsin@hanyang.ac.kr , phone-, fax-

Oral plenary

We use gauge/gravity duality to calculate the nuclear symmetry energy in dense matter. We find that at all densities the symmetry energy monotonically increases and at small densities, it exhibits square root dependence on the density.

Very high energy cosmic ray production in Historical Supernova remnants

Vera Georgievna Sinitsyna, Vera Yurievna Sinitsyna P.N. Lebedev Physical Institute, RAS

presented by: Vera Georgievna Sinitsyna email-sinits@sci.lebedev.ru, phone-+7(499)1354275, fax-+7(499)1354275

Oral parallel

TeV energies gamma-rays, measurable by the imaging Cherenkov technique, are the most interesting for searching hadronic cosmic rays (CRs) in supernova remnants SNRs because they provide the information about CRs of highest possible energies $10^{13} - 10^{14}$ eV. Direct information about high-energy CR population in SNRs can be obtained from gamma-ray observation by SHALON on Tien-Shan high-mountain station, namely Tycho's SNR, Cas A, Geminga and Crab Nebula. The results of observations of two types of galactic SNRs are presented: the Crab plerion, Geminga (probably plerion), the Cas A and Tycho's SNRs which are shell type SNRs. The experimental data confirmed theory prediction on the hadronic origin of the very high energy gamma-rays (800 GeV -80 TeV) in the Tycho's SNR. The detection of gamma-ray emission at 5 - 10 TeV and the hard spectrum below 1 TeV would favor the π°-decay origin of the gamma-rays in Cas A SNR. The obtained results show the different origin mechanism of the very high energy gamma-ray emission in the considered objects.

Constrains of Extragalactic Background Light expected from observations of TeV xtragalacttic sources at distances from z=0.0179 to z=..375

Vera Yurievna Sinitsyna, Vera Georgievna Sinitsyna P.N. Lebedev Physical Institute, RAS

presented by: Vera Yurievna Sinitsyna email-verasinsin@gmail.com, phone-+7(499)1354275, fax-+7(499)1354275

Poster

As the TeV gamma-rays can be absorbed due to interaction of low-energy photons of Extragalactic Background Light (EBL), the observations of Active Galactic Nuclei (AGN) can also be used for the study background at the wide range. The understanding of EBL requires the detection of a large sample of VHE gamma-ray objects at varying redshifts. The redshifts of SHALON TeV gamma-ray sources range from z=0.0179 to z=1.375. During the period 1992 - 2011, SHALON has been used for observations of the sources NGC1275 (z=0.0179), SN2006gy (z=0.019), Mkn421 (z=0.031), Mkn501 (z=0.034), Mkn180 (z=0.046), OJ287 (z=0.306), 3c454.3 (z=0.895), 1739+522 (z=1.375). In 1998 and 1999 years a distant sources of FSRQs type 3c454.3 (z=0.859) and 1739+522 (z=1.375) were detected by SHALON and are being intensively studied since then. The spectra and images of these distant AGN are obtained. Also, spectral energy distribution of EBL constrained from observations of Mkn421, Mkn501, 3c454.3 and 1739+52! 2 together with models and measurements are presented. Observations of distant sources have shown that the Universe is more transparent to VHE gamma-rays than previously believed.

Viscosity and Black Holes

Dam Thanh Son Institute for Nuclear Theory Univerity of WWashington

presented by: Dam Thanh Son email-dtson@uw.edu, phone-1-206-685-9782, fax-1-206-685-3730

Oral plenary

Viscosity is a very old concept which was introduced to physics by Navier in the 19th century. However, in strongly coupled systems, viscosity is difficult to compute from first principle. In this talk I will describe some recent surprising developments in string theory which allow one to compute the viscosity for a class of strongly interacting quantum fluids not too dissimilar to the quark gluon plasma. I will describe efforts to measure the viscosity and other physical properties of the quark gluon plasma created in relativistic heavy ion collisions.

Computation of black hole entropy from Ashtekar-Wheeler-DeWitt field theory

Chopin Soo National Cheng Kung U., Taiwan

presented by: Chopin Soo email-cpsoo@mail.nclu.edu.tw, phone-, fax-

Oral parallel

Canonical quantization of spherically-symmetric Ashtekar-Wheeler-DeWitt midisuperspace theory is performed. Semi-classical states, with integration constant identified with the mass parameter of black holes, are solved exactly from the Hamilton-Jacobi Equation. These states can be matched to Schwarzschild spacetimes in usual standard spherically-symmetric form and also in Painleve-Gullstrand form. The Hamilton function remains well-defined at the classical singularity; and it has an imaginary contribution (independent of the Immirzi parameter in Ashtekar-Barbero theory) which can be interpreted as yielding the correct Bekenstein-Hawking entropy-area relation.

Cosmic Microwave Background

Naoshi Sugiyama Depertment of Physics, Nagoya University / IPMU, University of Tokyo

presented by: Naoshi Sugiyma email-sugiyama.naoshi@e.nagoya-u.jp, phone-+81-52-789-2427, fax-

Oral plenary

Cosmic Microwave Background (CMB) provides important clues for cosmology and particle physics. From its temperature fluctuations, the contents of the Universe such as dark energy, dark matter and baryons are precisely determined. The most stringent limit of masses of neutrinos is obtained from temperature fluctuations. From future observations of B-mode polarization and non-Gaussianity will prove the existence of inflation. Here I review what we have already known and what we will learn from CMB.

G-Gran Sasso: an experiment for the terrestrial measrement of the Lense-Thirring effect by means of ringlaasers

Angelo Tartaglia Politecnico di Torino and INFN

presented by: Angelo Tartaglia email-angelo.tartaglia@polito.it, phone-+390110907328, fax-+390110907399

Oral parallel

The talk presents a proposal for a new experiment aimed to the detection of the gravito-magnetic Lense-Thirring effect at the surface of the Earth. The core of the experimental device is a set of gyrolasers, mounted on a rigid "monument" and with various orientations in space. Actually there is an anisotropy in the propagation of light in a rotating system; part of it is purely kinematical (Sagnac effect), part is due to the gravito-magnetic field of the Earth (gravito-magnetic frame dragging). In a ring laser (gyrolaser) a light beam travelling counterclockwise is superposed to another beam travelling in the opposite sense. The anisotropy in the propagation leads to standing waves with slightly different frequencies in the two directions; the final effect is a beat frequency proportional to the size of the instrument and to its absolute rotation rate in space, including the gravito-magnetic drag. Current laser techniques and the performances of the best existing! ring lasers allow at the moment a sensitivity within one order of magnitude of the required accuracy for the detection of gravito-magnetic effects, so that the objective of the proposed measurement is in the range of feasibility for a dedicated device. The experiment is planned to be built in the Gran Sasso National Laboratories in Italy and is based on an international collaboration among four Italian groups, the Technische Universitaet Muenchen and the Canterbury University in Christchurch (NZ).

The primordial abundance of He4: evidence for non-standard big bang nucleosynthesis?

Trinh X. Thuan University of Virginia

presented by: Trinh X. Thuan email-txt@virginia.edu, phone-, fax-

Oral plenary

We present a new determination of the primordial helium mass fraction Yp based on spectra of low-metallicity extra-galactic HII regions, taking into account the latest developments concerning systematic effects. We find a value of Yp higher at the 2 sigma level than the value given by standard big bang nucleosynthesis, implying deviations from it.

Dark Universe or Twisted Universe?

Thomas Schucker, Andre Tilquin Center of Theoretical Physic (CPT), Center of Particle Physic of Marseille (CPPM)

presented by: Andre Tilquin **email-tilquin@cppm.in2p3.fr, phone-(33) 04 91 82 72 58, fax-(33) 04 91 82 72 99**

Oral parallel

The standard General Relativity is commonly used to describe cosmology. However more than 95The Einsein-Caartan's theory extends the General Relativity by the use of space-time torsion couples to half-integer spin. Using a maximally symmetric universe and both parity-even and parity-odd torsion fields the new Friedman like equations are derived. The Einstein-Caartan's theory is then confronted to real data using the Hubble diagram from the union-2 sample containing more than 550 type Ia supernovae. A tentative answer to the question "could torsion fields replace the dark side of the universe?" is given.

Research into the influence of teh sun on the status of the F2 layer of the equatorial ionosphere

Ha Quoc Tran HCMC University of Pedagogy

presented by: Ha Quoc Tran **email-tranquochadhsp@yahoo.com, phone-0902 888 182, fax-**

Poster

The research into the Solar-Terrestrial relations is very important and has large technological applications. This thesis is aimed at studying the influence of the 23th Solar cycle (mainly from 2002 to 2006) on the status of F2 layer of Ionosphere observed in Ho Chi Minh city, which is located at geomagnetic equatorial region.

Hidden Markov Model (HMM) and Stochastic Differential Equation (SDE) of Solar Radiation Sequences

Van Ly Tran Mathématiques et Applications, Physique Mathématique d'Orléans (MAPMO) CNRS : UMR6628'; Université d'Orléans, France

presented by: Van Ly Tran **email-tranvanly@math.cnrs.fr, phone-(+33) 02 38 41 72 32, fax-(+33) 02.38.41.72.05**

Poster

Analyzing the time sequence of classes of solar days leads us to think that the solar radiation days would be governed by a Hidden Markov Chain with some underlying unobservable mechanism of solar radiation. Under this consideration, we have first established Hidden Markov Model (X_t, Y_t) for solar radiation sequences (HMM-SRS) . The Markov chain X_t is homogeneous and is not observed directly, instead we observe the scalar process Y_t. Then, the problem of estimating the parameters for HMM-SRS is discussed. New exact filters for obtaining Maximum Likelihood parameter estimates are derived from the Expectation Maximization (EM) algorithm. We seek recursive filters for the number of jumps from one state to another, for the occupation time of a state, and for a process related to the observations. From these estimates, we obtain estimates of parameters of model. Some results are obtained for the two cases : HMM estimation of daily solar radiation sequences and HM! M estimation of solar radiation day. In the first case, the Markov chain is denoted in discrete time and discrete set (and is thus termed discrete-state) ; the finite-state observation process Y_t is a noisy function of the chain. We apply results obtained in this case for an example on sequences of types of solar radiation days (problem mentioned in the article "Classification of daily solar radiation distributions using a mixture of Dirichlet distributions" of Ted Soubdhan, Richard Emilion and Rudy Calif, Science Direct - Solar Energy, 2009). For the second case, we present the HMM where the Markov chain X_t is considered in continuous time and the observation process (solar radiation) Y_t is given by a stochastic differential equation (SDE). In continuous time, results are obtained by similar methods, where SDE and stochastic integrals are involved and are used throughout the technical approach.

Key Words Sollar Radiation, Sunshine, Direct Beam Radiation, Hidden Markov Model, Parameter Estimation, Maximum Likelihood, EM Algorithm, Brownian motio,, SDE.

A device to detect ultra small energy relases

G. N. Izmaov, T. Q. Khanh, A. M. Tskhovrebov, L. N. Zherikhina Moscow Aviation Institute; National Technological University, P. N. Lebedev Institute of Physics (under Russian Academy of Sciences)

presented by: Khanh Quoc Tran email-quockhanh.tran@gmail.com, phone-+84 1999 3999 37, fax-

Poster

The researches on ultra-weak interactions (ones into gravitational waves, alterations of the neutrino's flavor, reactions between weakly interacting massive particles [WIMPs], and the search for a "fifth"; form of interaction) have been being one among actual trends in experimental physics. Aiming for those targets, the precision of measuring complexes at extremely small signal-to-noise ratios has become the prerequisite problem, which would be resolved by both creating high-precision and low-noise measuring devices and selecting appropriate computing facilities and data processing methods as well as other suitable metrological provisions. In this eorrt,, the possibility of creating such a device is considered. Its schematic diagram includes mainly a calorimeter using magnetic material as working body in order to detect the rare events, characterized by super small energy release, like cosmic rays, WIMPs, solitary X-ray quanta, etc. Its function is brought about thanks to the adiabatic demagnetization method, where its magnetic response is metered by a SQUID device. The thermodynamical examinations of those devices using paramagnetic and/or ferromagnetic working substances are given. The trigger detection of ultra small energy releases through a ferromagnetic medium in the metastable state is particularly described, and then the physical limits of the ultra-weak signal registration methods sensitivity are estimated

Gravitational Lensing in Plasma

O.Yu. Tsupko, G.S. Bisnovatyi-Kogan Space Research Institute (IKI) of Russian Academy of Sciences

presented by: O.Yu. Tsupko email-tsupko@iki.rssi.ru, phone-+7-495-3334588, fax-+7-495-3334588

Oral plenary

We discuss gravitational lensing in plasma. We show that the gravitational deflection by point mass in homogeneous plasma differs from the vacuum deflection and depends on frequency of the photon. The dependence of the lensing angle on the photon frequency in uniform plasma resembles the properties of a refractive prism spectrometer, the strongest action of which is for very long radio waves. We also consider more general case of the photon deflection by mass distribution in non-homogeneous plasma, for different gravitational lens models. Our approach allows us consider two effects simultaneously: the gravitational deflection in plasma which differs from the vacuum case (new effect), and the non-relativistic effect (refraction). This work was partially supported by the RFBR grants 08-02-00491 and 11-02-00602.

ANTARES and the status of high-energy neutrino astronomy

Veronique Van Elewyck, for the ANTARES Collaboration APC and Universite Paris Diderot

presented by: Veronique Van Elewyck email-elewyck@apc.univ-paris7.fr, phone-+33 1 57276956, fax-+33 1 57276071

Oral parallel

Neutrino astronomy has entered an exciting time with the successful operation of the first undersea neutrino telescope in the Mediterranean (ANTARES) and the completion of the first km^3-scale neutrino telescope at the South Pole (IceCube). This new generation of experiments is approaching the sensitivity levels required to explore at least part of the current landscape of neutrino flux predictions from astrophysical sources, bringing neutrino astronomy on the verge of its first discovery. Thi contributiion will discuss the latest results from these experiments, with an emphasis on their multi-messenger programs.

Evolution of the equation of state parameters of cosmological tachyonic field components through mutual interaction

Murli Manohar Verma Department of Physics, Lucknow University, Lucknow 226 007, India

presented by: Murli Manohar Verma email-sunilmmv@yahoo.com, phone-+91-9415725291, fax-+91-522-2740462

Oral parallel

We study the perturbed equation of state (EOS) parameters of the cosmological tachyonic scalar field components and their mutual time-dependent interaction. It is shown that the discrete temperature dependent pattern of the EOS emerges from an initial continuum along the evolution of the universe. This leads to two major components in form of dark energy and dark matter, and also suggests a solution to the cosmological constant problem and the coincidence problem

Did the universe have a beginning ?

Alexander Vilenkin Department of Physics and Astronomy. Tufts University

presented by: Alexander Vilenkin email-vilenkin@cosmos.phy.tufts.edu , phone-, fax-

Oral plenary

Inflationary spacetimes can be eternal to the future but are necessarily incomplete to the past, indicating that the universe must have had a beginning. This conclusion is apparently avoided in the "emergent universe" scenario, which assumes that the universe is in a static or oscillating state in the asymptotic past. Such a state, however, is unstable with respect to quantum collapse (even though it may be classically stable). Thus the universe could not have stayed in this state for an infinite time.

SOME INTERESTING PROPERTIES OF WHITE HOLE IN THE VECTOR MODEL FOR GRAVITATIONAL FIELD

Vo Van On Department of Physics - Natural Sciences Faculty - Thu Dau Mot University

presented by: Vo Van On email-vovanon1963@gmail.com, phone-0983330749, fax-

Poster

There is a strange macro object exists in the Vector model for gravitational field which we call the white hole, it appears after the black hole disappears. In this report we survey the radial motion of a particle into it and point out some of its strange properties as: it has a surface vibration, has a very high red shift, it can also has a blue shift.

Superluminal neutrinos in the light of extra-dimension approach

Vo Van Thuan Institute for Nuclear Science and Technology (INST)

presented by: Thuan Van Vo email-thuanvova@gmail.com, phone-84-904005565, fax-84-4-22202531

Oral parallel

Concerning the widespread argumentation of the claim of faster-than-light neutrinos at OPERA, a brief review of the superluminal special relativity is presented. In particular, we introduce a space-time symmetrical theory proposed by Recami. We notice, however, that the absolute space-time symmetry seems hard to meet the physical reality. Dealing with the problem, we develop a generalized superluminal Lorentz transformation (GSLT) with two time-like extra-dimensions which can be applied in the lepton sector, leading to a dynamic relation between tachyon leptons and their bradyon partners. In order to meet the physical reality, we propose to add to the flat space-time a curvature element of general relativity. Therefore, the extended time-space serves a scene in which the quantum structures of leptons both subluminal and superluminal are embedded. We propose a geometrical dynamics formalism which allows to derive Proca-like and Dirac-like equations of motion for spinning micr! o-particles and to investigate the nature of lepton mass, charge and spin. In this model, Majorana neutrinos are originally expected to be superluminal. However, they are shown up almost massless and neutral due to a special suppression. For this reason, a bradyon observer adopts them rather luxons moving with the speed of light, than tachyons. The neutrino residual masses estimated by

this model are in a consistency with the data of PNC experiments, neutrino oscillations and the SN1987A observation. A critical discussion is given in analysis of the neutrino data obtained recently at OPERA.

Progress of Improved Test of Gravitational Inverse-Square-Law at Submillimeter Ranges

Qinglan Wang, Shengguo Guan, Liangcheng Tu , Shanqing Yang, Chenggang Shao, Bifu Zhan, Jun Luo Department of Physics, Huazhong University of Science and Technology

presented by: Qing Lan Wang email-11774024@qq.com, phone-, fax-

Poster

An improved test of gravitational inverse-square-law has been in progress. A minimal surface separation between test and source mass can be approached as close as 120 microm by using a thinner electrostatic shielding membrane. The Newtonian gravitational perturbations are precisely balanced by a counterweight mass during the distance from 120 to 240microm. Higher frequencies are chosen for the dual modulation of both the expected signal and the calibration gravitational torque, and then a higher sensitivity can be achieved. A preliminary result shows that we have been limited by the electrostatic disturbances in separation modulation experiment. The researches include studying the origin of the electrostatic disturbances and effective shielding of the system.

A conflict of quantum predictions related to the equivalence principle

Steve Wilburn, Douglas Singleton California State University, Fresno

presented by: Steve Wilburn email-swilburn@csufresno.edu, phone-+1-559-278-2371, fax-

Oral parallel

We compare the response function of an Unruh-DeWitt detector for different space-times and different vacua and show that there is a detailed violation of the equivalence principle. In particular comparing the response of an accelerating detector to a detector at rest in a Schwarzschild space-time we find that both detectors register thermal radiation, but for a given acceleration the fixed detector in the Schwarzschild space-time measures a higher temperature. This allows one to locally distinguish the two cases. As one approaches the horizon the two temperatures have the same limit so that the equivalence principle is restored at the horizon.

Some experimental evidences of long-range gravitational-like interaction in a neutral cold gas

M. Chalony, A. Olivetti, B. Marcos, J. Barre and D. Wilkowski University of Nice (France) NanyangTechnollogical University (Sinaapore)

presented by: David Wilkowski email-david.wilkowski@ntu.edu.sg, phone-+65 9061 1269, fax-+65 6795 7981

Oral parallel

When the interactions between the microscopic components of a system act on a length scale comparable to the size of the system, one may call them "long range". For instance, the inverse-square law of the gravitational force between two point masses is one of the best known and oldest law in Physics, since it was published in 1687 by Sir Isaac Newton in his famous book Principia. In the many particles world, this law is responsible for dramatic collective effects such as the collapse of a gravothermal catastrophe or the clustering at the origin of the structures of galaxies in the present universe. Beyond gravitation, such long range interactions deeply influence the dynamical and thermodynamical properties of such systems. At the level of equilibrium thermodynamics, long range interacting systems are not additive. This property is at the origin of very peculiar equilibrium properties: the specific heat may be negative; canonical (fixed temperature) and microcanonical (fi! xed energy) ensembles are not equivalent. These special features have been known for a long time in the astrophysics community, in the context of self gravitating systems. Te equilibriumm characteristics of long range interacting systems are theoretically well established. This situation is in striking contrast with the experimental side of the subject: there is no controllable experimental system exhibiting the predicted peculiarities. We have recently show some experimental evidences of a gravitational-like interaction on an one-dimensional test system consisting in a cold gas of neutral Strontium atoms in interaction with two counter-propagating quasi-resonant lasers. During my presentation, I will discuss in detail the experimental apparatus, results and the origin of the long-range gravitational-like interaction in such system.

Inflating wormholes in the brane world models

Ki Cheong Wong, Tiberiu Csaba Harko, Kwong Sang Cheng The University of Hong Kong

presented by: Ki Cheong Wong email-fankywong@gmail.com, phone-97231588, fax-

Poster

The braneworld model, in which our Universe is a three-brane embedded in a five-dimensional bulk, allows the existence of wormholes, without any violation of the energy conditions. A fundamental ingredient of traversable wormholes is the violation of the null energy condition (NEC). However, in the brane world models, the stress energy tensor confined on the brane, threading the wormhole, satisfies the NEC. In conventional general relativity, wormholes existing before inflation can be significantly enlarged by the expanding spacetime. We investigate the evolution of an inflating wormhole in the brane world scenario, in which the wormhole is supported by the nonlocal brane world effects. As a first step in our study we consider the possibility of embedding a four-dimensional brane world wormhole into a five dimensional bulk. The conditions for the embedding are obtained by studying the junction conditions for the wormhole geometry, as well as the full set of the five dimensio! nal bulk field equations. For the description of the inflation we adopt the chaotic inflation model. We study the dynamics of the brane world wormholes during the exponential inflation stage, and in the stage of the oscillating scalar field. A particular exact solution corresponding to a zero redshift wormhole is also obtained. The resulting evolution shows that while the physical and geometrical parameters of a zero redshift wormhole decay naturally, a wormhole satisfying some very general initial conditions could turn into a black hole, and exist forever.

G-inflation

Masahide Yamaguchi Tokyo Institute of Technology

presented by: Masahide Yamaguchi email-gucci@phys.titech.ac.jp, phone-+81-3-5734-2385, fax-+81-3-5734-2745

Oral plenary

We study generalized Galileons as a framework to develop the most general single-field inflation models named G-inflation, containing previous examples such as k-inflation, extended inflation, and new Higgs inflation as special cases. We investigate the background and perturation evvolution in this model, calculating the most general quadratic actions for tensor and scalar cosmological perturbations to give the stability criteria and the power spectra of primordial fluctuations. The non-Gaussianities of tensor and scalar perturbations are also disuussed.

Accelerated expansion of the Universe from f-essence and g-essence

K.K.Yerzhanov, P.Y.Tsyba, Y.M.Myrzakulov, O.V.Razina, N.A.Myrzakulov, K.R.Esmakhanova, R.Myrzakulov Eurasian National University

presented by: K.K.Yerzhanov email-Yerzhanov_kk@enu.kz, phone-+7-7172-342221, fax-

Poster

In the present work we analyze the g-essence model for the particular Lagrangian: $L = R + 2[\alpha X^n + \epsilon Y - V(\psi, \bar{\psi})]$. The g-essence models were proposed recently as an alternative and as a generalization to the scalar k-essence. We have presented the 3 types solutions of the g-essence model. We reconstructed the corresponding potentials and the dynamics of the scalar and fermionic fields according the evolution of the scale factor. The obtained results shows that the g-essence model can describes the decelerated and accelerated expansion phases of the universe. We also present some important reductions of the model as well as its some generalizations. We also found the exact solution of f-essence and examine the influence of such gravity-fermion interaction on the observed accelerated expansion of our universe.

New formulation of Horava-Lifshitz quantum gravity as a master constraint theory

Hoi Lai YU Institute of PHysics, Academia Sinica, Taiwan

presented by: Hoi Lai Yu email-hlyu@phys.sinica.edu.tw, phone-886-2-27896783, fax-

Oral parallel

Horava-Lifshitz theory of quantum gravity attempts to preserve unitarity by relinquishing space-time covariance, and improve renormalizability by including igher order (sspatial) derivatives. For theories without full space-time covariance, departures of the constraint algebra from the Dirac algebra are to be expected. In the non-projectable version of Horava-Lifshitz gravity, the commutator of two *local* Hamiltonian constraints leads to severely restrictive secondary constraints and perplexing 'troubles'. On the other hand, the projectable version has an *integrated* Hamiltonian constraint and consistent constraint algebra. But an extra graviton mode which can be problematic is then allowed, whereas in Einstein's theory the spurious mode is eliminated precisely by the *local* Hamiltonian constraint. A new formulation of Horava-Lifshitz gravity, naturally *realized as a representation of the master constraint algebra* studied by loop quantum gravity researchers, is presented in this work. This reformulation yields a consistent canonical theory with 1st class constraints. It captures the essence of Horava-Lifshi! tz gravity in retaining only spatial diffeomorphisms (instead of full space-time covariance) as the physically relevant non-trivial gauge symmetry; at the same time the local Hamiltonian constraint which is needed to remove the spurious mode is equivalently enforced by the master constraint.

Progress of Improved Test of Gravitational Inverse-Square-Law at Submillimeter Ranges

BiFu Zhan,ShanQing Yang,QingLan Wang,ChengGang Shao,LiangCheng Tu,WenHai Tan,Jun Luo Huazhong University of Science & Technology

presented by: BiFu Zhan email-ysq2011@mail.hust.edu.cn, phone-86-013477043060, fax-08-027-87542391

Poster

We report a new test of gravitational inverse-square-law at millimeter ranges by using a dualmodulation torsion pendulum. We find no deviations from Newtonian physics with 95% confidence level, and establish the most stringent constraints on non-Newtonian interaction in the ranges from 0.7 mm to 5.0 mm.