14th Regional Conference on Mathematical Physics

Titles and Abstracts of Presentations

Nudrat Aamir **Shaheed Benazir Bhutto Women University, Peshawar**

New skipping approach to fixed point method for nonlinear unconstrained optimization

Abstract: Multi-step quasi Newton methods for nonlinear optimization were introduced by Ford and Moghrabi [1, 2], where update of Hessian matrix is needed for each iteration. This makes it computationally expensive, they introduced two techniques to update the Hessian matrix, accumulative and fixed point. Ford and Aamir [3] introduced a new technique known as multi-step skipping and modified skipping technique, to overcome the computational burden. In this paper, we propose to introduce a new technique for fixed point skipping method. Proposed idea will be tested on functions available in literature and will be compared with existing single and multi-step methods for nonlinear optimization.

1. J. A. Ford, On the use of additional function evaluations in quasi-newton methods, department of computer science, university of Essex, 1986
2. J. A. Ford and I. A. Moghrabi, Multi-step quasi-Newton methods for optimization, Journal of Computational and Applied Mathematics 50: (1994), 305-323.
3. J. A. Ford and N. Aamir, Multi-step skipping methods for unconstrained optimization, Numerical analysis and applied mathematics ICNAAM 2011: International Conference on Numerical Analysis and Applied Mathematics, Vol. 1389, AIP Publishing, 2011, 1806-1808.

Ghulam Abbas **COMSATS Institute of Information Technology, Sahiwal**

Compact stars in general relativity and modified theories of gravity

Abstract: In this talk, we discuss the possibility of forming of anisotropic compact stars in GR as well in *f (R)* and *f (T)* gravity theory. To this end, we have applied the analytical solution of Krori and Barua metric to a static spherically symmetric space-time in *f(R)* gravity. The unknown constants in Krori and Barua metric have been determined by using masses and radii of class of compact stars like 4*U* 1820-30, Her X-1, SAX J 1808-3658. The properties of these stars have been analyzes in detail. Furthermore, we have checked the regularity conditions, energy conditions, anisotropic behavior, stability and surface redshift of the compact stars 4*U* 1820-30, Her X-1, SAX J 1808-3658

Hassan Ahmed **University of Wah, Wah Cantt**

Dark matter: a review

Abstract: To explain the rotation of our galaxies their observable matter is not sufficient, there must be some more matter which contributes to the observed gravity effects. This strange and unknown matter, realized by its gravitational effects on visible matter only, is called dark matter. This extra matter is also needed to enable galaxies stay intact. Unlike normal matter, dark matter does not interact with the electromagnetic force. This means it does not absorb, reflect or emit light, making it extremely hard to spot. Also this information is not enough to identify the particle species that make up dark matter.

In this paper, we will review the current status of the search for the nature of dark matter. We will provide an introduction to possible particle candidates for dark matter and discuss the recent experimental results that constrain the properties of those candidates.

Ishtiaq Ahmed **National Centre for Physics, Islamabad**

Flavor physics a yard stick for new physics

Mashhood Ahmad **National University of Science and Technology, Islamabad**

Entanglement dynamics of two-mode amplified qubits

Abstract: We have seen the entanglement dynamics of two-mode qubit as it is amplified through CEL amplifiers. The ensemble measurement of the amplified system is carried out through Balanced Homodyne Detection by sampling out noise-free quadratures. The measured quadrature distribution function gives rise to the Wigner Function. A few points (four Points) information of this phase-space representation (Wigner function) is used to determine the entanglement content in the amplified system by using Von Neumann entropy. It is observed that the entanglement content degrades with gain in the system and improves with the squeezing.

Ahmed Ali **DESY, Hamburg, Germany**

Multiquark hadrons - A new facet of QCD

Abstract: In 2003, Belle, an experiment at the KEK B-factory in Tsukuba, Japan, discovered a hadron, called X (3872) (the number in the parentheses is its mass in MeV), in the decay $B \to K\, X$ (3872), with the subsequent decay of X (3872) into $J/\psi\, \pi^+\, \pi^-$, $J/\psi\, \pi^+\, \pi^-\, \pi^0$, and into a pair of charmed hadrons $D\, \bar{D}^*$. The existence of X (3872) was confirmed subsequently by a number of experiments at

the $e^+ e^-$ colliders, and in hadronic collisions at the Tevatron and the LHC. This hadron does not fit in the canonical charmonium spectroscopy.
The discovery of *X* (3872) was a harbinger of a new hadronic spectroscopy. In the meanwhile, a large number of *X* (3872)-like hadrons, totalling well over two dozens and counting, have been found by BaBar, Belle, BES (an experiment at the Beijing $e^+ e^-$ collider) and LHCb. Depending on their spin, parity and charge conjugation quantum numbers, these neutral exotic hadrons are generically called *X* ($J^{PC} = 1^{++}$) and *Y* (with $J^{PC} = 1^{--}$) states. Their classification is at present a matter of intense theoretical debate, with hadron molecules, tightly-bound tetraquark hadrons, and hybrids, being the leading candidates. Somewhat later, Belle discovered a charged hadron, $Z^{\pm}$ (4430), in the process $B \rightarrow K\, Z^{\pm}$ (4430), with the $Z^{\pm}$ (4430) decaying into $\psi(2S)\pi^{\pm}$. In the valence approximation, $Z^{\pm}$ (4430) must contain (at least) four quarks and antiquarks, i.e., it is a tetraquark. In the meanwhile, other *Z*-like states, such as $Z^{\pm}$ (3900) and $Z^{\pm}$ (4020) have also been established.

The exotic spectroscopy is not confined to the charmonium sector alone, as similar hadrons have been discovered in the bottomonium sector as well. The first of these, $Y_b(10890)$, was announced in 2010 by Belle in the electron-positron annihilation process $e^+ e^- \rightarrow Y_b$. The charged bottomonium-like hadrons $Z_b{}^{\pm}$ (10610) and $Z_b{}^{\pm}$ (10650) have been discovered in the decays Y_b (10890)/Υ (5*S*) $\rightarrow Z_b{}^{\pm}$ (10610) $\pi^{\mp}$ and Y_b (10890)/ Υ (5*S*) $\rightarrow Z_b{}^{\pm}$ (10650) $\pi^{\mp}$, with the subsequent decays into h_b (1*P*, 2*P*) $\pi^{\pm}$, and Υ (1*S*, 2*S*, 3*S*) $\pi^{\pm}$, going at almost the same rate. Tetraquark interpretation of the $Z_b{}^{\pm}$ (10610) and $Z_b{}^{\pm}$ (10650), which have in their Fock space both spin-0 (h_b (1*P*, 2*P*)) and spin-1 (Υ (1*S*, 2*S*, 3*S*) components, offer a natural explanation of these transitions.

While the experimental progress establishing the multiquark hadrons is both irrefutable and impressive, their theoretical understanding is less evident. There are several competing mechanisms to accommodate them. It is very likely that hadron spectroscopy finds itself at the threshold of a new era, and in anticipation thereof, several dynamical models of the *X*, *Y* and *Z* hadrons have been put forward in the current literature as viable explanations. The aim of this talk is to first summarise the current data on exotic hadrons and confront them with the dynamical models in the market. We will argue that a new facet of QCD dealing with multiquark states has dawned and needs dedicated studies to consolidate it.

Askar Ali **Quaid-i-Azam University, Islamabad**

Effective temperature of Kerr blackhole

Abstract: A field vacuum state is given in space-time of a Kerr black hole. The analysis of this state can be done in terms of how an observer sees it which depends on the effective temperature function which was introduced by Barcelo et.al. (Phys. Rev. D 83 041501 (2011). In this work we find the analytic expression for the effective temperature function which not only depends upon the vacuum state but also related to the motion of the specific observer by giving information about its

position, the local velocity and proper acceleration. In the end we give the physical interpretation of the results obtained.

Naila Amir **National University of Sciences and Technology, Islamabad**

Algebraic solutions of quantum mechanical systems with position-dependent effective mass

Abstract: Position-dependent effective mass systems are of great significance due to the fact that these models have numerous applications in various areas of physics. The qualitative understanding of a complicated realistic system can be acquired by analyzing the exact solutions of a related simplified model.

A general recipe for obtaining the exact solutions of quantum systems with spatially varying mass is presented. This algebraic method is based on supersymmetric quantum mechanics along with the property of shape invariance. Furthermore, appropriate ladder operators along with the associated algebraic structure of the underlying position-dependent effective mass systems are obtained.

In order to illustrate this general formalism a non-linear harmonic oscillator with spatially varying mass has been considered. Explicit expressions for the energy spectrum and the corresponding wave functions in terms of modified Hermite polynomials are obtained. Moreover, ladder operators for this particular system are constructed which enable us to obtain the underlying algebraic structure of the given system.

Muhammad Ayub **COMSATS Institute of Information Technology, Abbottabad**

Algebraic linearization for differential equations

Abstract: Differential Equations play a key role in mathematical modeling of physical problems in applied sciences from atoms to star. Linearization has a significant role in the analysis of different aspects of differential equations. In this talk, the basic idea of algebraic linearization for differential equations, initiated by Lie himself [1842-1899], will be discussed in detail. Moreover their applications for scalar ODEs will be discussed and try to present how they are developed for case of systems of ODEs. Furthermore recent work and our contributions will be discussed for this approach. At the end, physical examples will be discussed to illustrate this approach.

Taha Aziz **University of the Witwatersrand, Johannesburg, South Africa**

Group theoretical analysis and invariant solutions for time-dependent flow model of a non-Newtonian fluid

Abstract: The present work deals with the modelling and solution of the unsteady flow of an incompressible third grade fluid over a porous plate within a porous medium. The flow is generated due to an arbitrary velocity of the porous plate. The fluid is electrically conducting in the presence of a uniform magnetic field applied transversely to the flow. Lie group theory is employed to find symmetries of the model equation and these symmetries are used to transform the original third order partial differential equation to a third order ordinary differential equations. The third order ordinary differential equations are then solved analytically and numerically. The manner in which various emerging parameters have an effect on the structure of the velocity is discussed with the help of several graphs.

Ahmet Bakkaloğlu **M.S.G.S.U FEN-ED, Istanbul, Turkey**

Invariant approach to optimal investment-consumption problem: the constant elasticity of variance (CEV) model

Abstract: The optimal investment-consumption problem under the constant elasticity of variance (CEV) model is solved using the invariant approach. Firstly, the invariance criteria for scalar linear second-order parabolic partial differential equations in two independent variables are reviewed. The criteria is then employed to reduce the CEV model to one of the four Lie canonical forms. It is found that the invariance criteria help in transforming the original equation to the second Lie canonical form and with a proper parameter selection, the required transformation converts the original equation to the first Lie canonical form which is the heat equation. As a consequence, we find some new classes of closed-form solutions of the CEV model for the case of reduction into heat equation and also into second Lie canonical form. The closed-form analytical solution of the Cauchy initial value problems for the CEV model under Investigation is also obtained.

Kazuharu Bamba **Fukushima University, Fukushima City, Japan**

Inflationary universe in fluid description

Abstract: We explore the perfect fluid description of the inflationary universe. In particular, we demonstrate that the three observables of inflationary cosmology: (i) the spectral index of the curvature perturbations, (ii) the tensor-to-scalar ratio of the density perturbations, and (iii) the running of the spectral index, can be consistent with the recent Planck results. Furthermore, the equation of state (EoS) of the fluid is explicitly reconstructed from the spectral index of the curvature perturbations compatible with the Planck analysis. In addition, it is shown that the universe can gracefully exit from inflation.

Yafis Barlas **University of California, Riverside, USA**

Dissipation-less edge currents in two-dimensional crystal: Role of topology

Abstract: Topology is a mature branch of mathematics dedicated to the study of shapes and spaces. Objects that can be continuously deformed into each other by bending and stretching, but not cutting and gluing, are considered topologically equivalent. More recently, ideas borrowed from the field of topology have influenced several areas of physics. In this talk, I will discuss a particular application of these concepts which has led to characterization and description of robust dissipation-less edge transport (i.e. current flow without energy loss at the sample edges) in material physics. I will identify the conditions required to realize these states and discuss the experimental signatures and influence of disorder on transport. Realization of these systems is anticipated to revolutionize design of low-power-consumption electronic devices.

Adnan Bashir **University of Michoacan, Morelia, Mexico**

Understanding pion from quarks and gluons: QCD versus experiment

Abstract: Quark mass function evolves from a small value when quarks are close to each other to a large value of the order of a few hundred MeV when the traverse distances of hadronic size. This evolution reflects in physical observables of dynamic origin such as form factors and parton distribution functions inside hadrons, thus providing a unified approach based upon QCD's fundamental field equations, namely, Schwinger-Dyson equations to predict a host of hadronic observables. In particular, I present a consistent analysis based upon a symmetry preserving simultaneous Schwinger-Dyson and Bethe-Salpeter equations treatment to calculate pion transition form factor to γ and γ^*. This is the first full calculation of this form factor to large photon probing momenta. Our results are in agreement with all the existing experimental data with an exception of the large $-Q^2$ BaBar data with which they disagree markedly. We expect future Belle II experiments to confirm, yet again, that QCD is in fact the theory of hadrons at all momentum scales.

M. Zaeem-Ul-Haq Bhatti **University of the Punjab, Lahore**

Role of some physical factors on the stability of collapsing system

Abstract: In this talk, we study the effects of some physical factors on the dynamical instability of self-gravitating system. We will continue our systematic analysis to investigate the instability regions by constructing collapse equation under certain limits.

Faisal Munir Bhutta **Institute of High Energy Physics, Beijing, China**

Introduction to Randall-Sundrum Model and flavour Physics

Abstract: We review how warped extra dimensions model known as Randall-Sundrum (RS) model provide warped geometry solutions to gauge hierarchy problem and fermion mass hierarchies in Particle Physics. Different types of RS models are presented. We see that the Minimal RS model provide large corrections to electroweak precision parameters S, T and U and Zbb^{-} couplings which provide constraints on the mass scale of lowest Kaluza-Klein (KK) excitations MKK to be of the order of tens TeV. We show that for custodial RS model and bulk Higgs RS model it may be possible to remain in agreement with all the constraining observables by keeping MKK scale to be in LHC reach.

İsmail Boztosun **Akdeniz University, Antalya, Turkey**

Photonuclear reactions for the determination of energy levels and half-lifes of proton rich nuclei

Abstract: Half-life and energies of gamma-ray transition in the decay of several proton-rich nuclei such as the isotopes of Ga, Sc, Pr, produced by photonuclear reactions, have been measured. A bremsstrahlung photon beam of 18 MeV end-point energy produced by the electron linear accelerator (e-LINAC) has been used to create the radioactive isotopes. The subsequent decay has been measured by p-type HPGe detector with 40% relative efficiency and resolution of 1.85 keV FWHM at 1332 keV (^{60}Co). Maestro, GF3 and ROOT programs were used for spectrum analysis. The time evolution of the counts was recorded for the purpose of obtaining the half-life of the decaying isotopes. The obtained accuracy for the transition energies and half-life are comparable to the data available in the literature.

In the second part of my talk, I will be providing information on the research topics carried out by the Akdeniz University Nuclear Sciences Application and Research Center; Our recent results on (g, n) and (g ,p) photo-nuclear reactions and photo-fission of heavy nuclei such as Thorium, Uranium and Americium will be presented. Possible applications in different fields of fundamental and applied sciences such as agriculture and foodstuffs, engineering sciences, health and medicine as well as research and development studies will also be presented.

Uğur Camcı **Akdeniz University, Antalya, Turkey**

Symmetry analysis of the Klein-Gordon equation in pp-wave spacetimes

Abstract: In this study, we derive the Noether gauge symmetries of the Klein-Gordon equation in background of some pp-wave spacetimes. To get the Klein-Gordon equation in some pp-wave spacetimes, we construct a Lagrangian of the model. Using the obtained Lagrangian for pp-wave spacetimes, we calculate and

classify Noether gauge symmetry generators. Furthermore, we give conservation laws admitted by Lagrangians for representing physical system.

Zaheer-ud-Din **CECOS University, Peshawar**

RBF solution method of 1D oscillatory Fredholm integral equations having kernel function free of stationary-points

Hina M. Dutt **National University of Sciences and Technology, Islamabad**

Linearization and group classification of ordinary differential equations

Abstract: Lie's method of converting scalar second order ordinary differential equations (ODEs) to the linear form by point transformations was already extended to the third and fourth order scalar ODEs by point and contact transformations and to the systems of second order ODEs. The point symmetry group classification of linear nth order scalar and second order systems of m ODEs was provided. Till recently no work on the linearization and classification has been done for higher order systems of ODEs and scalar ODEs linearizable via point, contact and higher order tangent transformations.

Complex methods are employed to obtain the complex-linearizable form of two dimensional systems of third order ODEs. The most general linearizable form and linearization conditions for such class of two dimensional systems of third order ODEs are derived. We obtain a canonical form for two dimensional linear systems of third order ODEs. This canonical form that corresponds to the linearizable, complex, scalar third order ODEs is used for the symmetry group classification of two dimensional systems of third order ODEs. Five equivalence classes of such systems are proved to exist.

Contact and higher order symmetries of scalar ODEs are related with the point symmetries of the reduced systems. Two new types of transformations that build up these relations and equivalence classes of scalar third and fourth order ODEs linearizable via these transformations are obtained. Four equivalence classes of these equations are seen to exist.

Sarah Elahi **Qauid-i-Azam University, Islamabad**

Effective temperature of Reissner-Nordstrom black hole

Abstract: In this work we are interested in analyzing how hawking radiation in a Reissner-Nordstrom metric is perceived by an observer in vacuum state. Our method is based on the introduction of an effective temperature function. First we introduce a non-stationary vacuum state, and then we find a general analytic expression for the effective temperature function which, apart from the vacuum state, depends on the position, local velocity and the acceleration of the specific

observer. We also give a physical interpretation of the quantities appearing in the expressions.

Rıza Erdem **Akdeniz University, Antalya, Turkey**

Exact analysis of free energy surfaces for the spin–1 mean-field Ising model in the microcanonical formalism using gamma function

Abstract: Exact free energy values (F_E) of the spin-1 mean-field Ising model for finite systems that consist of N particles are calculated in the microcanonical formalism which uses the gamma function $(\Gamma(N))$. We constructed the contour map of the free energy surfaces in the phase space of dipolar (M) and quadrupolar (Q) order parameters for various values of N. From these maps, stable, metastable and unstable states are seen explicitly. We analyzed these states in comparison with the free energy values (F_A) obtained by using the approximated expression for the entropy using the Stirling approximation to deal with factorials. Moreover, the relative error between our exact values and the approximate one using the Stirling formula $(F_A - F_E)/F_E$ is calculated and displayed as the contour map in the $M - Q$ phase space.

Aeeman Fatima **University of the Witwatersrand, Johannesburg, South Africa**

A note on the integrability of a remarkable static Euler– Bernoulli beam equation

Abstract: It has recently been shown that the fourth-order static Euler–Bernoulli ordinary differential equation, where the elastic modulus and the area moment of inertia are constants and the applied load is a function of the normal displacement, in the maximal case has three symmetries. This corresponds to the negative fractional power law $y^{-\frac{5}{3}}$, and the equation has the non-solvable algebra *sl(2, I R*). We obtain new two and three parameter families of exact solutions when the equation has this symmetry algebra. This is studied via the symmetry classification of the three-parameter family of second-order ordinary differential equations that arises from the relationship among the Noether integrals. In addition, we present a complete symmetry classification of the second-order family of equations. Hence the admittance of *sl(2, I R)* remarkably allows for a three-parameter family of exact solutions for the static beam equation with load a fractional power law $y^{-\frac{5}{3}}$.

Muhammad Ayub Faridi **University of the Punjab, Lahore**

Density functional theory and its applications

Abstract: Density functional theory (DFT) is a computational quantum mechanical modelling method used in different realms of science to explore the electronic structure at the ground state of many-body systems, in particular atoms,

molecules, and the condensed phases. With the use of DFT, the characteristics of a many-electron system can be determined by using functionals, depending spatially on electron density. In present talk many applications of DFT are discussed and numerical results are attained where analytical methods fail to work.

Fayyazuddin **Qauid-i-Azam University, Islamabad**

Lepton flavor violating muon and tau decays

Abstract: It is well known that in the Standard Model the lepton flavor violating decays are not possible. In this talk I will discuss a model where we can extend the gauge group of the Standard Model.

Fakhra Ghafoor **University of Wah, Wah Cantt.**

Simulations of minimum bias and underlying events using different PDFs

Abstract: We simulate Minimum Bias and underlying events to tune PYTHIA6 Monte Carlo event generator using data from the Large Hadron Collider (LHC) and Tevatron. Multiple Parton Interaction (MPI) parameters including three Lambda parameters are considered for tuning as these parameters are more sensitive to the selected data. It is shown that these tunings describe selected distributions quite well, especially transverse momentum (pt) distribution at three collision energies, 0.9 TeV, 1.9 TeV and 7 TeV provided that charge particles with pT>500MeV are used.

Results are presented using three types of Parton Density Functions (PDFs) of proton: leading order (LO), modified leading order (LO*) and next-to-leading order (NLO). We found that all three types of PDFs can describe minimum bias and underlying event distributions equally well.

Graham S. Hall **University of Aberdeen, Aberdeen, UK**

Some remarks on Einstein's geodesic postulate

Abstract: The main theme of this talk is the idea that, under reasonable conditions, particles in general relativity follow timelike geodesics (Einstein's geodesic postulate). Such an idea leads to the concept of projective relatedness for space-times; that is, a consideration of those space-times which agree as to their geodesics, and the strength of projective relatedness for space-times will be shown. This, in turn, leads to Weyl's projective tensor (which is the same for two projectively related space-times) and to the study of projective symmetry and Weyl projective symmetry. A list of reasonable conditions on space-times which relate to (its level of) projective structure will be given and it will be shown that no two of them are equivalent. Finally, the restrictions imposed on a space-time by the specification of its Weyl projective tensor will be investigated.

Usman Hasan **National Centre for Physics, Islamabad**

Dynamical localization in double quantum dots

Pervez Hoodbhoy **Forman Christian College University, Lahore**

New mathematics for old physics

Abstract: This talk will be a quick introduction to new mathematical methods and concepts that have helped create a deeper understanding of classical mechanics, general relativity, gauge field theories, and which have also become indispensable in the development of string theories.

Afifa Hussain **University of Wah, Wah Cantt**

Investigation of phenomenological approaches implemented in PYTHIA

Abstract: Soft hadronic interactions are modeled in PYTHIA6 using phenomenological adaptation of QCD to describe non perturbative pp processes. We studied the MPI, lambda treatment, matter distribution and color reconnection models using best fit to minimum bias data published by ATLAS experiment at two center of mass energies 0.9 TeV and 7 TeV.

Athar Hussain **COMSATS Institute of Information Technology, Islamabad**

Mid-latitude anticyclones and climate of Pakistan

Abstract: The development of a predominantly mid-tropospheric, meridional circulation pattern within a sector of the northern or southern hemisphere is commonly referred to as atmospheric blocking anticyclone. This stagnation of the zonal flow gives rise to difficulties in operational weather forecasts for regions within and near the blocked region. Developing an understanding of the processes that leads to the formation of such circulation patterns is thus of significant interest. Considerable anticyclone related weather and climate based impacts have already been noticed. These include but not limited to occurrence of heat and cold waves, air quality degradation, and sustained precipitation resulting in floods. In this talk, after a brief summary of some of suggested formation processes of atmospheric blocking anticyclones, several new phenomenological implications due to the occurrence of atmospheric blocking anticyclones will be presented. In particular, it will be emphasized that varying magnitude of reduced variance in the surface temperature and the change in the precipitation patterns occurs due to the occurrence of atmospheric blocking anticyclones, depending upon the region. These implications in turn point towards the attribution of changing regional surface temperature and precipitation patterns towards atmospheric blocking anticyclones.

Mureed Hussain **National University of Sciences and Technology, Islamabad**

New Physics constraints from B——> K*μ^+ μ^- on flavor symmetry-based MSSM

Abstract: We study the sparticle spectrum of flavor symmetry-based minimal super-symmetric standard models which are known as sMSSM. In these models soft symmetry breaking terms for sfermions of first two families are set equal, which differ in general from the corresponding third family mass. We see that the constraints from angular analysis of B→ K* μ^+ μ^- provide further limits on the particle spectrum of sMSSM to those provided by the b→sy, B→μ^+ μ^- and B→TU.

Viqar Husain **University of New Brunswick, New Brunswick, Canada**

Time, vacuum energy, and the cosmological constant

Abstract: I review the assumptions (and their limitations) underlying the standard formulation of the cosmological constant problem. I then describe a link between the cosmological constant problem and the problem of time in quantum gravity. This arises by examining the relationship between the cosmological constant and vacuum energy in non-perturbative formulations of quantum gravity. This approach suggests that either the problem is non-existent, or takes a very different form than envisioned in its usual formulation.

Sehrish Iftikhar **University of the Punjab, Lahore**

Polytropic thin-shell collapse

Abstract: We study collapse of a spherically symmetric non-commutative thin-shell with most general polytropic equation of state. We formulate equation of motion for the shell using Israel junction conditions. We examine the formation of a black hole or a naked singularity from the non-commutative collapsing thin-shell.

Ayesha Ikram **University of the Punjab, Lahore**

Warm inflation in f (G) gravity

Abstract: We study warm inflation in $f(G)$ theory of gravity using scalar fields. We evaluate the slow-roll parameters, scalar and tensor power spectra and their corresponding spectral indices as well as tensor-scalar ratio using viable power-law model. These parameters are calculated for intermediate and logamediate inflationary regimes. Finally, we check compatibility of the model with Planck data.

Amer Iqbal **Lahore University of Management Sciences, Lahore**

Instanton-monopole correspondence from M-branes

Abstract: I will discuss BPS excitations in a certain M5-M2-brane configuration. The supersymmetric partition function of this system has two distinct interpretations depending on how it is viewed and leads to a new correspondence between certain classes of instanton and monopole configurations.

Suleman Khalid **Qauid-i-Azam, Islamabad**

Stability of orbits around black holes

Abstract: We discuss the stability of orbits around black holes and find the least stable orbit and check the stability properties according to different parameters.

Chaudry Masood Khalique **North-West University, Mmabatho, South Africa**

Group analysis of a hyperbolic Lane-Emden system

Abstract: In this talk we perform a complete group analysis for the hyperbolic Lane-Emden system. It is shown that the principal Lie algebra which is one-dimensional, extends in several cases. We also classify the Noether point symmetries for the hyperbolic Lane-Emden system. Thereafter, conservation laws are derived for those cases that admit the Noether point symmetries.

Muhammad Mansoor Khan **University of Wah, Wah Cantt.**

Physics of simulation machines: the event generators

Abstract: Current Quantum Chromodynamics (QCD) models typically use perturbative QCD to explain parton interactions along with an alternative phenomenological approach to describe low pt or non-perturbative QCD processes. The tool used to make predictions for collision experiments taking into account all aspects of QCD are Monte Carlo (MC) event generators. The most important feature of these generator is the ability to generate results at hadron level by the simulation of full events as they are observed by a detector in reality. Event generators are software libraries that provide the full simulations of the high energy collision. They randomly generate events as those produced in particle accelerators or the early universe. They are widely used by the experimentalists for data analysis as well as by theorists to make predictions. As event generators are main tools in high energy physics, so it is important to know the physics behind these event generators. The aim of this review paper is to explain the physics behind event generators, which are mostly common between almost all the event generators. Most event generators divide the simulation process in five steps, hard process, parton shower, hadronization, underlying event and unstable particles decay to

explain a full high energy collision. In this paper we present an overview of these processes so that event generators are considered as real physics tools rather than black boxes.

Fazeel Mahmood Khan **Institute of Space Technology, Islamabad**

Moving towards direct detection of gravitational waves - a binary supermassive black hole coalescence scenario

Abstract: Gravitational Waves (GWs) are ripples in space time predicted by Einstein's Theory of General Relativity (GR). There are indirect astrophysical evidences that GWs exist but a direct detection is yet to come. In this talk, I shall review detectable sources of GWs by current and future ground and space borne detectors. Particularly, I shall focus on GW detection scenario by coalescing Super Massive Black Hole (SMBH) Binaries in the hearts of merging galaxies. This scenario has received a considerable attention in last decade or so as coalescing SMBH binaries produce loudest bursts of GWs which fall in sensitivity window GW detectors such as Pulsar Timing Array (PTA) and Laser Interferometer Space Antenna (LISA). However in order to quantify the events rate with considerable confidence it is critical to have a good knowledge of lifetime of these coalescing binary. In last part of my talk, I shall present recent results of our full scale numerical modelling of SMBH binary evolution starting from merger of two well separated galaxies till the final coalescence of Black Holes and present coalescence times of binaries having mass that ranges from few million solar mass to few billion solar masses residing in the hearts of late type spiral galaxy bulges to faint elliptical galaxies. Coalescence times obtained are well within a Hubble time for redshift upto 6 making SMBH binaries very promising sources of GWs for both ground and space based GW detectors.

Mehmet Koca **Sultan Qaboos University, Al-Khoud, Oman**

Coxeter-Weyl groups and quasicrystals

Abstract: Quasicrystals are ordered materials which lack translational invariance but form stable structures with higher rotational symmetries that has not been observed in regular crystals. Quasicrystals with 5-fold, 8-fold, 10-fold, 12-fold, and 30-fold rotational symmetries have been observed which are not compatible with the translational symmetry. Its mathematics has not been fully developed yet. Quasicrystallography attracts interest of material scientists, chemists, physicists and mathematicians working in the field of discrete groups and crystallography. As an eminent mathematical physicists remarked once it will occupy the interest of scientists for decades before the topic is settled down. I present an approach based on group theoretical analysis of the hypercubic lattices described by the affine Coxeter-Weyl group W (Bn). An h-fold symmetric quasicrystal structure follows from the hyperqubic lattice whose point group is described by the Coxeter-Weyl group W (Bn) with the Coxeter number h=2n. Projection of the lattice B4 describes a quasicrystal structure with 8-fold symmetry. The B5 lattice leads to quasicrystals

with both 5-fold and 10-fold symmetries. The lattice B6 projects on a 12-fold symmetric quasicrystal as well as a 3D icosahedral quasicrystal depending on the choice of subspace of projections. The projections of the lattices described by the exceptional Coxeter-Weyl groups F4 and E6 lead to 12-fold symmetric quasicrystal structures.

Bushra Majeed **National University of Sciences and Technology, Islamabad**

Slowly rotating black hole in horava-lifshitz gravity and a 3 + 1 dimensional topological black hole: motion of particles and BSW mechanism

Abstract: The motion of a neutral particle in the vicinity of a slowly rotating black hole in the Horava-Lifshitz theory of gravity and 3+1 dimensional topological Lifshitz black hole is investigated. Geodesics for radial motion of the particles are also plotted. Some different cases of the orbital motion of the particle are discussed where maximum and minimum values of the effective potential are calculated. Further the Bañados, Silk and West (BSW) mechanism is studied for these black holes. It is shown that the centre-of-mass energy (CME) of two colliding uncharged particles at the horizon of these black holes remains finite. Thus the BSW effect cannot be seen in these cases.

Samra Maqsood **Quaid-i-Azam University, Islamabad**

Thermodynamics of a non-Kerr rotating back hole

Abstract: Black holes are gravitating objects, so massive and dense with such a strong gravitational attraction that even light cannot escape from them. Gravity is responsible for the formation of these astrophysical objects. In this talk we have discussed the thermodynamics of rotating non-Kerr black holes. First, We discuss some basic concepts about black holes and some of the terms associated with black holes like singularities, horizons, angular velocity etc. We give introduction to rotating non-Kerr black holes and then we investigates the properties of ergosphere and energy extraction by Penrose process in a rotating non-Kerr black hole. If we compare with the Kerr black hole, the deformation parameter ε can enhance the maximum efficiency of the energy extraction process greatly. We discuss thermodynamics of rapidly rotating non-Kerr black holes and its sub-case i.e. slowly rotating non-Kerr black holes and work out their Hawking temperature and surface gravity.

Najmeh Al-Sadat Mazhari **Eurasian National University, Astana, Kazakhstan**

Entanglement entropy for non-equilibrium 2D holographic superconductor

Abstract: We develop Holographic entanglement entropy for a two dimensional time dependent holographic superconductors.

Davood Momeni **Eurasian National University, Astana, Kazakhstan**

Holographic entanglement entropy in 2D holographic superconductor

Abstract: The aim of the present talk is to find the holographic entanglement entropy (HEE) in 2D holographic superconductors (HSC). Indeed, it is possible to compute the exact form of this entropy due to an advantage of approximate solutions inside normal and superconducting phases with backreactions. By making the UV and IR limits applied to the integrals, an approximate expression for HEE is obtained. In case the software cannot calculate minimal surface integrals analytically, it offers the possibility to proceed with a numerical evaluation of the corresponding terms. We'll understand how the area formula incorporates the structure of the domain wall approximation. We see that HEE changes linearly with belt angle. It's due to the extensivity of this type of entropy and the emergent of an entropic force. We find that the wider belt angle corresponds to a larger holographic surface. Another remarkable observation is that no "confinement/deconfinement" phase transition point exists in our 2D dual field theory. Furthermore, we observe that the slope of the HEE with respect to the temperature dSdT decreases, thanks to the emergence extra degree of freedom(s) in low temperature system. A first order phase transition is detected near the critical point.

M. Zubair Ali Moughal **Quaid-i-Azam University, Islamabad**

Effects of accreting mater on the mass of black holes

Abstract: We study backreaction of accreting matter onto a cylindrically symmetric black hole in a perturbative way, when accretion is in a quasi-steady state. General expressions for corrections to the metric coefficients are found in the cylindrical coordinates. Examples for the dust solutions and perfect fluid solutions are discussed.

Zouhair Mouayn **Sultan Moulay Slimane University, Morocco**

Coherent states for Landau levels on two-dimensional surfaces

Saadia Mumtaz **University of the Punjab, Lahore**

Stability of thin-shell wormholes

Abstract: We discuss stability of thin-shell wormholes which are constructed from regular black hole by employing the standard cut and paste technique. The Israel formalism is adopted to calculate surface stresses of the shell. The energy conditions as well as attractive and repulsive characteristics of thin-shell wormholes are analyzed. We also explore stability of these constructed wormhole solutions

against linear perturbations by assuming different equations of state for exotic matter with different corresponding parameters.

Jameel-Un Nabi **Ghulam Ishaq Khan Institute of Engineering Sciences and Technology, Topi**

Electron capture cross section for supernova simulation

Abstract: Current one-dimensional core-collapse supernova models fail to produce explosions. One is not sure whether this failure is due to incorrect microphysics input or whether it implies that the explosion actually requires multidimensional effects like convection and rotation. One important aspect of microphysics that determines the fate of a core-collapse supernova is electron capture on protons and nuclei. These weak captures serve to deleptonize the core of the massive star and determine the final electron fraction, and therefore they set the size of the homologous core.

Here we present our calculation of electron capture cross section for supernova simulation. We calculate accessible states for parent nuclei using the BCS theory. Gamow-Teller transitions to daughter excited states were calculated using the pn-QRPA model. We study extensively the cross sections and rates of electron capture process by iron group peaked nuclei that are important for investigating the neutrino nucleosynthesis and dynamics of core-collapse supernovae.

Hajia Naseem **University of Engineering & Technology, Peshawar**

Numerical solutions of reaction diffusion pde's arising in electronegative plasma

Abstract: Converting system of ode's to pde's to describe the diffusion of particle inside plasma is relatively new work. That results in a system of reaction diffusion s. For the numerical solutions of reaction diffusion PDE's arising in (EN) plasma, we have used operator splitting and explicit methods based on mesh-less procedures. In this work the diffusion of atomic oxygen inside plasma and dependencies of plasma parameters on gas pressure and applied power has been studied. Due to non-availability of exact solutions, the numerical results thus obtained are verified by the experimental results .The determination of plasma parameters, atomic oxygen density as a function of applied power and gas pressure and the study of diffusion of atomic oxygen inside plasma gives useful information regarding the understanding and optimization of plasma processing application.

Rubina Nasir **Air University, Islamabad**

Magnetothermoelectric transport in graphene

Iqra Nawazish **University of the Punjab, Lahore**

Chaotic inflationary universe in f(R) gravity

Abstract: This study investigates chaotic inflationary scenario in the framework of f(*R*) gravity. We explore different chaotic potential models such as quadratic, quartic and fractional potentials. We evaluate slow-roll parameters, number of e-folds and other significant observational parameters like spectral index, scalar power spectrum as well as tensor-scalar ratio and discuss their consistency with Planck and BICEP2 constraints.

Işıl Başaran Öz **Akdeniz University, Antalya**

Noether gauge symmetries of Bianchi I spacetimes in scalar-coupled gravity theories

Abstract: We consider the induced theory of gravity in Bianchi I. We found new exact solutions of those spacetimes via Noether gauge symmetries. We use the Noether gauge symmetries to write the first integrals and find the exact solutions of field equations for the induced theory of gravity.

Teoman Özer **Istanbul Technical University, Istanbul, Turkey**

Theoretical analysis of heat transfer equation by transformation methods

Abstract: Using linearization methods, we determine the first integrals, $\lambda-$symmetries and integrating factor of nonlinear fin equation in which the thermal conductivity and heat transfer coefficient are assumed to be functions of the temperature. And we examine these symmetries for different types of thermal conductivity and the heat transfer coefficient functions. Then, using the modified Prelle-Singer approach, we point out that explicit the time independent first integral and general solution of the equation corresponding to these integrals can be identified for the fin equation in different heat and temperature functions. Furthermore, using this approach, an appropriate the Lagrangian and the Hamiltonian formalism can be obtained. Finally, we comment these solutions by their graphics.

M. Ali Paracha **National University of Science and Technology, Islamabad**

Heavy to light meson transition form factors and applications

Maulik Parikh **Arizona State University, Phoenix, USA**

The dual origins of gravity

Abstract: I show that Einstein's equations and the null energy condition are both derivable in two very different ways. In string theory, they arise as the spacetime interpretation of, respectively, conformal invariance and worldsheet diffeomorphism invariance. But I will show that they also arise from the first and second laws of thermodynamics. I will end by discussing why there are two completely different derivations and what that means about the deepest origins of gravity.

Wajeeha Pervaiz **National University of Sciences and Technology, Islamabad**

Gravitational lensing in the strong field limit

Abstract: Deflection of light was predicted by the general theory of relativity and was confirmed observationally in 1919. This led to the idea of a gravitational lens in which a massive object like a galaxy or clusters of galaxies comes between the source and the observer and causes multiple imaging or magnification. We will first give an introduction to Bozza's method and then apply it to the Schwarzschild and Ressiner-Nordstrom, metrics. Finally we will apply it to the Schwarzschild deSitter, Schwarzschild black hole with topological defect (monopole) and Ressiner-Nordstrom de Sitter metric.

Babar A. Qureshi **Lahore University of Management Sciences, Lahore**

Ground state energy of the universe and the cosmological constant

Abstract: In a completely non-perturbative setting, we investigate the relation between vacuum energy and the cosmological constant term in Einstein's Equation for an FRW background and show that it is not linear in some natural time gauges, opposite to what is assumed in usual semi-classical approximations. This result provides a new perspective on the relation between time, the cosmological constant, and vacuum energy.

Abdul Raheem **COMSATS Institute of Information Technology,**

On super (a,d)-edge-antimagic total labeling of subdivided star trees

Abstract: Let G = (V, E) be a graph with v = |V (G)| vertices and e = |E (G)| edges. An (a,d)-edge antimagic total (EAT) labeling is a bijective function λ from V (G)∪E(G) to the set of consecutive integers {1, 2,…, v + e} such that the weights of the edge W = {w(xy) : xy ∈ E(G)} form an arithmetic sequence with the initial term a and common difference d, where w(xy) = λ(x) + λ(y) + λ(xy). W is called

the set of edge-weights of the graph G. And, if λ (V) = {1, 2,…, v} then G is super (a, d)-EAT. In this paper we formulate super edge antimagic total labeling on isomorphic copies of subdivided star trees for d = {0, 1,2 ,3}.

Hassan Raza **Centre for Fundamental Research**

The bottom-up approach towards nanoelectronics

Hassan Raza **Centre for Fundamental Research**

Novel devices based on graphene nanostructures

Abdur Rehman **National Centre for Physics, Islamabad**

Charm quark effects* at *NNLO QCD contributions to $\mathcal{B}\ (\bar{B} \rightarrow\ X_s\ \gamma)$

Abstract: The inclusive $(\overline{B} \rightarrow X_S\ \gamma)$arises due to loop-mediated FCNC transitions is known to provide strong constraints on beyond-SM physics. The current experimental world average for its branching ratio is $(3.43 \pm 0.22) \times 10^{-4}$, which agrees very well with our recently updated SM prediction $(3.43 \pm 0.23) \times 10^{-4}$. Some of the NNLO QCD corrections are included with the help of interpolation in the charm quark mass, which causes about ± 3% uncertainty. Efforts towards removing this uncertainty is the topic of my talk.

Shahin Rouhani **Sharif University of Technology and IPM, Tehran, Iran**

Scale versus conformal invariance for ultra-relativistic theories

Abstract: We show that just like their relativistic counter parts, Galilean field theories also enjoy conformal invariance provided scale invariance is added to the Galilean symmetries. We also derive a Lyapunov function for field theories which possess conformal Galilean symmetry. This implies that renormalization group flow in these theories lead to a fixed point which is conformally invariant.

Rabia Saleem **University of the Punjab, Lahore**

Dynamics of inflationary universe models

Abstract: We study the dynamics of warm inflation in the context of FRW universe model. In order to discuss inflationary perturbations, we evaluate perturbed parameters like scalar and tensor power spectra, scalar and tensor spectral indices as well as tensor to scalar ratio. We checked the compatibility of our model with Planck recent data by constraining the model and perturbed parameters.

Rafia Sarwar **COMSATS Institute of Information Technology, Islamabad**

Dark matter, its detection and possible candidates

Abstract: Dark matter problem is based on the fact that astrophysical observation of galaxies based on their orbital velocities reveals missing matter. Various candidates of dark matter have been proposed in the realms of astrophysics and particle physics. This work focuses on the historical study of dark matter, review of popular candidates, kinematics of WIMP-nucleon interactions, detection and simulation of WIMP (hypothetical candidate) trajectory near sun. Numerical solutions of differential equations are used in the simulation of WIMP. In addition, we also employ iterative based adaptive time step symplectic integrators to simulate the 2-D trajectory of WIMP near Sun. Both approaches are found to be consistent with each other.

Syed Qamar Abbas Shah **Quaid-i-Azam University, Islamabad**

Significance of phonon modes and excess conductivity of $(Cu_{0.5}Tl_{0.5})Ba_2Ca_3(Cu_{4-x}Ti_x)O_{12-\delta}$ ***(x = 0, 0.25, 0.50, 0.75, 1.0) Superconductors***

Abstract: I will focus on the synthesis techniques of CuTl-1212, 1223 and 1234 superconductors. Further the characterizations that we have employed on these superconductors in order to study various properties of these complex multi-layered structures will be highlighted. Special focus will be on the role of electron and phonon interactions in such compounds. How to extract different superconducting parameters employing Aslamazov and Larkin model with in the domain of Ginzberg Landau theory will also be discussed.

Ghulam Shabbir **GIK Institute of Engineering Sciences and Technology, Topi**

Affine symmetry using the rank of the Riemann tensor

M. Farasat Shamir **National University of Computer & Emerging Sciences, Lahore**

Exact solutions of LRS Bianchi type I spacetime in f (R, T) gravity

Abstract: Modified theories of gravity have attracted much attention of the researchers in the recent years. f (*R, T*) gravity is one such theory in which R is the scalar curvature and T denotes the trace of the energy-momentum tensor. Bianchi type I universe is investigated in the context of f (*R, T*) gravity. For this purpose, exact solutions of locally rotationally symmetric Bianchi type I space-time are explored. The modified field equations are solved by assuming expansion scalar proportional to shear scalar which gives A = B^n, where A, B are the metric coefficients and n is an arbitrary constant.

Muhammad Sharif **University of the Punjab, Lahore**

Gravitational lensing in a string cloud background

Abstract: We study two interesting issues of a black hole with string cloud background. Firstly, we investigate null geodesics and find unstable orbital motion of particles. Secondly, we calculate deflection angle in strong field limit. We then find positions, magnifications and observables of relativistic images for supermassive black hole at the galactic center. We conclude that string parameter highly affects the lensing process and results turn out to be quite different from the Schwarzschild black hole.

Abdul Hanan Sheikh **QUEST, Nawabshah**

Multilevel Helmholtz solver with applications in seismic imaging

Abstract: The Shifted Laplace preconditioner for the Helmholtz equation is slower to converge for large wave numbers. This can be explained by the occurrence of and gradual increase (with respect to wavenumber) in small eigenvalues of the preconditioned systems. In this talk, deflation is introduced where deflation of these small eigenvalues is performed by multigrid vectors. These vectors are constructed by the standard coarsening of a uniform mesh. Two various algorithms are implemented. The first variant deflates the preconditioned operator and requires some form of approximation to become computationally viable. The second variant deflates the original Helmholtz operator and can be applied directly. The extension of both algorithms to multiples levels of coarsening requires the deployment of a Krylov subspace iterations on each level. This gives raise to so-called multilevel Krylov algorithms. A Rigorous Fourier analysis confirms that the use of deflation results in a tighter cluster of eigenvalues that assures faster convergence of the outer Krylov iteration. Numerical results give evidence of a speedup of the computations between five and fifteen depending on problem size. Problems that were previously too large can now instead be solved.

Douglas Singleton **California State University, Fresno, USA**

Connecting horizon pixels and interior voxels of a black hole

Abstract: In this talk we discuss to what extent one can infer details of the interior structure of a black hole based on its horizon. Recalling that black hole thermal properties are connected to the non-classical nature of gravity, we circumvent the restrictions of the no hair theorem by postulate that the black hole interior is singularity free due to violations of the usual energy conditions. Further these conditions allows one to establish a one-to-one, holographic projection between Planckian areal "bits" on the horizon and "voxels", representing the gravitational degrees of freedom in the black hole interior. We illustrate the repercussions of this idea by discussing an example of the black hole interior consisting of a de Sitter core postulated to arise from the local graviton quantum vacuum energy. It is

shown that the black hole entropy can emerge as the statistical entropy of a gas of voxels.

Samia Siddiqui **University of Sindh, Jamshoro**

Eco-friendly synthesis and characterization of bimetallic core-shell nanoparticles (Au-Ag)

Abstract: Bimetallic nanoparticles (BMNPs) are receiving much attention due to their distinctive properties which are different from corresponding monometallic NPs. It is well known that the addition of a second metallic component enhances the activity, selectivity and stability of a pure monometallic catalyst [1]. For some metals, such as Cu, Ag, Au, and the alkali metals, the frequency of the plasmon resonance lies within the visible range, and this is the reason why colloidal dispersions of those metals display intense and beautiful colors. When two different metals are contained within a single nanoparticle, the resulting optical properties arise from a combined contribution of both metals, and the distribution of the metal atoms within the particle is of fundamental importance [2]. The fabrication of novel gold core silver-coated bimetallic NPs was achieved by one-pot synthetic approach at ambient conditions. The synthesis of core-shell Au-Ag BMNPs was achieved by using l-cysteine for the first time as a reducing and capping agent. The synthesized BMNPs demonstrate surface plasmon band at 493 nm. Characterization of BMNPs was carried out using UV-visible spectroscopy under the optimized conditions. FTIR characterization studies evident the interaction of the reducing agent with the BMNPs. Surface morphology of the synthesized nanoparticles is investigated by Atomic force microscopy AFM that indicated the average height of nanoparticles around 77.0±2 nm. Crystal structure of Au-Ag BMNPs was investigated by X-Ray diffraction. The synthesized BMNPs will be employed for the fabrication of an electrochemical sensor.

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2.B. Rodrı´guez-Gonza´lez, A. Sa´nchez-Iglesias, M. Giersig and L. M. Liz-Marza´n, The Royal Society of Chemistry, 125, 133, (2004).

Tallat Sohail **Air University, Islamabad**

Development of noval genetic algorithm to solve first & second order initial value problems

Muhammad Tahir **University of Sargodha, Sargodha**

Tuning thermoelectric properties of topological insulators

Muhammad Usman **National University of Science and Technology, Islamabad**

Dark energy via multi-Higgs doublet models: accelerated expansion of the Universe in inert doublet model scenario

Ihsan Ullah **Quaid-i-Azam University, Islamabad**

Optical Properties of topological Insulator thin films

Roman Ullah **Bacha Khan University, Charsadda**

Mathematical Modeling of Some Infectious Diseases

Abdul Wahab **COMSATS Institute of Information Technology, Wah Cantt.**

Inverse electromagnetic scattering through shape derivatives

Abstract: In this talk, the inverse problem of identifying the location of a small electromagnetic inclusion in a homogeneous isotropic background medium from boundary wave field measurements is considered. The case of full Maxwell equations is entertained. The crux of the work is rigorous mathematical analysis of the detection algorithm based on shape derivative of a filtered L^2-cost functional wherein the filter is defined in terms of a *Neumann-Poincaré* type boundary integral operator.

The concept of shape derivatives, initially proposed for shape optimization, has been recently applied to inverse scattering [1, 2] in the context of biomedical imaging and non-destructive testing. A trial inclusion is created in the background medium (inclusion free medium) at a given search location and the boundary data relative to fictitious inclusion is fitted. Then, a discrepancy functional is constructed. The search points that minimize the discrepancy between measured data and the fitted data are then sought. In order to find its minima, the misfit is expanded using the asymptotic expansions due to the perturbation of the displacement field in the presence of an inclusion versus its characteristic size. The Frechét derivative of the misfit is calculated which synthesizes its sensitivity relative to the insertion of an inclusion at a particular search location. The point at which shape derivative attains its maximum is the potential candidate of true location of the inclusion. In this work, we briefly discuss issues related to resolution and stability of these algorithms and justify the identification paradigm in different imaging scenarios.

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for a topological derivative based imaging functional, SIAM Journal on Control and Optimization, 50: (2012), pp. 48-76.

Muhammad Abdul Wasay **University of Agriculture, Faisalabad**

Spectrum of supersymmetric and bosonic open 2-brane

Abstract: We consider both the supersymmetric open 2-brane and bosonic open 2-brane, their quantization and spectrum, under the flat metric condition. The supersymmetric spectrum turns out to be discrete, while the spectrum of purely bosonic open 2-brane is shown to be devoid of any massless states.

Abdullah Yar **Kohat University of Science & Technology, Kohat**

Radiation assisted transport in two-dimensional electron gas

Aydın Yıldırım **Akdeniz University, Antalya, Turkey**

Geodesics of some pp-wave spacetimes in polar coordinates

Abstract: In this study, we shall try to solve geodesic equations for pp-wave spacetimes, which are a class of gravitational waves. For this purpose, the Noether gauge symmetries for some classes of pp-waves in polar coordinates are presented. Using these symmetries, the first integrals or in other words Noether constants related to these symmetries are calculated. Finally, with Noether constants, geodesic equations of these classes are integrated.

Azka Younas **National University of Sciences and Technology, Islamabad**

Strong gravitational lensing by Kiselev black hole

Abstract: We investigate the gravitational lensing scenario due to Schwarzschild-like black hole surrounded by quintessence (Kiselev black hole). We work for the special case of Kiselev black hole where we take the state parameter w_q=-2/3. For the detailed derivation and analysis of the bending angle involved in the deflection of light, we discuss three special cases of Kiselev black hole: nonextreme, extreme and naked singularity. We also calculate the approximate bending angle and compare it with exact bending angle. We found the relation of bending angles in the decreasing order as: naked singularity, extreme kiselev black hole, nonextreme kiselev black hole and Schwarzschild black hole. In the weak field approximation, we compute the position and total magnification of relativistic images as well.

Zeeshan Yousaf **University of the Punjab, Lahore**

Causes of inhomogeneous energy density in relativistic fluids with f (R) background

Abstract: In this talk, we study the stability of regular energy density in relativistic stellar interior. We explore various factors involved in the appearance of density irregularities for non-dissipative and dissipative fluid distributions.

Ahsan Zeb **National centre for physics, Islamabad**

Topological polaritons

Muhammad Zubair **COMSATS Institute of Information Technology, Lahore**

Cosmological reconstruction in f (R, T) theory of gravity

Abstract: We study the cosmological reconstruction of f (*R, T*) gravity (where R and T denote the Ricci scalar and trace of the energy–momentum tensor respectively) corresponding to the evolution background in FRW universe. It is shown that any cosmological evolution including ∧ cold dark matter, phantom or non-phantom eras and possible phase transition from decelerating to accelerating can be reproduced in this theory. We propose some specific forms of Lagrangian in the perspective of de Sitter and power law expansion history. Finally, we formulate the perturbed evolution equations and analyze the stability of some important solutions.