Quantum Geometry, Field Theory and Gravity

Wed Sep 18, 2019

All day Arrival Day

Wed Sep 18, 2019
Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

20:15 - 23:00 Welcome Dinner

Where: Tripas Restaurant (Kinopiastes Village).
Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
map: https://drive.google.com/open?id=137MVM1GxutbVloFmTi0WMtlk9la_LY02&usp=sharing

Thu Sep 19, 2019

09:15 - 09:45 J Nishimura

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Jun Nishimura (KEK) Title: New perspectives on the emergence of (3+1)D expanding space-time in the Lorentzian type IIB matrix model Abstract: The type IIB matrix model is a conjectured nonperturbative formulation of superstring theory. In particular, the space-time does not exist a priori in this model, and it should somehow emerge dynamically. We investigate its Lorentzian version by the complex Langevin method treating the sign problem carefully unlike previous work. We report on the preliminary results, which provide new perspectives on the emergence of (3+1)D expanding space-time in this model.

09:50 - 10:20 A Tsuchiya

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Asato Tsuchiya (Shizuoka University) Title: How information geometry is encoded in bulk geometry Abstract: We study how information geometry is described by bulk geometry in the gauge/gravity correspondence. We consider a quantum information metric that measures the distance between the ground states of a CFT and a theory obtained by perturbing the CFT. Using the GKP-Witten relation, we find a universal formula that expresses the quantum information metric by a geometrical quantity in a back-reacted bulk geometry.

10:25 - 10:55 M Fukuma

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Masafumi Fukuma (Department of Physics, Kyoto University) Title: A new mechanism for the emergence of geometry from matrix models Abstract: In papers [Fukuma, Matsumoto and Umeda, arXiv 1705.06097, arXiv 1806.10915], we defined for a given stochastic system a distance between two configurations that quantifies the difficulty of the transition from one configuration to the other configuration. In this talk, we apply this idea to stochastic systems defined by matrix models, and show that this gives a novel way to define an emergent geometry from matrix models. In particular, we argue that quantum AdS blackholes emerge from stochastic unitary matrix models (such as the Gross-Witten model and the twisted Eguchi-Kawai model) with random couplings.

11:00 - 11:30 Coffee Break

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

Quantum Geometry, Field Theory and Gravity

11:30 - 12:00 C Iazeolla

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Carlo Iazeolla (G. Marconi University, Rome, Italy) Title: Singularity-resolution mechanisms in Vasiliev's higher spin gravity

12:05 - 12:35 B Dolan

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description: Speaker: Brian Dolan (Maynooth University) Title: TBA

12:40 - 13:00 S Papadoudis

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Stratos Papadoudis (National Technical University of Athens) Title: Dynamical Spacetime in the Euclidean IKKT Matrix Model: Compactification of Extra Dimensions via Spontaneous Symmetry Breaking Abstract: The IIB or the IKKT matrix model has been conjectured to be a non-perturbative definition of the type IIB superstrings. Spacetime emerges dynamically from the microscopic matrix degrees of freedom in the large-N limit and we study the scenario of dynamical compactification of extra dimensions via Spontaneous Symmetry Breaking (SSB) of the SO(10) symmetry of the Euclidean model. We employ Monte Carlo simulations using the Complex Langevin Method (CLM) because the model has a strong complex action problem. The model is deformed in order to avoid the singular drift problem in the CLM and the SSB pattern is studied as we vary the deformation parameters. By extrapolating back to the original model, we are able to conclude that the SSB pattern is consistent with previous results obtained with the Gaussian Expansion Method (GEM), predicting an SO(3) symmetric vacuum. We perform consistency checks by applying the GEM to the deformed matrix model and find that the SSB pattern is in agreement with the one obtained using the CLM.

13:10 - 16:00 Lunch

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

16:00 - 16:30 G Bergner

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Georg Bergner (TPI University of Jena) Title: Supersymmetry on the lattice and numerical simulations of supersymmetric gauge theories in four dimensions Abstract: In this talk I review the general status of numerical investigations of supersymmetric gauge theories. As a particular important example I will discuss our result on N=1 supersymmetric Yang-Mills theory. These include the bound state mass spectrum and the phase transitions of the theory. I will provide an overview of possible further directions and follow up studies based on these encouraging results.

16:35 - 17:05 F Bonechi

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Francesco Bonechi (INFN, Firenze) Title: The equivariant Batalin-Vilkovisky formalism Abstract: I will discuss an equivariant extension of the Batalin-Vilkovisky formalism for quantizing gauge theories. This general procedure encompasses several equivariantly extended models that have proven very fruitful for exact computations in quantum field theories. We will focus on the AKSZ construction of the classical master equation, that admits a straightforward equivariant extension. The main example will be topological Yang-Mills in two and four dimensions. This is based on https //arxiv.org/abs/1907.07995, joint work with A. S.Cattaneo, J.Qiu and M.Zabzine.

Quantum Geometry, Field Theory and Gravity

17:05 - 17:25 Coffee Break

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

17:40 - 18:00 F Bascone

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Francesco Bascone (Naples University Federico II & INFN) Title: Symmetries and Dualities in sigma models with Wess-Zumino term Abstract: I will focus on new aspects of Poisson-Lie symmetry in sigma models with Wess-Zumino term on group manifolds, within an alternative formalism which is based on algebra deformation.

18:05 - 18:35 F Valach

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Fridrich Valach (Charles University, Prague) Title: HigherPoisson-Lie T-duality Abstract: We present a natural extension of theframework of Courant algebroids/generalized geometry to the context ofhigher (gauge) theories, and discuss the corresponding analogues of thePoisson-Lie T-duality. The framework uses differential graded manifoldsand produces a BV description of the theories. This is a joint workwith Pavol Ševera and Ján Pulmann.

18:40 - 19:10 M Saridakis

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Manos Saridakis (NTUA) Title: The effective field theory approach to torsional geometrical modified gravities Abstract: The effective field theory (EFT) approach allows to analyze the perturbations in a systematic way and separately from the background evolution. We apply and generalize the EFT approach to torsional geometrical gravity and its modifications. We find that the effect of the additional scalar degrees of freedom is suppressed, but it is still possible to observe it at post-Newtonian experiments. Additionally, we find that the speed of gravitational waves in torsional gravity is exactly equal to the light speed, however by examining the dispersion relation we find a deviation from the results of General Relativity, quantified by a new parameter. Although its value is relatively small, its possible future measurement through the advancing gravitational-wave detection would be the smoking gun of testing this type of modified gravity.

Fri Sep 20, 2019

09:15 - 09:45 J Tekel

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Juraj Tekel (Comenius University, Bratislava) Title: Fuzzy field theories and related matrix models Abstract: Fuzzy spaces have been around for quite some time now. Importantly as various solutions and backgrounds in matrix formulations of string theory, but also as toy models for spacetimes with a nontrivial short distance structure. This modified property of the space translates into nonlocal properties of theories defined on such a space. Scalar field theories on fuzzy spaces are described by a certain kind of matrix models, with the size of the matrix regulating the extent of nonlocality. As such, these theories are accessible to analytical nonperturbative treatment and provide a unique opportunity to investigate consequences of quantum structure of spacetime. We will discuss some aspects of these matrix models and what we can learn from them about fuzzy spaces and fuzzy field theories.

Quantum Geometry, Field Theory and Gravity

09:50 - 10:20 G Gubitosi

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Giulia Gubitosi (University of Burgos) Title: Generalized noncommutative Snyder spaces and projective geometry

10:25 - 10:55 Á Ballesteros

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Ángel Ballesteros (Universidad de Burgos) Title: The kappa-(A)dS non-commutative spacetime Abstract: The (3+1)-dimensional kappa-(A)dS noncommutative spacetime is explicitly constructed by quantizing its semiclassical counterpart, which is the kappa-(A)dS Poisson homogeneous space. This turns out to be the only possible generalization o the well-known kappa-Minkowski spacetime to the case of non-vanishing cosmological constant, under the condition that the time translation generator of the corresponding quantum (A)dS algebra is primitive. Moreover, the kappa-(A)dS noncommutative spacetime is shown to have a quadratic subalgebra of local spatial coordinates whose first-order brackets in terms of the cosmological constant parameter define a quantum sphere, while the commutators between time and space coordinates preserve the same structure of the kappa-Minkowski spacetime. When expressed in ambient coordinates, the quantum kappa-(A)dS spacetime is shown to be defined as a noncommutative pseudosphere. This is a joint work with I. Gutierrez-Sagredo and F. J. Herranz.

11:00 - 11:30 Coffee Break

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

11:30 - 12:00 N Sasakura

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Naoki Sasakura (Yukawa Institute for Theoretical Physics, Kyoto University) Title: Numerical and analytical studies of a matrix model with non-pairwise contracted indices Abstract: We study a matrix model that has an N-by-R matrix as its dynamica variable, whose first indices are pairwise contracted, but latter indices are not always done so. This matrix model has a motivation from a tensor model for quantum gravity, and is also related to the physics of glasses, because it has the same form as what appears in the replica trick of the spherical p-spin model for spin glasses, though the variable and parameter ranges of our interest are different. To study the dynamics, which in general depends on N and R, we perform Monte Carlo simulations and compare with some analytical computations in the leading and the next-leading orders. A transition region has been found around R~N^2/2, which matches a relation required by the consistency of the tensor model. The simulation and the analytical computations agree well outside the transition region, but not in this region, implying that some relevant configurations are not properly included by the analytical computations. With a motivation coming from the tensor model, we also study the persistent homology of the configurations generated in the simulations, and have observed its gradual change from a circle to higher dimensional cycles with the increase of R around the transition region. This talk is based on arXiv 1907.06137 [hep-th].

Quantum Geometry, Field Theory and Gravity

12:05 - 12:35 T Matsumoto

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Takaki Matsumoto (Dublin Institute for Advanced Studies) Title: Diffeomorphisms and approximate invariants on fuzzy sphere Abstract: The matrix regularization is a regularization of the world volume theory of membranes and gives a matrix model which is expected as a nonperturbative formulation of M-theory. In the matrix regularization, area-preserving diffeomorphisms, which are the residual gauge transformations in the light-cone gauge, are replaced by unitary similarity transformations of matrices. However, we have not completely understood how general diffeomorphisms act on the matrix variables. It is important to clarify the full diffeomorphisms in the matrix model for constructing a covariant formulation of M-theory and understanding the mechanism to describe gravity in terms of matrices. For the case of the fuzzy sphere, we construct the matrix regularization in terms of the Berezin-Toeplitz quantization. By using this quantization map, we define diffeomorphisms on the space of matrices and explicitly construct the diffeomorphic configurations of the fuzzy sphere. We also propose three methods of constructing approximate invariants on the fuzzy sphere. These are exactly invariant under unitary similarity transformations and only approximately invariant (i.e. invariant in the limit of large matrix size) under general matrix diffeomorphisms.

12:40 - 13:00 M D'Arcangelo

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Mauro D'Arcangelo (University of Nottingham) Title: Random fuzzy spaces in the spectral triple formalism Abstract: The spectral triple formalism allows to treat commutative and non-commutative geometries on an equal footing. In this picture, the Standard Model is viewed as an internal non-commutative space on each point of a commutative space-time manifold. Fuzzy spaces, which are described in terms of non-commutative spectral triples, have been proposed as candidates for replacing the commutative manifold at the Planck scale, thus obtaining a theory of geometry and matter which is finite at all scales. Allowing the Dirac operator of a fuzzy spectral triple to fluctuate according to a chosen probability measure implements the idea of path integration in the space of geometries. The problem can be studied numerically by means of Markov Chain Monte Carlo integration. Results in this direction are presented for various types of fuzzy Dirac operators.

13:10 - 16:00 Lunch

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16:00 - 16:30 R de Mello Koch

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Robert de Mello Koch (South China Normal University and University of the Witwatersand) Title: Primary fields in free CFT4 Abstract: Counting formulae for general primary fields in free four dimensional conformal field theories of scalars and fermions are derived. These are used to count primaries which obey extremality conditions defined in terms of the dimensions and left or right spins (i.e. in terms of relations between the charges under the Cartan subgroup of SO(4,2)). The construction of primary fields for scalar field theory is mapped to a problem of determining multi-variable polynomials subject to a system of symmetry and differential constraints. For the extremal primaries, we give a construction in terms of holomorphic polynomial functions on permutation orbifolds.

Quantum Geometry, Field Theory and Gravity

16:35 - 17:05 S Ramgoolam

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Sanjaye Ramgoolam (Queen Mary University of London) Title: 4D conformal quantum fields from 2D topological field theories and polynomial rings. Abstract: Correlators of free four-dimensional conformal quantum fields can be constructed from two-dimensional topological field theories having SO(4,2) symmetry. The spectrum of primary fields can be efficiently described in terms of a discrete sequence of polynomial rings. These results suggest that quantum fields can be usefully viewed as emerging from symmetries and representation theory. The talk will be based on https //www.sciencedirect.com/science/article/pii/S0550321314003575 https //link.springer.com/article/10.1007%2FJHEP08%282017%29077 https //link.springer.com/article/10.1007%2FJHEP08%282018%2908

17:10 - 17:30 Coffee Break

Calendar: Quantum Geometry, Field Theory and Gravity
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17:30 - 18:00 D Anselmi

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Damiano Anselmi (Department of Physics, University of Pisa)Title: Quantum gravity from fakeons Abstract: A new quantizationprescription is able to endow quantum field theory with a new type of“particle”, the fakeon (fake particle), which mediates interactions,but cannot be observed. A massive fakeon of spin 2 (together with ascalar field) allows us to build a theory of quantum gravity that isboth renormalizable and unitary, and to some extent unique. Afterpresenting the general properties of this theory, I discuss itsclassical limit, which carries important remnants of the fakeonquantization prescription. I also discuss the possibility that theHiggs boson might be a fakeon.

18:10 - 18:30 G Giotopoulos

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Grigorios Giotopoulos (Heriot-Watt University) Title: L-infinity algebra of Einstein-Cartan-Palatini Gravity and its braided non-commutative deformation Abstract: An L-infinity algebra encoding the field content, gauge transformations, equations of motion and Noether identities of the classical theory is presented. The algebra is deformed to a braided L-infinity algebra, encoding the (braided) non commutative deformation of the theory.

18:35 - 19:05 C Saemann

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Christian Saemann (Heriot-Watt University) Title: Strong Homotopy Lie Algebras and Field Theories Abstract: I will describe how the BV-formalism maps classical field theories to strong homotopy Lie algebras and how quasi-isomorphisms between these capture field theory equivalence. This map explains in particular the recent renewed interest in strong homotopy Lie algebras. I point out the connection to higher Chern-Simons theory and finish by talking about some applications. In particular, I will show that a the Berends-Giele recursion relation for Yang-Mills theory scattering amplitudes is directly obtained and generalized to arbitrary field theories from our perspective.

Quantum Geometry, Field Theory and Gravity

19:10 - 19:30 J Gohara

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Jumpei Gohara (Tokyo University of Science) Title: Formulation of Category Including Several Noncommutative Geometries Abstract: We propose a generalization of quantization as a categorical way. For a fixed Poisson algebra quantization categories are defined as subcategories of R-module category with structure of classical limit. We construct the generalized quantization categories including Matrix regularization, strict deformation quantization, pre-quantization, and Poisson enveloping algebra, respectively. It is shown that the categories of deformation quantization, pre-quantization and Matrix regularization with some condition are categorically equivalent. On the other hand, the categories of Poisson enveloping algebra is not equivalent to the other categories.

Sat Sep 21, 2019

09:15 - 09:45 M Katanaev

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Mikhail Katanaev (Steklov Mathematical Institute) Title: Global properties of warped solutions in General Relativity with an electromagnetic field and a cosmological constant Abstract: We consider general relativity with cosmological constant minimally coupled to electromagnetic field and assume that four-dimensional space-time manifold is the warped product of two surfaces with Lorentzian and Euclidean signature metrics. Einstein's equations imply that at least one of the surfaces must be of constant curvature. It means that the symmetry of the metric arises as the consequence of equations of motion (``spontaneous symmetry emergence''). We give classification of global solutions in two cases (i) both surfaces are of constant curvature and (ii) the Riemannian surface is of constant curvature. The latter case includes spherically symmetric solutions (sphere S^2 with SO(3)-symmetry group), planar solutions (two-dimensional Euclidean space R^2 with IO(2)-symmetry group), and hyperbolic solutions (two-sheeted hyperboloid H^2 with SO(1,2)-symmetry). Totally, we get 37 topologically different solutions. There is a new one among them, which describes changing topology of space in time already at the classical level.

09:50 - 10:20 Y Asano

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Yuhma Asano (KEK) Title: Emergent Geometries from the BMN Matrix Model Abstract: An idea to formulate string theory or M-theory by a gauge theory attracts theorists and has been extensively studied. The gauge theory should be lower dimensional so that a geometry in string or M-theory, which has higher dimensions, must emerge from it. This suggests that there would be a phase transition in the gauge theory and that the geometry should appear as its temperature decreases. In this talk, I will explain things about the BMN matrix model, a gauge theory considered as a non-perturbative formulation of M-theory on the plane-wave geometry. This theory has infinitely many vacua and each of them corresponds to one of bubbling geometries in the type IIA supergravity. Gauge-theory computation showed that a certain BPS operator reproduced the geometries on the gravity side and also brane geometries in the M-brane picture. At finite temperatures, these geometries should be realised in a non-trivial way, an example of which is a phase transition regarding a black hole---the confinement/deconfinement transition. Recently, the gravity solution corresponding to the thermal BMN model around the trivial vacuum was numerically obtained so that the critical temperature of the deconfinement transition was computed. I will show recent results of Monte Carlo simulations of the gauge-theory side, which revealed two types of phase transitions, consistent with the gravity prediction.

Quantum Geometry, Field Theory and Gravity

10:25 - 10:55 A Iorio

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Alfredo Iorio (Charles University) Title:Analog hep-th, onDirac materials and in general Abstract: In the first part, I shallillustrate the work of our group at Charles University on reproducingscenarios of high energy theoretical physics on Dirac materials, like graphene. The main goal will be to explain how versatile these systemsare, and how far and wide into the hep-th territory we can explore withthem. I shall review why these materials lend themselves to theemergence of special relativistic-like matter and space. Then the focuswill be on the emergence of curvature. I shall show why the lowdimensions (2+1), and Weyl symmetry, are crucial to identify thespecific arrangements that realize a Unruh-kind of phenomenon. I shall then point to a variety of other interesting scenarios, that includethe BTZ black hole and de Sitter spacetime, and shall also brieflycomment on how far we went in the direction of experiments. I shallthen just list some fresh results from the time-loop to spot torsion,to the generalized uncertainty principle stemming from and underlying(lattice) length, from a model of grain-boundaries and their relationto (A)dS and Poincaré spacetime algebras, to Unconventional Supersymmetry and the role of the two Dirac points of graphene. Thesecond part, based on arXiv1902.07096, will be devoted to generalconsiderations on the role of analogs in contemporary research onfundamental physics. This will give me an excuse to promote the realization of a 'CERN for analogs', where theorists (both of thehep-th and of the cond-mat types) sit next to experimentalists (mostlyof the cond-mat type). I shall call this facility HELIOS, an evocativeGreek name for something that should shed light on the darkness of theunknown, and an acronym for ``High Energy Laboratory for IndirectObservationS".

11:00 - 11:30 Coffee Break

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

11:30 - 12:00 A Pachol

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Anna Pachol (Queen Mary University of London) Title: Digital Quantum Geometries Abstract: Noncommutative geometry, as the generalised notion of geometry, allows us to model the quantum gravity effects in an effective description without full knowledge of quantum gravity itself. On a curved space one must use the methods of Riemannian geometry - but in their quantum version, including quantum differentials, quantum metrics and quantum connections. After presenting the general framework, I will discuss some results on noncommutative Riemannian geometries in small dimensions, working over the field F_2 of 2 elements and with coordinate algebras up to dimension n <=3 (arXiv 1807.08492). We have found a rich moduli of examples for n=3 and top form degree 2, including 9 that are Ricci flat bu not flat. The choice of the finite field in this framework proposes a

12:05 - 12:35 F Mercati

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Flavio Mercati (University of Naples Federico II) Title: kappa-deformed special relativity Abstract: I will give an overview of the motivations and recent results of kappa-deformed special relativity. With this I mean any theory of physics on the kappa-Minkowski noncommutative spacetime that respects the relativity principle (equivalence between inertial observers), and is thereby covariant under the kappa-Poincaré group of symmetries. As an example, I will illustrate a model of free quantum scalar fields on kappa-Minkowski and extract from it informations about the causal structure of this noncommutative spacetime. My talk is based on the recent results published in arXiv:1801.01765, 1810.08134, 1811.08409 and 1909.01000.

Quantum Geometry, Field Theory and Gravity

12:40 - 13:00 M Manfredonia

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Mattia Manfredonia (Università degli Studi di Napoli FedericoII) Title:
Localization and Reference Frames in κ-Minkowski SpacetimeAbstract: We study the limits to the localizability of events andreference frames in the κ-Minkowski quantum spacetime. Our main toolwill be a representation of the κ-Minkowski commutation relationsbetween coordinates, and the operator and measurement theory borrowedfrom ordinary quantum mechanics. Spacetime coordinates are described byoperators on a Hilbert space, and a complete set of commutingobservables cannot contain the radial coordinate and time at the sametime. The transformation between the complete sets turns out to be theMellin transform, which allows us to discuss the localizabilityproperties of states both in space and time. We then discuss thetransformation rules between inertial observers, which are described bythe quantum κ-Poincaré group. These too are subject to limitations inthe localizability of states, which impose further restrictions on theability of an observer to localize events defined in a different observer's reference frame.

13:05 - 13:35 V Rivasseau

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Vincent Rivasseau (Université Paris-Sud) Title: Field Theory and Random Geometry Abstract: I ll discuss some of the problems of defining quantum fields on a quenched random geometry

13:40 - 17:30 Lunch

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

17:30 - 21:00 Boat trip

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Buses leave from the main gate of the Mon Repos Estate at 17:30 The boat (Atlantis Cruises) will depart from the Old Port (Cafe Giali) at 18:00

Sun Sep 22, 2019

09:15 - 09:45 G Fiore

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Gaetano Fiore (Università di Napoli Federico II, and INFN Napoli) Title:
Energy cutoff, noncommutativity and fuzzyness: the case of O(D)-covariant fuzzy spheres Abstract: As the example of Landau model shows, the low energy projection of a quantum theory on a commutative space(time) M may make the latter noncommutative. Moreover, if the Hamiltonian contains a very sharp confining potential on a submanifold N of M and one chooses the energy cutoff low enough to freeze transverse excitations, then one obtains an effective quantum theory on a noncommutative version of N. After reviewing the new fuzzy spheres S^d_l of dimensions d = 1,2 that we have recently constructed through this mechanism, I will present various systems of coherent states (SCS) on them and discuss the localization of these SCS both in configuration and (angular) momentum space. These models are covariant not only under rotations - as Madore's fuzzy sphere-, but under the full orthogonal group O(d+1).

Quantum Geometry, Field Theory and Gravity

09:50 - 10:20 A Borowiec

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Andrzej Borowiec (Wroclaw University) Title: Hopf-algebraic structure of quantum phase space

10:25 - 10:55 A Doikou

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Anastasia Doikou (Heriot-Watt University) Title: Discrete quantum systems & stochastics Abstract: We explore various connections between the theories of stochastic analysis and discrete quantum mechanical systems. We employ the notion of the quantum canonical transformation to simplify the form of the generic multi-particle quantum Hamiltonian with dynamical diffusion coefficients. We then study the time evolution problem of the generic multi-particle Hamiltonian via the path integral formulation. A precise computation of the path integral leads to a universal expression for the associated measure regardless of the form of the diffusion coefficients and drift. A basic example of quantum integrable system, the discrete non-linear Schrodinger hierarchy, is presented providing specific connections between quantum systems and stochastic differential equations (SDEs). The continuum limit of the SDEs for the first two members of the DNLS hierarchy turn out to be the stochastic transport and the stochastic heat equations respectively.

11:00 - 11:30 Coffee Break

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

11:30 - 12:00 A Deser

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Andreas Deser (Charles University Prague) Title: On Torsion and Curvature in Courant Algebroids Abstract: Using the definition of a connection in a graded vector bundle over a differential graded manifold, we are able to define the notion of curvature of a graded vector bundle as well as torsion. Specifying to the case of degree two differential graded manifolds, we get an intrinsically graded geometric definition of Courant algebroid curvature and torsion, which correctly reduce to their Lie algebroid versions on Dirac structures, if compatibility of the connection with the Dirac structure is imposed. Using an auxiliary connection on the underlying body manifold, we relate these notions to standard tensors and compute the corresponding Ricci and scalar curvature.

12:05 - 12:35 J Vysoky

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Jan Vysoky (Czech Technical University) Title: Courant algebroid morphisms revisited Abstract: In recent years, Courant algebroids had become a geometrical useful tool in string theory. As for any mathematical structure, one naturally attempts to establish the notion of Courant algebroid morphism. Although this was done twenty years ago, the most general definition remains relatively unknown. Similarly to the category of symplectic manifolds, the space of morphisms is not large enough. Based on the Weinstein's idea of symplectic "category" and its Lagrangian relations, one has to allow for a more general notion. This has its cost - not all morphisms can be composed. A generalization of this approach is presented. One can show that some relevant physical problems naturally fit into this framework, e.g. Poisson-Lie T-duality, Kaluza-Klein reduction of supergravity, or generalized geometry inclusion into para-Hermitian geometry (possible geometrical framework for DFT).

Quantum Geometry, Field Theory and Gravity

12:40 - 13:00 T Radenkovic

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Tijana Radenkovic (Institute of Physics Belgrade) Title: Higher Gauge Theories Based on 3-groups Abstract: We study the categorical generalizations of a BF theory to 2BF and 3BF theories, corresponding to 2-groups and 3-groups, in the framework of higher gauge theory. In particular, we construct the constrained 3BF actions describing the correct dynamics of Yang-Mills, Klein-Gordon, Dirac, Weyl, and Majorana fields coupled to Einstein-Cartan gravity. The action is naturally split into a topological sector and a sector with simplicity constraints, adapted to the spinfoam quantization procedure. In addition, the structure of the 3-group gives rise to a novel gauge group which specifies the spectrum of matter fields present in the theory, just like the ordinary gauge group specifies the spectrum of gauge bosons in the Yang-Mills theory. This allows us to rewrite the whole Standard Model coupled to gravity as a constrained 3BF action, facilitating the nonperturbative quantization of both gravity and matter fields. Moreover, the presence and the properties of this new gauge group open up a possibility of a nontrivial unification of all fields and a possible explanation of fermion families and all other structure in the matter spectrum of the theory.

13:10 - 16:00 Lunch

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

16:00 - 16:30 C P Martin

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Carmelo Perez Martin (Universidad Complutense de Madrid)Title: Quantum noncommutative ABJM theory Abstract: We introduce ABJMquantum field theory in the noncommutative spacetime by using thecomponent formalism and show that it is N= 6 supersymmetric. For the$U(1)_\kappa \times U(1)_{-\kappa}$ case, we compute all one-loop 1PI two and three point functions in the Landau gauge and show that they are UV finite and havewell-defined commutative limits $\theta_{\mu\nu} \to 0$, corresponding exactly to the1PI functions of the ordinary ABJM field theory. This result also holdsfor all one-loop functions which are UV finite by power counting. It seems that the noncommutative quantum ABJM field theory is free fromthe noncommutative IR instabilities.

16:35 - 17:05 N Ikeda

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Noriaki Ikeda (Ritsumeikan university) Title: Gauged sigma model with Lie algebroid symmetry and moment map Abstract: We analyze gauged nonlinear sigma models with Wess-Zumino terms in any dimension. In general, these systems have Lie algebroid symmetries. Compatibility conditions of these physical theories with Lie algebroid structures are described as geometric conditions of a momentum map on a (pre)-symplectic manifold ora (pre) -multisymplectic manifold. This is applied to analysis of T-duality in string theory and other physics such as membrane theories.

17:10 - 17:30 Coffee Break

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

Quantum Geometry, Field Theory and Gravity

17:35 - 18:05 F Besnard

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Fabien Besnard (EPF) Title: Noncommutative Geometry, background independence, and B-L extension of the Standard Model Abstract: I will present a new framework, called "algebraic backgrounds", which is a slight modification of Connes' Spectral Triples theory, and allows for a transparent representation of diffeomorphisms and spin structure equivalences. In an algebraic background, there is no fixed Dirac operator, but instead a bimodule of noncommutative 1-forms which plays the role of the differential structure of the manifold. The configuration space is the space of Dirac operators which are compatible with this bimodule. They play the role of metrics compatible with the differential structure. The tetradic version of GR can be formulated naturally in this framework. The configuration space contains extra fields, not associated with a metric, but the projection on metric fields is diffeomorphism invariant, so that they can be safely removed. The same framework adapted to the Standard Model automatically gauge the B-L symmetry. The resulting Kaluza-Klein theory contains many non-SM fields, most of them only acting on flavour space. They can be removed like in the GR case. What remains is a B-L extension of the SM, with a complex scalar breaking the new symmetry.

18:10 - 18:30 J Narozny

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Jiri Narozny (Charles University, Prague) Title: Simplicial principal bundles and higher connections

18:35 - 19:05 V Filev

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Veselin Filev (IMI BAS) Title: One Dimensional Flavoured Theories and Their Gravity Duals Abstract: I will cover different aspects of the BFSS and BMN Matrix Models and their gravity duals.

19:10 - 19:30 L H S Yu

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Lu Heng Sunny Yu (University of California (UC) Irvine) Title: Gravitational Fluctuation as an Alternative to Inflation Abstract: The ability to reproduce the cosmological matter power spectrum P(k) to high accuracy is often considered as a triumph of inflation. In this work, we explore an alternative explanation for the power spectrum based on nonperturbative quantum field-theoretical methods applied to Einstein's gravity, instead of ones based on inflation models. Both the general scaling and spectral indices can be calculated from gravitational fluctuations, without the need of additional scalar fields. The results from this fit rather well with both the cosmological matter power spectrum and the CMB angular temperature spectrum. The results we present here only assume quantum field theory and Einstein's Gravity, and hence provide a competing explanation of the power spectra, without relying on the assumptions usually associated with inflationary models. At the end, we also outline several testable predictions in this quantum gravitational picture that deviate from the conventional picture of inflation, and which hopefully will become verifiable in the near future with increasingly precise cosmological measurements.

Quantum Geometry, Field Theory and Gravity

20:00 - 23:30 Greek Night

Where: Tripas Restaurant (Kinopiastes Village).
Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
map: https://drive.google.com/open?id=137MVM1GxutbVloFmTi0WMtlk9la_LY02&usp=sharing

Mon Sep 23, 2019

09:15 - 09:45 M Hanada

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Masanori Hanada (University of Southampton/Keio University) Title: Black Hole from Colors

09:50 - 10:20 S Kovacik

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Samuel Kovacik (Dublin Institute for Advanced Studies) Title:The non-perturbative phase diagram of the bosonic BMN matrix modelAbstract: In this talk, I will discuss the bosonic version of thenotorious BMN model at finite temperature (the supersymmetric versionof this model is conjectured to describe dynamics of the M-theory onthe plane-wave background). It is also a mass deformed version of thebosonic BFSS model, with SO(9) symmetry reduced to SO(3)xSO(6). For anyfinite value of the mass parameter μ, this model undergoes two closelyseparated phase trans

10:25 - 10:55 T Krajewski

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Thomas Krajewski (CPT Marseille) Title: The SYK model and random tensors Abstract: The SYK model involves N Majorana fermions in 1+0 dimensions with quenched Gaussian disorder that proves to be exactly solvable in the large N limit at strong coupling. It has been initially proposed by Sachdev and Ye as a model of condensed matter and later gained some interest as a toy model of AdS/CFT correspondence, thanks to the work of Kitaev. On the other side, random tensors are generalisations of random matrices to objets that carry more than two indices. It turns out that the SYK model and random tensors involve a special class of Feynman graphs known as "melons". We will briefly review both constructions. Then, we will show how non Gaussian disorder can be reduced to a Gaussian one, treating the coupling as a random tensor, thanks to Gurau's Gaussian universality result. This last part is based on https //arxiv.org/abs/1812.03008.

11:00 - 11:30 Coffee Break

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

11:30 - 12:00 U Aydemir

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Ufuk Aydemir (Institute of High Energy Physics (IHEP), Beijing) Title: Black Hole Mimickers in Quadratic Gravity Abstract: In this talk, I will focus on ultracompact horizonless objects arising as a class of solutions in quadratic gravity, recently dubbed as 2-2 holes. I will review features of these objects and discuss them in the context of dark matter in similarity to primordial black holes.

Quantum Geometry, Field Theory and Gravity

12:05 - 12:35 F Scholtz

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description: Speaker: Frederik Scholtz (Stellenbosch University) Title: TBA

12:40 - 13:00 D Gocanin

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Dragoljub Gocanin (University of Belgrade, Faculty of Physics) Title:
Matter Fields in AdS Model of Noncommutative Gravity Abstract: Anti-de Sitter (AdS) group SO (2,3) reduces to Poincare group under Wigner-Inonu (WI) contraction. We also know that AdS gauge field theory, described by a geometric SO(2,3) gauge-invariant action of the Yang-Mills type, can be related to GR (with negative cosmological constant) by introducing a constrained auxiliary field and imposing a certain gauge fixing condition. WI contraction eliminates the cosmological constant and therefore changes the vacuum of the theory. We will upgrade the SO (2,3) model of pure gravity by introducing Dirac spinor field coupled to U(1) gauge field, and discuss the effects of WI contraction before and after NC deformation. Deformation quantization of classical space-time is performed by replacing ordinary commutative field multiplication by Moyal product. NC corrections are derived using the Seiberg-Witten approach to NC gauge field theory. Unlike in the case of pure NC gravity, the first non-vanishing NC correction is linear in the deformation parameter. In Minkowski space we obtain a non-standard NC Electrodynamics and discuss how space-time noncommutativity changes relativistic La

13:10 - 16:00 Lunch

Calendar: Quantum Geometry, Field Theory and Gravity
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Tue Sep 24, 2019

09:15 - 09:45 S Mignemi

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Salvatore Mignemi (Università di Cagliari) Title: Progress in Snyder
model Abstract: We review the main features of the relativistic Snyder model and its generalizations. We discuss the quantum field theory on this background using the standard formalism of noncommutaive QFT and discuss the possibility of obtaining a renormalizable theory.

09:50 - 10:20 M Arzano

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Michele Arzano (University of Naples "FedericoII") Title:Horizon
temperature without space-time Abstract: I will show how thecharacteristic thermal effects that observers experience in space-timespossessing an event horizon, emerge already in a simple quantum systemwith affine symmetry living on the real line. The derivation I willpresent is essentially group theoretic in nature a thermal stateemerges naturally when comparing different representations of the groupof affine transformations of the real line. The freedom in the choiceof different notions of translation generators is the key to the“linear” Unruh effect I will describe.

10:25 - 10:55 H S Yang

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Hyun Seok Yang (CQUeST) Title: Generalization of AdS/CFT
correspondence

Quantum Geometry, Field Theory and Gravity

11:00 - 11:30 Coffee Break

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

11:30 - 12:00 L Castellani

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Leonardo Castellani (Universita' del Piemonte Orientale andINFN Torino)
Title: Covariant hamiltonian formalism for gravity coupledto p-forms Abstract: We review the covariant canonical formalisminitiated by D'Adda, Nelson and Regge in 1985, and extend it to includea definition of form-Poisson brackets (FPB) for geometric theoriescoupled to p-forms, gauging free differential algebras. Theform-Legendre transformation and the form-Hamilton equations arederived from a d-form Lagrangian with p-form dynamical fields φ.Momenta are defined as derivatives of the Lagrangian with respect tothe "velocities" dφ and no preferred time direction is used. Actioninvariance under infinitesimal form-canonical transformations can bestudied in this framework, and a generalized Noether theorem isderived, both for global and local symmetries. We apply the formalismto vielbein gravity in d = 3 and d = 4. In the d = 3 theory we candefine form-Dirac brackets, and use an algorithmic procedure toconstruct the canonical generators for local Lorentz rotations anddiffeomorphisms. In d = 4 the canonical analysis is carried out usingFPB, since the definition of form-Dirac brackets is problematic. Lorentz generators are constructed, while diffeomorphisms are generatedby the Lie derivative. A "doubly covariant" hamiltonian formalism ispresented, allowing to maintain manifest Lorentz covariance at everystage of the Legendre transformation. The idea is to take curvatures as "velocities" in the definition of momenta.

12:05 - 12:35 J Arnlind

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Joakim Arnlind (Linköping University) Title: Homomorphisms of pseudo-Riemannian calculi and noncommutative minimial submanifolds Abstract: In this talk I will review the concept of pseudo-Riemannian calculi as a framework for noncommutative Riemannian geometry. In this setting, one can consider metric and torsion-free connections and prove that there exists at most one such ("Levi-Civita'') connection. By introducing homomorphisms of such calculi, one can discuss noncommutative embeddings and we show that there exists a theory of submanifolds much in analogy with the classical case, including second fundamental forms, the Weingarten map and Gauss' equations. Via the trace of the second fundamental form, one readily introduces the mean curvature, and the definition of a noncommutative minimal submanifold is given as an embedding with zero mean curvature. As a motivating example, we consider the noncommutative torus as a minimal surface in the noncommutative 3-sphere.

12:40 - 13:00 N Konjik

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Nikola Konjik (Faculty of Physics, University of Belgrade) Title: Noncommutative field theory from an angular twist

13:10 - 16:00 Lunch

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos

Quantum Geometry, Field Theory and Gravity

16:00 - 16:30 M Kurkov

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Maxim Kurkov (Università di Napoli Federico II, Istituto Nazionale di Fisica Nucleare) Title: Parity anomaly in four dimensions Abstract: We discuss a parity breaking in a theory of fermions, which are trapped inside a four-manifold with boundary. Even though the theory is parity-invariant at the classical level, the radiative corrections induce parity-violating gauge and gravitational Chern-Simons terms on the boundary.

16:35 - 17:05 V Dobrev

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Vladimir Dobrev (INRNE, Bulgarian Academy of Sciences) Title: Multiparameter Quantum Minkowski Space-Time and Quantum Maxwell Hierarchy Abstract: In the present talk we present the construction of deformed multiparameter analogs of some conformally invariant equations, in particular, the Maxwell equations. We present also a multiparameter quantum Minkowski space-time

17:10 - 17:30 Coffee Break

Calendar: Quantum Geometry, Field Theory and Gravity
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17:30 - 17:50 M Subjakova

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: Maria Subjakova (Comenius University, Bratislava) Title: Multitrace matrix models of fuzzy field theories Abstract: Scalar field theories on fuzzy spaces can be described as matrix models. The kinetic term in the action of such theories contributes with multitrace terms to the probability measure of the corresponding matrix model. Due to technical difficulties these multitrace terms are known only approximately. Various approximations capture different aspects of the full model, however some of the model features obtained through the numerical simulations are beyond these approximations. We will present the techniques that are used to solve the approximative models and discuss the models strengths as well as limitations in regard to obtaining the properties of fuzzy field theories.

17:55 - 18:25 B Jurco

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description: Speaker: Branislav Jurco (Charles University Prague) Title: TBA

18:30 - 18:50 G Manolakos

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos
Description:
Speaker: George Manolakos (NTUA) Title: Non-Commutative Gravity Abstract: First, we briefly review the description of gravity theories as gauge theories in three and four dimensions. Specifically, we recall the procedure in which the results of General Relativity in three and four dimensions are recovered in a gauge-theoretic approach. Also, the procedure is applied for the case of the Weyl gravity, too. Then, after reminding briefly the formulation of gauge theories on noncommutative spaces, we review our most recent works in which gravity models are constructed as gauge theories on noncommutative spaces.

Quantum Geometry, Field Theory and Gravity

Wed Sep 25, 2019

All day Departure Day

Wed Sep 25, 2019

Calendar: Quantum Geometry, Field Theory and Gravity
Created by: Konstantinos Anagnostopoulos