Poster Presentations

P01: Masaru Adachi (Hirosaki University)

Title : "Inhomogeneous interpretation on the m-z relation of the type Ia supernovae"

Abstract : We re-analyze the recently observed magnitude-redshift relation of the type Ia supernovae, and examine the possibility that the apparent acceleration of the cosmic expansion is a consequence of large-scale inhomogeneities in the universe.

P02: Fumitoshi Amemiya (Keio University)

Title : "Deparametrised quantum cosmology with Phantom dust"

Abstract : In the canonical formulation of General Relativity (GR), there are constraints which generate infinitesimal diffeomorphism and the canonical Hamiltonian is a linear combination of them. Hence gauge invariant quantities (which Poisson comute with all constraints) do not evolve with respect to canonical Hamiltonian. Thus GR is parametrised theory because there is no natural notion of time in the theory. However it is known that GR can be deparametrised by adding the pressure free dust as a matter field. We perform a canonical quantization of deparametrised version of Friedmann-Robertson-Walker universe and compute the expectation value of the scale factor as a function of physical time.

P03: Hideyoshi Arakida (Waseda University)

Title : "Influence of Dark Matter on Light Propagation in Solar System Experiment"

Abstract : We investigated the influence of dark matter on light/signal propagation in the solar system. First, we derived the approximate solution of Einstein field equation as the function of time t and r under the spherically symmetric spacetime. As the form of dark matter density, we assumed $\rho(t,r) = \rho(t)(\ell/r)^k$ where ℓ is the normalized factor. In accordance with derived approximate solution, we concentrated on the light propagation and examined the additional corrections due to the dark matter on the time delay of light/signal and the relative frequency shift. As the application, we considered the secular increasing of the astronomical unit reported by Krasinsky and Brumberg (2004).

P04: Frederico Arroja (University of Portsmouth)

Title : "Second order gravitational waves"

Abstract : TBA

P05: Ryuichi Fujita (Raman Research Institute)

Title : "Bound geodesics in Kerr space time"

Abstract : We derive the analytical solutions of the bound timelike geodesic orbits in Kerr spacetime. The analytical solutions are expressed in terms of the elliptical integrals using Mino time λ. As pointed out by Bardeen, we can express bound geodesic orbits with the elliptical integrals even if we do not use Mino time. But Mino time is more useful to understand physical properties of Kerr geodesics since it decouples radial and polar motion of a particle. For example, we can estimate the fundamental frequencies of the orbits such as radial, polar and azimuthal motion, and the Fourier series of arbitrary functions of particle's orbits. In this paper,

we derive the analytical expression of the fundamental frequencies in terms of the complete elliptical integrals. Then we derive the analytical solutions of the orbits in terms of the elliptical integrals using Mino time. We can use these analytical expressions to investigate physical properties of Kerr geodesics and immediately apply them to the estimation of gravitational waves from the extreme mass ration inspirals.

P06: Teruki Hanada (Yamaguchi University)

Title : "Cosmology of multigravity"

Abstract : We have constructed a nonlinear multi-graviton theory. The application of this theory to the cosmology is discussed. We find that the scale factors in a solution for this theory repeat the acceleration and the deceleration.

P07: Kazuhiro Iwata (Nagoya University)

Title : "The distance-redshift relation for the inhomogeneous and anisotropic universe"

Abstract : Recently, there have been a indication that the universe is in a state of accelerated expansion. This accelerated expansion is supposed to be caused by unidentified dark energy as a result of fitting the observations of type Ia supernovae to a distance-redshift relation of homogeneous and isotropic universe model. But the universe is not perfectly homogeneous and isotropic because of structures such as galaxies or groups of galaxies. In this work, by taking into account effects of such inhomogeneities and anisotropies of the matter distribution, we explain the distance-redshift relation suggested by the observations of type Ia supernovae without dark energy. First, we show that after averaging the optical scalar equation of an inhomogeneous and anisotropic spacetime over the sphere, we can obtain a simplified optical scalar equation, which coincides with that in the Lemaître-Tolman-Bondi spacetime with a Dyer-Roeder-like extension. Then, we

show that the distance-redshift relation obtained from our equation provides better fitting of the observational data than the ΛCDM model and the void model.

P08: Nahomi Kan (Yamaguchi Junior College)

Title : "Cancellation of long-range forces in Einstein-Maxwell-dilaton system"

Abstract : We examine cancellation of long-range forces in Einstein-Maxwell-dilatonic system. Several conditions of the equilibrium of two charged masses in general relativity have been found by many authors. These conditions are altered by taking account of dilatonic field. Under the new condition, we show cancellation of $1/r^2$ potential using Feynman diagrams.

P09: Shota Kisaka (Hiroshima University)

Title : "The correlation of black hole mass with metallicity index of host spheroid"

Abstract : We investigate the correlation between the mass of the supermassive black holes (SMBHs) and metal abundance, using existing data sets. The SMBH mass M_{bh} is well correlated with integrated stellar feature of M_{gb}. For 28 galaxies, the best-fitting M_{bh}–M_{gb} relation has a small scatter, which is an equivalent level with other well-known relation, such as a correlation between the stellar velocity dispersion and the mass. An averaged iron index Fe also

positively correlates with M_{bh}, but the best-fitting M_{bh}–Fe relation has a larger scatter. The difference comes from the synthesis and evolution mechanisms, and may be important for the SMBH and star formation history in the host spheroid.

P10: Hiroshi Kozaki (Ishikawa National College of Technology)

Title : "Integrability of strings with a symmetry in the Minkowski spacetime"

Abstract : The Nambu-Goto equations of motions for a string are reduced to the geodesic equations if the worldsheet is tangent to a Killing vector field. In the Minkowski spacetime, such strings are classified into seven families. We find that the geodesic equations for all the families are integrable.

P11: Satoshi Maeda (Tokyo Institute of Technology)

Title : "Primordial magnetic fields from second-order cosmological perturbations: Tight coupling approximation"

Abstract : We explore the possibility of generating large-scale magnetic fields from second-order cosmological perturbations during the pre-recombination era. The key process for this is Thomson scattering between the photons and the charged particles within the cosmic plasma. To tame the multicomponent interacting fluid system, we employ the tight coupling approximation. It is shown that the source term for the magnetic field is given by the vorticity, which signals the intrinsically second-order quantities, and the product of the first order perturbations. The vorticity itself is sourced by the product of the first-order quantities in the vorticity evolution equation. The magnetic fields generated by this process are estimated to be $\sim 10^{-29}$, Gauss on the horizon scale.

P12: Takuya Maki (Japan Woman's College of Physical Education)

Title : "Dilatonic Domain-like Universe of Arbitrary Dimensions"

Abstract : We investigate the 1-parameter solutions of Dilaton gravity. And we have found the non-linear differential equation system which describe some class of the solutions. Then we present some physically important solutions and investigate their physical properties. Also we discuss the application to Cosmology by means of the solutions.

P13: Masato Minamitsuji (CQUeST, Sogang University)

Title : "On thick de Sitter brane solutions in higher dimensions"

Abstract : We present thick de Sitter brane solutions which are supported by two interacting phantom scalar fields in five, six and seven dimensional spacetime. It is shown that for all cases regular solutions with an de Sitter asymptotic (5D problem) and a flat asymptotic far from the brane (6D and 7D cases) exist. We also confirm that the obtained solutions are stable against linear perturbations in all cases under consideration.

P14: Yoshiyuki Morisawa (Osaka University of Economics and Law)

Title : "On volume operator"

Abstract : By a kind of informational interpretation on volume operator in loop quantum gravity, it is suggested that a quantum gate has a minimum volume.

P15: Kouji Nakamura (the Grad. Univ. for Adv. Studies, NAOJ)

Title : "Second-order gauge-invariant cosmological perturbation theory 3 : — Consistency of equations —"

Abstract : Based on the gauge-invariant formulation of the genera relativistic second-order gauge-invariant cosmological perturbation theory developed in the papers [K. Nakamura, Prog. Theor. Phys. 117 (2007), 17; preprint arXiv:0804.3840[gr-qc]], the second-order perturbations of the Einstein equation and the equations of motion for matter field on a four dimensional homogeneous isotropic universe are derived in the case of the single perfect fluid. We have also derived the consistency equations of the system of these equations and checked these consistency equations are satisfied through the lower order equations. This implies that the derived equations in the above papers give the consistent set of the equations for the second-order cosmological perturbations and we are ready to clarify the physical behaviors of the second-order cosmological perturbations.

P16: Hiroyuki Nakano (Rochester Institute of Technology)

Title : "Comparison of Post-Newtonian and Numerical Evolutions of Black-Hole Binaries"

Abstract : In this presentation, we compare the waveforms and orbital dynamics in the post-Newtonian predictions with long-term, fully non-linear, numerical simulations of generic black-hole binaries. Here, we can identify features in the waveforms related to precession.

P17: Hidenori Nomura (Hiroshima University)

Title : "Damping of the baryon acoustic oscillations in the matter power spectrum as a probe of the growth factor"

Abstract : We investigate the damping of the baryon acoustic oscillations (BAO) signature in the matter power spectrum due to the quasi-nonlinear clustering of density perturbations. On the basis of the third order perturbation theory, we construct a fitting formula of the damping in an analytic way. This demonstrates that the damping is closely related with the growth factor and the amplitude of the matter power spectrum. Then, we investigate the feasibility of constraining the growth factor through a measurement of the damping of the BAO signature. An extension of our formula including higher order corrections of density perturbations is also discussed.

P18: Masato Nozawa (Waseda University)

Title : "Quasinormal modes of black holes localized on the Randall-Sundrum 2-branes"

Abstract : We investigate conformal scalar, electromagnetic, and massless Dirac quasinormal modes of a brane-localized black hole. The background solution is the four-dimensional black hole on a 2-brane that has been constructed by Emparan, Horowitz, and Myers in the context of a lower dimensional version of the Randall-Sundrum model. The conformally transformed metric admits a Killing tensor, allowing us to obtain separable field equations. We find that the radial equations take the same form as in the four-dimensional "braneless "Schwarzschild black hole. The angular equations are, however, different from the standard ones, leading to a different prediction for quasinormal frequencies.

P19: Yuji Ohsumi (Nagoya University)

Title : "Classicality of the stochastic approach to inflation"

Abstract : The stochastic approach to the inflationary universe is the method in which we treat quantum time evolution of long wave length mode of an inflaton field as a stochastic process. In this presentation, by using the bipartite entanglement, or quantum correlation among two regions, we discuss the conditions acquired for the probability distribution behaving as classical one, and what they mean.

P20: Takahiro Sato (Hiroshima University)

Title : "Testing general relativity on the scales of cosmology using the redshift-space distortion"

Abstract : As a test of general relativity on cosmological scales, we measure the γ parameter for the growth rate of density perturbations using the redshift-space distortion of the luminous red galaxies (LRG) in the Sloan Digital Sky Survey (SDSS). Assuming the cosmological constant model, which matches the results of the WMAP experiment, we find $\gamma = 0.63 + 1.8(\sigma_8 - 0.8) \pm 0.09$ at 1-sigma confidence level, which is consistent with the prediction of general relativity, $\gamma = 0.55 \sim 0.56$. Rather high value of σ_8 (≥ 0.85) is required to be consistent with the prediction of the cosmological DGP model, $\gamma = 0.68$.

P21: Yuuiti Sendouda (YITP, Kyoto University)

Title : "Higher curvature theories of gravity in the ADM canonical formalism"

Abstract : We canonically formulate higher-curvature theories of gravity whose action is a class of generic functions of Riemann and Ricci curvature tensors. The canonical formalism of Arnowitt, Deser, and Misner (ADM) allows to count dynamical degrees of freedom of gravity through non-dynamical constraints derived from gravitational Hamiltonian. We find a surface term that gives Dirichlet boundary conditions for dynamical degrees of freedom that leads to generalised junction conditions.

P22: Hisa-aki Shinkai (Osaka Institute of Technology)

Title : "Towards the dynamics in Einstein-Gauss-Bonnet gravity: Initial Value Problem"

Abstract : Towards the investigation of the full dynamics in higher-dimensional and/or stringy gravitational model, we present the basic equations of the Einstein-Gauss-Bonnet gravity theory. We show $(N+1)$-dimensional version of the ADM decomposition including Gauss-Bonnet terms, which shall be the standard approach to treat the space-time as a Cauchy problem. Due to the quasi-linear property of the Gauss-Bonnet gravity, we find that the evolution equations can be in a treatable form in numerics. We also show the conformally-transformed constraint equations for constructing an initial data. We discuss how the constraints can be simplified by tuning the powers of conformal factors. Numerical examples are supposed to be presented. (This work is in collaboration with Takashi Torii.)

P23: Takeshi Suehiro (Keio University)

"Gravitational radiation from a stationary cosmic string"

Abstract : We obtain a set of solutions of stationary cosmic string governed by Nambu-Goto action in Minkovski spacetime, where the timelike Killing vecor field tangent to their world

surface is $\partial_{\rm x} + aL_{\rm y}$ ($\partial_{\rm x}$ and $L_{\rm y}$ denote space translation and Lorentz boost.) To examine metric perturbations around them, we study the linearized Einstein equation in a transverse traceless gauge.

P24: Hideyuki Tagoshi (Osaka University)

Title : "Detecting gravitational waves from inspiraling binaries with a network of geographically separated detectors"

Abstract : In recent years, a number of ground based gravitational wave detectors are taking quality science data and are collaborating together, thus the time is ripe to consider analysis of network data for the detection of inspiraling binaries. The advantages of multidetector search for the binary inspiral is that, not only does it improve the confidence of detection, but it also provides information about the direction and polarization state of the source. Inspiraling compact binaries are one of the most promising candidates for first detection of gravitational waves (GW). We compare two strategies of multi-detector detection of compact binary inspiral signals, namely, the coincidence and the coherent for the realistic case of geographically separated detectors. The coincident strategy treats the detectors as if they are isolated - compares individual detector statistics with their respective thresholds while the coherent strategy combines the detector network data to form a single detection statistic which is then compared with a single threshold. We consider the detectors widely separated on Earth. This means that the detectors necessarily have different orientations. We compare the performances of the methods by plotting the receiver operating characteristics (ROC) for the strategies. Several results are derived analytically in order to gain insight. Simulations are performed to estimate parameters and draw the ROC curves. We show quantitatively that though the coincident analysis is computationally cheaper in general than coherent analysis, the coherent strategy is superior to the coincidence strategy as regards performance - in the viable false alarm regime, at the same false alarm rate, the false dismissal probability is considerably smaller for the coherent strategy than the coincident one.

P25: Takashi Tamaki (Waseda University)

Title : "Revisiting chameleon gravity–thin-shells and no-shells with appropriate boundary conditions"

Abstract : We consider gravitating Q-balls and their stabilities via a catastrophe theory. As a concrete model, we adopt the potential $V_3 = \frac{m^2}{2}\phi^2 - \mu\phi^3 + \lambda\phi^4$. Intrinsic differences from the case without gravity are (i) uniqueness of the solution for a fixed phase frequency ω is not guaranteed. (ii) as a result, number of stable and unstable solutions when we fix basic parameters, e.g., m and the Q-ball charge, also changes. We discuss the relation to boson stars and the implication as a dark matter candidate.

P26: Shinya Tomizawa (KEK)

Title : "Kaluza-Klein-Kerr-Gödel Black Holes"

Abstract : Applying *squashing transformation* to Kerr-Gödel black hole solutions, we present a new type of a rotating Kaluza-Klein black hole solution to the five-dimensional Einstein-

Maxwell theory with a Chern-Simon term. The new solutions generated via the squashing transformation have no closed timelike curve everywhere outside the black hole horizons. At the infinity, the metric asymptotically approaches a twisted S^1 bundle over a four-dimensional Minkowski space-time. One of the remarkable features is that the solution has two independent rotation parameters along an extra dimension associated with the black hole's rotation and the Gödel's rotation. The space-time also admits the existence of two disconnected ergoregions, an inner ergoregion and an outer ergoregion. These two ergoregions can rotate in the opposite direction as well as in the same direction.

P27: Takashi Torii (Osaka Institute of Technology)

Title : "Dilatonic Black Holes in Gauss-Bonnet Gravity in Various Dimensions"

Abstract : We study spherically symmetric, asymptotically flat black hole solutions in the low-energy effective heterotic string theory, which is the Einstein gravity with Gauss-Bonnet term and the dilaton, in various dimensions. The black hole solutions of various masses is obtained numerically in $D = 4, 5, 6$ and 10 dimensional spacetime with $(D-2)$-dimensional hypersurface with positive constant curvature. A detailed comparison with the non-dilatonic solutions is made. We also examine their thermodynamic properties. It is found that the dilaton has significant effects on the black hole solutions. We will also discuss the asymptotically adS case, which is under investigation, if possible.

P28: Yuta Yamada (Osaka Institute of Technology)

Title : "Apparent horizon formation in higher dimensional spacetime"

Abstract : We numerically investigate the formation of an apparent horizon in higher dimensional spacetime in the context of the cosmic censorship hypothesis.We model the matter by distributing collisionless particle both in a spheroidal and toroidal configuration.We prepare the sequence of initial data by solving the Hamiltonian constraint equation and discuss the varidity of the hoop conjecture. (This work is in the collaboration with Hisaaki Shinkai)