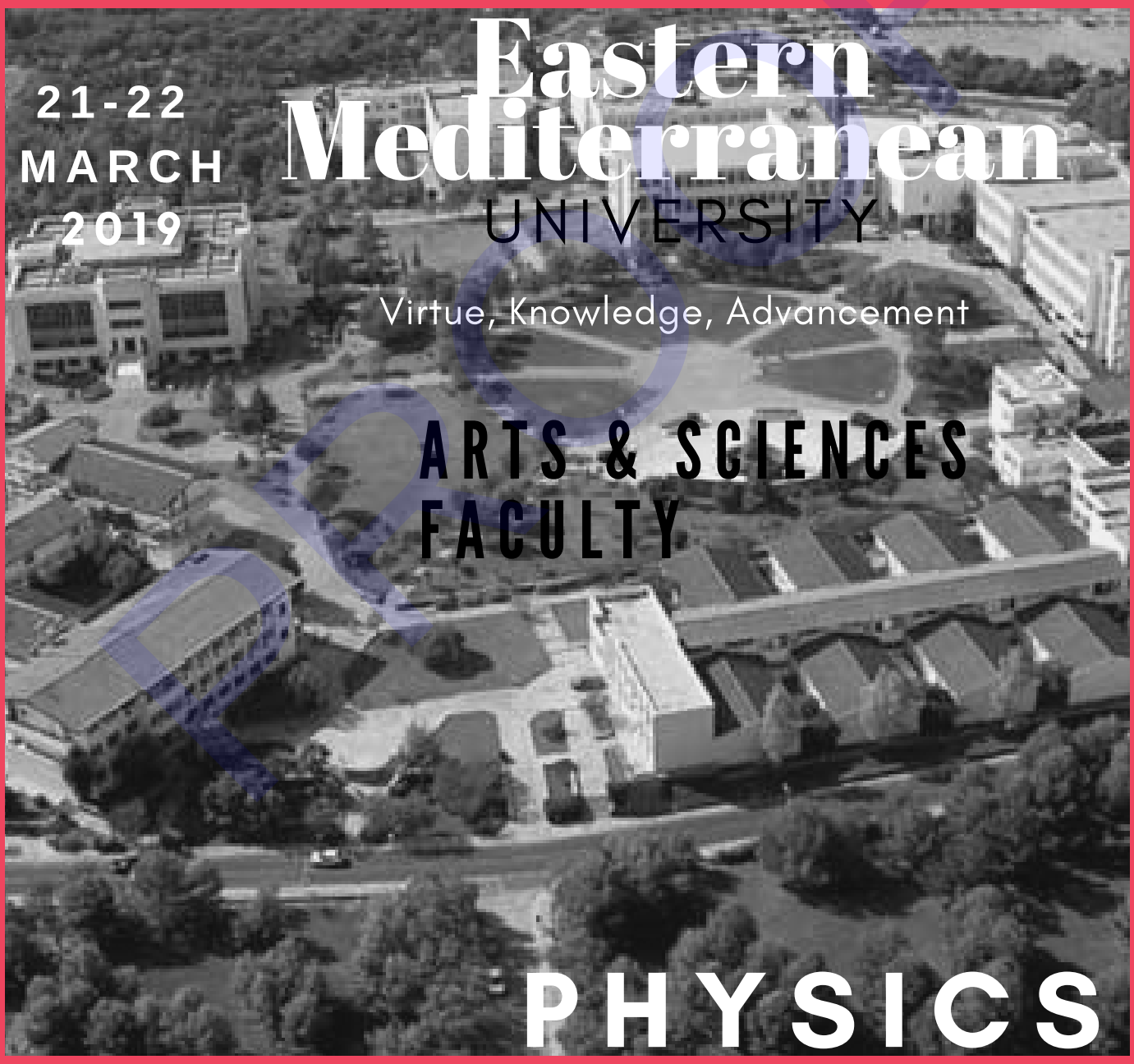
2nd EMU PHYSICS DAYS

Abstracts

2019



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department

Doğu Akdeniz Üniversitesi
"Erdem, Bilgi, Gelişim"

Eastern Mediterranean University
"Virtue, Knowledge, Advancement"

Book of Abstracts

2nd EMU PHYSICS DAYS MEETING

Department of Physics and Chemistry

Faculty of Arts and Sciences

Eastern Mediterranean University

Famagusta, Northern Cyprus

March 21-22, 2019

THE WORLD UNIVERSITY RANKINGS 2018 TOP 800

QS STARS RATED FOR EXCELLENCE 2017 TEACHING

QS STARS RATED FOR EXCELLENCE 2017 FACILITIES

QS STARS RATED FOR EXCELLENCE 2017 INCLUSIVENESS

QS STARS RATED FOR EXCELLENCE 2017 INTERNATIONALIZATION

2ND EMU PHYSICS DAYS – PROGRAM FLOW

	March 21, 2019 THURSDAY		March 22, 2019 FRIDAY
10:00-10:15	**Opening Speeches**		
	FIRST SESSION		**FIRST SESSION**
10:15-11:00	Vahid Karimipour (Sharif University of Technology) "Quantum simulation of physical systems"	09:45-10:30	Can Kozcaz (Boğaziçi Univ.): " Understanding gauge theories from string theory "
11:00-11:45	Alikram Nuhbalaoğlu Aliev (Tübitak) "Superradiance and Black Hole Bomb: Profiling the Invisible"	10:30-11:15	Vahid Karimipour (Sharif University of Technology): "Topological Quantum Computing"
		11:15-11:45	Mehmet E. Özel (FSMV Univ.): "Biospheric Energization and Origin of Life : Çanakkale "ABD" Model"
11:45-12:00	**Coffee Break**	11:45-12:00	**Coffee Break**
	SECOND SESSION		**SECOND SESSION**
12:00-12:30	Mustafa Halilsoy (Eastern Mediterranean Univ.):"Einstein-Rosen Gravitational Waves"	12:00-12:30	Aysel Karafistan (Kyrenia Univ.): "Structure and Stability of primordial stars"
12:30-13:00	Özlem Yeşiltaş (Gazi Univ.): "Higher Order Supersymmetric Models in Quantum Mechanics "	12:30-13:00	Osman Adıgüzel (Fırat Univ.): "Lattice Reactions and Physical Basis of Phase Transformations in Shape Memory Alloys"
13:00-14:00	**LUNCH**	13:00-14:00	**LUNCH**
	THIRD SESSION		**THIRD SESSION**
14:00-14:30	Hüseyin Çakallı (Maltepe Univ.): "Up continuity of real functions"	14:00-14:30	Sıddık İçli (Solar Energy Institute, Ege Univ.): "Photosynthesis: Miracle of Organic Life and Its Technologies"
14:30-15:00	Ahmad Al-Badawi (Al-Hussein Bin Talal Univ.): " Comparing geodesics equations between Schwarzschild black hole and Schwarzschild immersed in homogeneous electrostatic field "	14:30-15:00	Razieh Morad (Boğaziçi Univ.): "Jets of light hadrons via AdS/CFT correspondence"
15:00-15:30	Tahsin Çağrı Şişman (Turkish Aeronautical Association Univ.): "Kerr-Schild-Kundt metrics"	15:00-15:30	Özay Gürtuğ (Maltepe Univ.): "Quantum Resolution of Time-Like Curvature Singularities"
15:30-15:45	**Coffee Break & Poster Presentation**	15:30-15:45	**Coffee Break & Poster Presentation**
	FOURTH SESSION		**FOURTH SESSION**
15:45-16:10	Çetin Şentürk (Turkish Aeronautical Association Univ.): "A Modified Theory of Gravity: Null Aether"	15:45-16:10	Yenal Öğmen "Cypriot Astronomer": "Dwarf Novae: A class of Cataclysmic Variables"
16:10-16:35	Ali Övgün (Eastern Mediterranean Univ.): "Light Deflection by Blackholes/Wormholes Using Gauss-Bonnet Theorem"	16:10-16:35	Danial Forghani (Eastern Mediterranean Univ.): "On Thinshell Wormholes"
16:35-17:00	Ercan Kılıçarslan (Uşak Univ.): "Weak field limit of infinite Derivative Gravity"	16:35-17:00	Yashmitha Kumaran (Sussex Univ. & Eastern Mediterranean Univ.): "Production of Gravitational Waves in The Early Universe From First-Order Phase Transitions"
17:00-17:25	Mehmet Ali Olpak (Turkish Aeronautical Association Univ.): "Calculating covariant expressions for Dirac bilinears"	17:10-17:35	Huriye Gürsel (Eastern Mediterranean Univ.): "AdS/CMT Correspondence for Black Holes with Dynamic Critical Exponent"
17:25-17:50	Halil Mutuk (On Dokuz Mayıs Univ.): "Artificial Neural Network Applications in Quantum Mechanics"	17:10-17:30	Niloufar Abtahi (Eastern Mediterranean Univ.): "Dynamics of Flexoelectric fluid membrane"
	Mass Photo Shooting	17:30-17:50	Eren Erberk Erkul (GMTMK): "Theory of Photonical Gravity and Considerations of String Theory's Extra Dimensions and Its Implications"
		17:50	**Closing Speeches**

Poster Presentation

Tomotaka Kitamura (Waseda University, Japan): " Tree-Level Unitarity and Renormalizability in Lifshitz Scalar Theory" *in collaboration with* ***Toshiaki Fujimori, Takeo Inami, and Keisuke Izumi***

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March 21, 2019 THURSDAY

FIRST SESSION

10:15-11:00

Quantum Simulation of Quantum Systems

Vahid Karimipour

Sharif University of Technology, Iran & ICTP, Italy

Abstract:

We will discuss why quantum systems cannot be simulated by classical computers, no matter how fast they are and then present an introduction to the concept of quantum simulation of different physical systems. As examples, we sketch the main ideas for simulating the dynamics of quantum particles, spin systems and quantum fields.

11:00-11:45

Superradiance and Black Hole Bomb: Profiling the Invisible

Alikram Nuhbalaoğlu Aliev

TÜBİTAK Research Institute for Fundamental Sciences, Turkey

Abstract:

Black holes play a profound role in the fundamental description of nature. They occupy a central place in all theories of gravity formulated in various spacetime dimensions, shedding light into their mathematical structures and physical consequences. Astronomical observations point to the existence of black holes in X-binary systems and at the centers of most galaxies, including our Milky Way Galaxy. The merger of black holes in a binary system turned out to be the source for the first direct detection of gravitational waves, thus opening a new window into the Universe. In this talk, I will begin with a brief overview of developments, which led to relativity theories and the black hole idea. Then, I will discuss one of the distinguished phenomena in black hole physics, namely the superradiance and black hole bomb mechanism in all spacetime dimensions.

SECOND SESSION

12:00-12:30

Einstein-Rosen Gravitational Waves

Mustafa Halilsoy

Eastern Mediterranean University, North Cyprus

Abstract:

These waves were given first by Einstein and Rosen in 1937 (J. Franklin Institute, Vol. 223, p. 43). A vibrating cylindrical source emits cylindrical gravitational waves, like cylindrical electromagnetic waves. The reality of these waves was studied long ago be Weber and Wheeler (RMP. 29,509(1957)). These were linearly polarized, so they had to be generalized to cover the second polarization as well. This means there is an ellipse of polarization in the plane of $z\varphi$ in the cylindrical coordinates (t, ρ, z, φ). An asymptotic solution was discussed by Piran and Safier (Nature, (London) 318, 271 (1985)). An exact monochromatic solution covering both polarization components were given in 1988 (NC, 102B,563) and PRD 1990 (42,437).

12:30-13:00

Higher Order Supersymmetric Models in Quantum Mechanics

Özlem Yeşiltaş

Gazi University, Turkey

Abstract:

We study an extended version of the supersymmetry (SUSY) formalism using the second, third and higher order differential operators. By means of the Darboux transformations and their aspects, we may generate partner systems with their spectral design and modifications.

14:00-14:30

Up Continuity of Real Functions

Hüseyin Çakallı

Maltepe University, Turkey

Abstract:

We introduce and investigate the concepts of *up continuity* and *up compactness*. A real valued function f on a subset E of $\mathbb{R}$, the set of real numbers is up continuous if it preserves upward half Cauchy sequences, i.e. the sequence $(f(\alpha_n))$ is upward half Cauchy whenever (α_n) is an upward half Cauchy sequence of points in E; and a subset E of $\mathbb{R}$ is called *up compact*, if any sequence of points in E has an upward half Cauchy subsequence, where a sequence (α_k) of points in $\mathbb{R}$ is called upward half Cauchy if for every $\varepsilon > 0$ there exists an $n_0 \in \mathbb{N}$ such that $\alpha_n - \alpha_m < \varepsilon$ for $m \geq n \geq n_0$. It turns out that the set of up continuous functions is a proper subset of the set of continuous functions.

Keywords: Sequences, series, summability, continuity.

References

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14:30-15:00

Comparing Geodesics Equations Between Schwarzschild Black Hole and Schwarzschild Immersed in Homogeneous Electrostatic Field

Ahmad Al-Badawi

Al-Hussein Bin Talal University, Jordan

Abstract:

In this talk, we consider a solution of the Einstein-Maxwell field equations. This solution represents an external gravitational and electrostatic field outside an uncharged nonrotating mass. The background spacetime is nothing but the Berttoti-Robinson universe. We will consider the geodesics of this solution and make a detail comparison with Schwarzschild black hole. The influence of this specific background on the geodesic equations is investigated.

15:00-15:30

Kerr-Schild-Kundt metrics

Tahsin Çağrı Şişman

Turkish Aeronautical Association University, Turkey

Abstract:

In this talk, I will present some recent results that we obtained for the solutions of higher derivative gravity theories. First, I will discuss that the Kerr-Schild metrics belonging to the Kundt class yield a remarkable simplification in the field equations of the most general metric-based higher derivative gravity. This simplification indicates that the Kerr-Schild--Kundt (KSK) metrics solving Einstein's gravity and quadratic curvature gravity are also solutions of the generic gravity theory. Until recently, AdS-plane and AdS-spherical wave solutions were the only explicitly known metrics belonging to the KSK class and there was no prescription for generating these solutions. However, very recently, we provided a solution-generation technique in which curves on a (d-1)-dimensional Minkowski spacetime or Euclidean space are used to generate d-dimensional KSK spacetimes. With this technique, we generated a new member for KSK class, that is the dS-hyperbolic wave solutions. Lastly, I will discuss the implications of these results for a particular higher curvature gravity which is defined with a Born-Infeld type determinantal action and has a unitary spin-2 graviton spectrum around its unique viable AdS vacuum. Specifically, I will give the (A)dS wave solutions of this Born-Infeld gravity without a need for further calculations.

15:45-16:10

AModified Theory of Gravity: Null Aether

Metin Gürses and Çetin Şentürk*

Bilkent University, Turkey

Abstract:

General quantum gravity arguments predict that Lorentz symmetry might not hold exactly in nature. This has motivated much interest in Lorentz breaking gravity theories recently. Among such models are vector-tensor theories with preferred direction established at every point of spacetime by a fixed-norm vector field. The dynamical vector field defined in this way is referred to as the "aether." In this paper, we put forward the idea of a *null* aether field and introduce, for the first time, the Null Aether Theory (NAT)–a vector-tensor theory. We first study the Newtonian limit of this theory and then construct exact spherically symmetric black hole solutions in the theory in four dimensions, which contain Vaidya-type non-static solutions and static Schwarzschild-(A)dS type solutions, Reissner-Nordström-(A)dS type solutions and solutions of conformal gravity as special cases. Afterwards, we study the cosmological solutions in NAT: We find some exact solutions with perfect fluid distribution for spatially flat FLRW metric and null aether propagating along the x direction. We observe that there are solutions in which the universe has big-bang singularity and null field diminishes asymptotically. We also study exact gravitational wave solutions–AdS-plane waves and *pp*-waves–in this theory in any dimension $D \geq 3$. Assuming the Kerr-Schild-Kundt class of metrics for such solutions, we show that the full field equations of the theory are reduced to two, in general coupled, differential equations when the background metric assumes the maximally symmetric form. The main conclusion of these computations is that the spin-0 aether field acquires a "mass" determined by the cosmological constant of the background spacetime and the Lagrange multiplier given in the theory.

16:10-16:35

Light Deflection by Blackholes/Wormholes Using Gauss-Bonnet Theorem

Ali Övgün

Eastern Mediterranean University, Turkey

Abstract:

Gravitational lensing is a thriving research field at the interface of astrophysics and theoretical physics. In this talk, I will discuss the deflection of light by blackholes/wormholes. We perform our analysis through optical geometry using the Gibbons-Werner method by adopting the Gauss-Bonnet theorem, which offers a global perspective of lensing different from the usual treatment. We report an interesting result for the deflection angle in leading-order terms.

References

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16:35-17:00

Weak Field Limit of Infinite Derivative Gravity

Ercan Kılıçarslan

Uşak University, Turkey

Abstract:

A form of infinite derivative gravity is free from ghostlike instabilities with improved small scale behavior. In this theory, we calculate the tree-level scattering amplitude and the corresponding weak field potential energy between two localized covariantly conserved spinning point-like sources that also have velocities and orbital motion. We show that the spin-spin and spin-orbit interactions take the same form as in Einstein's gravity at large separations, whereas at small separations, the results are different. We find that not only the usual Newtonian potential energy but also the spin-spin and spin-orbit interaction terms in the potential energy are nonsingular as one approaches $r \rightarrow 0$.

References

[1] E. Kilicarslan, Phys. Rev. D 98, 064048 (2018).

17:00-17:25

Calculating Covariant Expressions for Dirac Bilinears

Mehmet Ali Olpak

Turkish Aeronautical Association, Turkey

Abstract:

Bilinear expressions of Dirac spinors involving different momentum arguments appear frequently in quantum field theory problems. Such expressions are generally calculated in specified reference frames and referring to specified representations in practice. However, covariant expressions of these objects may also be needed in certain contexts, for example in hadronic physics in relation to calculating hadronic wave functions. This talk addresses this problem by stating the relations between Dirac bilinears and relevant Lorentz structures, and by identifying the path along which one can arrive at covariant expressions for the bilinears involving different momentum arguments.

The talk is based on the ongoing studies on the problem with Prof. Dr. Altuğ Özpineci (Middle East Technical University, Dept. of Physics, Ankara, Turkey).

17:25-17:50

Artificial Neural Network Applications in Quantum Mechanics

Halil Mutuk

On Dokuz Mayıs University, Turkey

Abstract:

Applications of the machine learning mechanisms to high energy physics problems has gained a popularity in recent years. The machine learning mechanism can pave the way for solving higher-dimensional and more complex problems. Artificial Neural Networks (ANNs) are being used in these machine learning systems. Besides that, they have a wide range of use: classifying, prediction, image processing, etc. In this talk, I will talk about the brief history of ANNs and give some examples for solving differential equations. I will also give some examples about quantum mechanical problems, such as solving Schrödinger and Dirac equations via ANNs.

FIRST SESSION

09:45-10:30

Understanding Gauge Theories From String Theory

Can Kozcaz

Boğaziçi University, Turkey

Abstract:

Supersymmetric gauge theories can be embedded and studied in string theory using various constructions. In this talk, I will present geometric engineering and describe how topological string theory and topological vertex can be used to determine the so-called prepotential and BPS content of the theory.

10:30-11:15

Introduction to Topological Quantum Computation

Vahid Karimipour

Sharif University of Technology, Iran & ICTP, Italy

Abstract:

Quantum computers store and process information in quantum states. However, quantum states are extremely fragile and can be destroyed in various ways. Topological quantum computation is a scheme in which due to topological properties, no error occurs at all. Topological quantum computation is intimately connected to the concept of topological order which is the central idea behind new phases of matter. In this talk, we will present an introduction to these ideas.

11:15-11:45

Biospheric Energization and Origin of Life: Çanakkale "ABD" Model

Mehmet E. Özel *ÇOMÜ Astrobiology Group (*)*

FSMVÜ, Turkey

Abstract:

A model about the origin of life we refer to as "Molecular ABC Model" developed by Çanakkale Astrobiology Group (ÇAG) between 2005-2008, will be reviewed. Proposed model is based on an periodic re-energization process following the day-night illumination cycles of the early Earth. This cyclic energization also allows an auto-catalytic fine tuning, so that, suitable early atmospheric and climatic conditions makes it possible to evolve, from very simple beginnings, into a highly complex and exponentially responsive biosphere. The net growth factor of, so called, "the chemical (organic) potential energy" of the biosphere is very small but continuous since its very beginnings, accumulating its present-day value of biospheric mass, dead and alive. Although net growth factor is very small, it is stable and continuous. Auto-catalytic processes involved give a fractal character to its development, allowing an observable repeatability. This property also allows the observability of some of the cyclic properties, opening a window of opportunity for the interpretation of possible signs of life-like processes, in the atmospheres of exoplanets.

(*) ÇAG: Mehmet Emin Özel (ÇOMÜ, e-**. FSMVÜ, İstanbul), Edwin Budding (ÇOMÜ, e-** and Charter Observatory, New Zealand), Osman Demircan (ÇOMÜ, e-**), Cüneyt Akı (ÇOMÜ), Güngör Gündüz (METU, Ankara), Bülend Gündüz (AİBÜ, Bolu).

(**) Professor emetritus

12:00-12:30

Structure and Stability of Primordial Stars

Aysel Karafistan

Kyrenia University, North Cyprus

Abstract:

For decades large-scale cosmic structures have being modelled as the gravitational amplification of small density perturbations of the cosmological recombination epoch of the Big Bang. In astrophysics, cosmological nucleosynthesis is considered responsible for the production of the pristine gas, which should be found in the first-generation stars in the form of hydrogen and helium as the main constituents. In the later type of second-generation stars, hydrogen is converted into helium by the CN-cycle reactions, in which heavier elements are produced. These elements are believed to enrich the intergalactic medium by possible star bursts at the last stages of evolution. Stability criteria in the stellar evolutionary models pointed that first-generation stars should be massive and live long enough for the nucleosynthesis of the natural elements, heavier than hydrogen and helium. Initially, they were expected to be very faint and blue to be observed spectroscopically. Nowadays, more and more metal deficient star observations, made possible by the new era space telescopes, are interpreted as the discovery of a primordial footprint of the initially pure gas. These new data are combined with the astrophysical models, to review the predictability, mass, chemical composition with regard to stability and existence of the first-generation stars.

12:30-13:00

Lattice Reactions and Physical Basis of Phase Transformations in Shape Memory Alloys

Osman Adgüzel

Fırat University, Turkey

Abstract:

A series of alloy systems take place in a class of adaptive structural materials called smart materials by giving stimulus response to changes in the external conditions. Shape memory alloys take place in this group by exhibiting a peculiar property called shape memory effect. These alloys have ability to recover original and deformed shapes on heating and cooling after first cooling and deformation processes. Shape memory effect is facilitated by successive crystallographic transformations by which crystalline structure of the material change. These transformations are thermal and stress induced martensitic transformations and governed by two lattice reactions, lattice twinning and detwinning. Thermal induced martensitic transformations occur thermally as lattice twinning by means of lattice invariant shear on cooling, and the twinned martensite structures turn into detwinned structures by means of strain induced martensitic transformation by straining the material plastically in martensitic condition. The strain energy is stored in the material by deformation and released on heating over austenite finish temperature recovering the original shape, and material cycles between the deformed and original shapes on cooling and heating in reversible shape memory effect. Thermal induced martensitic transformations occur

with cooperative movement of atoms in <110 > -type directions by means of lattice invariant shears on {110} - type planes of austenite matrix which is basal plane of martensite.

Shape memory alloys exhibit another property called superelasticity, for which material is deformed at a constant temperature in parent phase region and recover original shape upon releasing, like standard elastic materials. Superelasticity is the result of stress-induced martensitic transformation, with which ordered parent phase structures turn into the detwinned structure and performed in non-linear way. Loading and unloading paths are different, and cycling loop reveals energy dissipation. It is well known that twinning and detwinning play a considerable role in shape memory effect and superelasticity.

Copper based alloys exhibit this property in metastable β-phase region, which has bcc-based structures at high temperature parent phase field, and these structures martensitically turn into layered complex structures with lattice twinning process on cooling. Lattice invariant shear is not uniform in copper-based shape memory alloys, and these types of shears gives rise to the formation of layered structures, like 3R, 9R or 18R depending on the stacking sequences on the close-packed planes of the ordered lattice. Periodicity and unit cell is completed through 18 layers in case of 18R martensite.

In the present contribution, x-ray diffraction and transmission electron microscopy (TEM) studies were carried out on two copper based CuZnAl and CuAlMn alloys.

X-ray diffraction profiles and electron diffraction patterns reveal that both alloys exhibit super lattice reflections inherited from parent phase due to the displacive character of martensitic transformation. Specimens of these alloys were aged at room temperature for along term, and x-ray diffractograms taken during ageing show that diffraction angles and peak intensities changed. This result refers to redistribution of atoms in diffusive manner.

THIRD SESSION

14:00-14:30

Photosynthesis: Miracle of Organic Life and Its Technologies

Sıddık İçli

Solar Energy Institute, Ege, Turkey

Abstract:

The photochemical reaction of carbon dioxide, nitrogen and water in at our atmosphere, production of amino acids, following protein molecular structures, finally creation of micro-living species, and the birth of plants, animals! These microscopic molecular structures (in rivers, lakes, seas) had given birth to moss on land, further all sorts of plants, animals and human beings, that are called as the Miracle of Universe. Human intelligence has created the Technologies simulating photosynthesis, named as Organic Photo-Electronic Technolojigies of OLED lamps, OFET transistors, OPV photovoltaics, that are now in our daily life. A distinct example is OLED-Organic LED lamps, in mobile phones, Lap-Top computers, colored TVs, and other electronics are now based on OLED technology. Advanced developments on Organic Photo Technologies, now overcome to the employment of inorganic materials of steel, iron etc. that creates huge pollution problems on Earth. The OLEDs, followed by the OPV-Organic Photo Voltaics and OFET-Organic Field Effect Transistors, with nature now entered into all of our electronic systems, capable us replace present inorganic technological systems-tools, and lower the pollution threat on our Earth.

14:30-15:00

Jets of light Hadrons via AdS/CFT Correspondence

Razieh Morad

Boğaziçi University, Turkey

Abstract:

The spectacular measurements from the Relativistic Heavy Ion Collider (RHIC) and the Large Hadron Collider (LHC) provide compelling evidence that the matter produced in heavy ion collision is a deconfined state of QCD, Quark-Gluon Plasma (QGP), at temperatures above ~160 MeV which appears to be nearly perfect, with an extremely low viscosity-to-entropy ratio $\eta/s \sim 1/4\pi$. Within this expanding fireball, jets are produced which probes the QGP. Analysis the energy loss of these energetic partons as they travel throw QGP may reveal extremely valuable information about the dynamics of the plasma and exhibit distinctive properties such as jet-quenching.

The "AdS/CFT correspondence" which imposes the duality between the gauge theory and gravity is a novel tool provides valuable insight into the strongly coupled plasma. The most important result of AdS/CFT is calculating the value of shear viscosity to entropy density ratio which is in remarkable agreement with the hydrodynamics predictions.

We study the energy loss rate of light quarks in the hot, strongly coupled plasma via the AdS/CFT. Unlike heavy quarks, light quark energy loss in AdS/CFT is surprisingly dependent on the gravity theory, the string initial conditions, and the very definition of the jet itself in the gravity theory. Jets in general thermalize very quickly in a strongly-coupled plasma, with extremely short stopping distances for jets with negative (in the particle physicists' sign convention) or very large positive virtuality.

15:00-15:30

Quantum Resolution of Time-Like Curvature Singularities

Özay Gürtuğ

Maltepe University, Turkey

Abstract:

The current status of probing time-like curvature singularities with quantum wave packets rather than point particles will be presented. Extension of the formalism to more general cases will also be addressed.

15:45-16:10

Dwarf Novae: A class of Cataclysmic Variables

Yenal Öğmen

Cypriot Astronomer, North Cyprus

Abstract:

Superoutbursts are the eruptions which are distinct to SU UMa type of dwarf novae. During a superoutburst, smaller brightenings with a period a few percent longer than the orbital period appear on the lightcurves. The origin of these superhumps is the precession of the elongated disk, driven by the resonance between the disk material and the secondary star. Precise measuring of superhump maximum and eclipse minimum time on visual light curves help us to obtain important system parameters, like the period of the precessing disk and the mass ratio.

16:10-16:35

On Thin-Shell Wormholes

S. Danial Forghani

Eastern Mediterranean University, North Cyprus

Abstract:

Wormholes spacetimes were discovered in the early decades of general relativity as exact solutions to Einstein field equations. However, they suffered from two main drawbacks: Firstly, they were not traversable, in general, and secondly, they demanded the existence of an unknown kind of matter. This so-called exotic matter does not satisfy the known energy conditions such as the weak energy condition. It took some decades until the late 1980s when Morris and Thorne addressed the first problem by systematically discussing the traversability of such wormholes and introduced a practically traversable one. Soon afterward, Visser moderated the second problem by establishing the theory of thin-shell wormholes (TSWs). This new class of traversable wormholes had this advantage that confined the exotic matter to a thin-shell, i.e. the throat of the TSW. Furthermore, applying Visser's method, called cut-and paste technique, one is able to construct TSWs out of non-wormhole spacetimes such as Minkowski, Schwarzschild, (extremal) Reissner-Nordström, and (Anti-)de Sitter ((A)dS) spacetimes. As another advantage, in mid-1990s Poisson and Visser developed a method to study the stability of such wormholes by radially disturbing their throats. This linear stability analysis soon became so popular that many articles were published in the next two decades using the same methods, with different spacetimes. The TSW studies also have found their way to higher dimensions and modified theories of gravity. However, in almost all the studies the structure of the TSWs is symmetric until very recently when this mirror symmetry was broken by assigning to the side spacetimes two geometries of a kind with different parameters (e.g. a Schwarzschild asymmetric TSW with different central masses), or two geometries of different natures (e.g. a Schwarzschild-Reissner-Nordström asymmetric TSW). In this brief, we will have an overview of the concept, construction and some properties of TSWs.

16:35-17:00

Production of Gravitational Waves in The Early Universe From First-Order Phase Transitions

Yashmitha Kumaran

Sussex University, UK & Eastern Mediterranean University, North Cyprus

Abstract:

This research is aimed at studying the first-order phase transitions (FOPTs) that is presumed to have ensued from the bubble growth in the early universe, and its consequences on the primordial gravitational waves. The FOPT resulting from bubble nucleation and coalescence is modelled as a turbulent fluid and taken as the source of the gravitational waves. Relativistic hydrodynamic equations are employed to estimate the required physical quantities such as the energy density, amplitude and frequency spectra of the relic gravitational wave background. The long-term goal of this project is to increase the possibility of the gravitational wave detection by enhancing the sensitivity of wave detectors in the future.

17:10-17:35

AdS/CMT Correspondence for Black Holes with Dynamic Critical Exponent

Huriye Gürsel

Eastern Mediterranean University, North Cyprus

Abstract:

AdS/CFT correspondence proposed by Maldacena can be referred as a radical progress through developing a unified framework consisting of string theory, general relativity, quantum field theory and condensed matter systems. It possesses the privilege of using concepts of holographic principle which plays a vital role in the latest theoretical and experimental achievements of modern physics. In particular, applying AdS/CFT correspondence to condensed matter systems can be investigated under the title referred as AdS/CMT correspondence. AdS/CMT correspondence is proposed quite recently and is regarded as a crucial and an exciting area of research in modern theoretical physics, as generalization of this correspondence leads to gauge/gravity duality, which can possibly be treated as a candidate for quantum gravity. Furthermore, there exists a great deal of experimental support for a possible mapping between strongly coupled fluids and objects of general relativity; the black holes. Lately, experimental evidence suggests that the quark–gluon plasma observed in heavy-ion collision experiments is best described by a strongly coupled relativistic fluid. From the perspective of condensed matter physics, using standard methods for such quantum systems is rather challenging; and thus many physicists have started to ask the question of whether one can achieve having a better understanding on such systems via investigating some specific black holes. Throughout this talk, it is aimed to provide information regarding the wave dynamics of a Lifshitz-like black hole with the specific case $z = 2$, and it is worthwhile to note that some black hole structures with this specific dynamic critical exponent are equivalent to systems with superconducting fluctuations. This suggests that one may obtain significant information regarding such systems and may as well use the relevant information for high temperature superconductors. The desire of attaining the condensed matter analogue of our analytic results acts as a motivation for further research and discussion, as there exists a broad range of applications of AdS/CMT correspondence in many different areas of physics.

17:10-17:30

Dynamics of Flexoelectric Fluid Membrane

Niloufar Abtahi*, Lila Bouzar, and Martin Michael Müller

Eastern Mediterranean University, North Cyprus

Abstract:

The morphology of spherically confined flexoelectric fluid membrane vesicles in an external uniform electric field is studied numerically. Due to the deformations induced by the confinement, the membrane gets polarized inducing an interaction with the external field. The equilibrium shapes of the vesicle without electric field were classified in a geometrical phase diagram as a function of scaled area and reduced volume in Ref. [1]. When the area of the membrane is only slightly larger than the area of the confining sphere, a single axisymmetric invagination can be found with a simple numerical integration scheme [1,2]. A non-vanishing electric field induces an additional elongation of the confined vesicle (which is either perpendicular or parallel depending on the sign of the electric field parameter) [3]. Higher values of surface area reduce the symmetry of the system resulting in complex folding which needs more advanced numerical treatments such as the finite elements method. We provide a detailed analysis of the resulting shapes and show how the geometrical phase diagram is altered in the presence of an electric field. The obtained folding patterns could be of interest for biophysical and technological applications alike.

References

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17:30-17:50

Theory Of Photonical Gravity and Considerations of String Theory's Extra Dimensions and Its Implications

Eren Erberk Erkul

Gazimağusa Türk Maarif College (GMTMK), North Cyprus

Abstract:

What is gravity? As easy as it sounds no mammals on this pale dusty dot came to understand it. Our quest for understanding gravity let by Isaac Newton's deterministic formulation and then was upgraded by Einstein to express more subtle conclusions of nature's hidden secrets. However, the story doesn't end here because modern physics, is also a habitat for another majestical theory, that is quantum mechanics. Quantum mechanical model and Einstein's relativistic model doesn't unite reason being that they have different approaches to physical reality. As a result of this absence of unification of macro and microworld, we are not able to

anticipate or predict areas which are both very small and highly concentrated areas like black holes and big bang. Researchers all around the world have united to formulate theories like string theory and quantum loop gravity in order to explain gravity's mysterious behaviour. I admit that they are both very beautiful theories, but they lack experimental verification and have abstract fantastical conclusions. Therefore, I think there might be a completely different approach that is just behind our noses waiting for primitive thinkers like ourselves to be painted. In the pursuit of explaining gravity's apparent behaviour and the source of gravity, the proposed hypothesis in this presentation will suggest the theory of photonical gravity which starts from symmetrical model and then arrives naturally at asymmetric model to introduce gravity as the consequence abnormalities. There will be also another attempt to introduce a new approach to string theory's additional dimensioned systems to explain the reasons why we only experience dimensions that are three space, one time instead of eleven and implications of this way of thinking.

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POSTER PRESENTATION

Tree-Level Unitarity and Renormalizability in Lifshitz Scalar Theory

Toshiaki Fujimori, Takeo Inami, Keisuke Izumi, and Tomotaka Kitamura*

Waseda University, Japan

Abstract:

We study unitarity and renormalizability in the Lifshitz scalar field theory, which is characterized by an anisotropic scaling between the space and time directions. Without the Lorentz symmetry, both the unitarity and the renormalizability conditions are modified from those in relativistic theories. We show that for renormalizability, an extended version of the power counting condition is required in addition to the conventional one. The unitarity bound for S-matrix elements also gives stronger constraints on interaction terms because of the reference frame dependence of scattering amplitudes. We prove that both unitarity and renormalizability require identical conditions as in the case of conventional relativistic theories.