Corfu2022: Workshop on Noncommutative and generalized geometry in string theory, gauge theory and related physical models

SEPTEMBER 18 - SEPTEMBER 25, 2022

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Scientific Programme

Zoom: tinyurl.com/2zlqtuf3 (Meeting ID: 812 8157 1036 Passcode: 169694)

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1 Program Summary

All times are in the Eastern European Standard Time (EEST) timezone (click here to see the current EEST time).

Monday, September 19, 2022

9:00	9:45	Brandenberger, Robert	Emergent Space-Time and Early Universe Cosmology from Matrix Theory
9:45	10:30	Pateloudis, Efstratios	Studies of the D0-matrix models at low temperatures
10:30	11:15	Tsuchiya, Asato	Renormalization group and cMERA (remote)
11:15	11:45	**Coffee Break**	
11:45	12:30	Ho, Pei-Ming	UV Physics and Hawking Radiation (remote)
12:30	12:55	Battista, Emmanuele	On the propagation across the big bounce in an open quantum FLRW cosmology
13:30	16:30	**Lunch**	
16:30	17:15	Balachandran, Aiyalam	Spin 1/2 From Colour and A Little More
17:15	18:00	Vitale, Patrizia	The Jacobi sigma model
18:00	18:20	**Coffee Break**	
18:20	19:05	Schupp, Peter	Fuzzy light cones and deformed micro-causality (in cosmology)
19:05	19:30	Froeb, Markus B.	Non-commutative coordinates from quantum gravity

Tuesday, September 20, 2022

9:00	9:45	Nishimura, Jun	Quantum tunneling in the real-time path integral by the Lefschetz thimble method (remote)
9:45	10:30	Hirasawa, Mitsuaki	The emergence of expanding space-time in a novel large-N limit of the Lorentzian type IIB matrix model
10:30	11:15	Tekel, Juraj	Towards removal of striped phase in matrix model description of fuzzy field theories
11:15	11:45	**Coffee Break**	
11:45	12:30	Vaidya, Sachindeo	Chaotic Dynamics in the SU(2) Gauge Matrix Model
12:30	12:55	Kovacik, Samuel	The Fuzzy Onion
13:30	16:30	**Lunch**	
16:30	17:15	Hanada, Masanori	Flux tube and chiral symmetry breaking in the partially-deconfined phase of Yang-Mills theory (remote)
17:15	18:00	Fioresi, Rita	Quantum Minkowski Superspace
18:00	18:20	**Coffee Break**	
18:20	19:05	Gubitosi, Giulia	Interplay between spacetime curvature, speed of light and quantum deformations of relativistic symmetries
19:05	19:30	Much, Albert	Noncommutative QFT and Curved Spacetimes
20:00	23:00	**Welcome Reception**	

Wednesday, September 21, 2022

9:00	9:45	Wu, Siye	Gauge theory, sigma models and generalised geometry
9:45	10:30	Strobl, Thomas	Angular momenta as constraints and the induced forest of ghosts
10:30	11:15	Skvortsov, Evgeny	Strong homotopy algebras in conformal field theory and higher spin gravity
11:15	11:45	**Coffee Break**	
11:45	12:30	Perez Martin, Carmelo	UV/IR mxing and noncommutative gauge theories defined by using the Seiberg-Witten map
12:30	12:55	Boffo, Eugenia	Spin field for the N=1 particle in the worldline
13:30	16:30	**Lunch**	
16:30	17:15	Lledo, Maria Antonia	A star product on N=1 chiral superspace
17:15	18:00	Tran, Tung	A twistorial higher-spin theory from the IKKT-matrix model
18:00	18:20	**Coffee Break**	
18:20	19:05	Van Suijlekom, Walter	Spectral truncations in noncommutative geometry
19:05	19:30	Razzaq, Junaid	N = 2 Minkowski Superspace and its Quantization

Thursday, September 22, 2022

9:00	9:45	Kowalski-Glikman, Jerzy	A few remarks on kappa
9:45	10:30	Lukierski, Jerzy	Quantum-deformed phase spaces with noncommutative coordinates and momenta
10:30	10:55	Hersent, Kilian	Quantum properties of U(1)-like gauge theory on kappa_x0014_-Minkowski
10:55	11:25	**Coffee Break**	
11:25	12:10	Jurco, Branislav	On the category of BV-theories (aka quantum L-infinity algebras)
12:10	12:35	Kurkov, Maxim	Poisson gauge models and the Seiberg-Witten map
13:30	16:30	**Lunch**	
16:30	17:15	Sitarz, Andrzej	Spectral Einstein Tensor.
17:15	18:00	Perez-Sanchez, Carlos I.	A Yang-Mills(-Higgs) matrix model
18:00	18:20	**Coffee Break**	
18:20	19:05	Borowiec, Andrzej	Twisted differential geometry and dispersion relations in kappa-deformed cosmology
19:05	19:30	Valach, Fridrich	On supersymmetric sigma models and the AKSZ construction
20:00	23:30	**Greek Night**	

Friday, September 23, 2022

9:00	9:45	Ramgoolam, Sanjaye	Partition algebras and Permutation symmetry in Matrix Quantum Mechanics
9:45	10:30	Saemann, Christian	T-Duality as a Correspondence of Higher Principal Bundles
10:30	11:15	Vysoky, Jan	Palatini variation in supergravity
11:15	11:45	**Coffee Break**	
11:45		**Excursion**	

Saturday, September 24, 2022

9:00	9:45	Dimitrijevic Ciric, Marija	Quantization of braided noncommutative field theories
9:45	10:30	Pinzul, Aleksandr	Noncommutative AdS_2/CFT_1 duality
10:30	11:15	Franchino-Vinas, Sebastian	Recent results on noncommutativity and curved momentum spaces
11:15	11:45	**Coffee Break**	
11:45	12:30	Weber, Thomas	Principal differential calculi over projective bases
12:30	12:55	Chakraborty, Anwesha	Fingerprints of the quantum space-time in time dependent quantum mechanics: An emergent geometric phase
13:30	16:30	**Lunch**	
16:30	17:15	Dobrev, Vladimir	Invariant Differential Operators: An Overview (remote)
17:15	18:00	Fiore, Gaetano	General O(D)-equivariant fuzzy hyperspheres via confining potentials and energy cutoffs
18:00	18:45	Castellani, Leonardo	Noncommutative Hamiltonian for noncommutative gravity
18:45	19:05	**Closure and Coffee Break**	

2 Detailed Program with Abstracts

2.1 Monday, September 19, 2022

Time: 9:00 – 9:45
Speaker: Brandenberger, Robert (McGill University)
Title: Emergent Space-Time and Early Universe Cosmology from Matrix Theory
Abstract: Starting with the BFSS matrix model in a high temperature state, we will show how continuous and infinite space and time can emerge. As well, a spatially flat metric appears to emerge. Thermal fluctuations in the resulting early universe phase lead to scale-invariant spectra of density perturbations and gravitational waves.

Time: 9:45 – 10:30
Speaker: Pateloudis, Efstratios (University of Regensburg)
Title: Studies of the D0-matrix models at low temperatures
Abstract: I will describe the low energy limit of the D0-matrix models and their gravitational interpretations. I will show that in low energies it is possible to obtain a confined, stable phase in the matrix model and how this is interpreted as a gas of supergravitons in 11D spacetime. This confinement/deconfinement transition is interpreted as a topology change in the gravity side. The deconfined phase can also be studied in low temperatures and I will show that by using the deformed D0-matrix model (BMN) where one is able to better test the gauge/gravity duality with small stringy corrections where a supergravity dual is analytically known and valid. Furthermore, if time permits, I will argue that the role of the singlet and non-singlet sectors in the contributions to the partition functions are almost the same in these low temperatures presenting theoretical arguments and numerical verifications.

Time: 10:30 – 11:15
Speaker: Tsuchiya, Asato (Shizuoka University)
Title: Renormalization group and cMERA
Abstract: The cMERA , the continuum counterpart of the MERA, is expected to realize the emergence of space-time through quantum entanglement. While it is obtained successfully based on the variational method in free field theory, it is quite nontrivial to construct in interacting field theory. Here we study an approach based on the renormalization group to the cMERA in interacting field theory. First, we obtain the scale-dependence of the ground state wave functional in interacting scalar field theory by using perturbation theory, Then, we find the entangler that connects the wave functionals at different scales. We also discuss a nonperturbative method to construct the cMERA in interacting field theory.

Time: 11:45 – 12:30
Speaker: Ho, Pei-Ming (National Taiwan University)
Title: UV Physics and Hawking Radiation
Abstract: Many researchers consider Hawking radiation insensitive to UV physics, despite the trans-Planckian problem. We show that, in fact, UV physics has the potential of significantly modifying Hawking radiation, even to turn it off after a critical time. It will be interesting to explore how various proposals of quantum spacetime affect Hawking radiation, to shed new light on the black-hole information loss paradox.

Time: 12:30 – 12:55
Speaker: Battista, Emmanuele (University of Vienna)
Title: On the propagation across the big bounce in an open quantum FLRW cosmology
Abstract: Recently, solutions of the IKKT matrix theory have been found, which can be interpreted as 3+1-dimensional quantum geometries describing an effective FLRW cosmology with a big bounce. In this talk, I will examine the propagation of a scalar field in an open FLRW spacetime arising within this framework. The talk is divided into two parts. In the first one, I will employ general-relativity tools to perform a classical analysis, which reveals that both massless and massive particles can safely travel across the big bounce. Then, I will exploit quantum-field-theory techniques to evaluate the scalar field propagator. We will show that in the late-time regime it resembles the standard Feynman propagator of flat Minkowski space, whereas for early times it gives rise to a well-defined correlation between two points on opposite sheets of the spacetime.This talk is based on the paper arXiv:2207.01295 [gr-qc], written in collaboration with Harold Steinacker.

Time: 16:30 – 17:15
Speaker: Balachandran, Aiyalam (Syracuse University)
Title: Spin 1/2 From Colour and A Little More

Abstract: TBA

Time: 17:15 – 18:00
Speaker: Vitale, Patrizia (Università di Napoli Federico II and INFN)
Title: The Jacobi sigma model
Abstract: TBA

Time: 18:20 – 19:05
Speaker: Schupp, Peter (Bremen)
Title: Fuzzy light cones and deformed micro-causality (in cosmology)

Time: 19:05 – 19:30
Speaker: Froeb, Markus B. (ITP, University of Leipzig)
Title: Non-commutative coordinates from quantum gravity
Abstract: Local observables in (perturbative) quantum gravity are notoriously hard to define, since the gauge symmetry of gravity - diffeomorphisms - moves points on the manifold. In particular, this is a problem for backgrounds of high symmetry such as Minkowski space or de Sitter spacetime which describes the early inflationary phase of our universe. Only recently this obstacle has been overcome, and a field-dependent coordinate system has been constructed to all orders in perturbation theory, in which observables are fully gauge-invariant. We show that these field-dependent coordinates are non-commutative, and compute their commutator to second order in the Planck length. This provides the first systematic derivation of non-commutativity that arises due to quantum gravity effects. Based on joint work with A. Much and K. Papadopoulos.

2.2 Tuesday, September 20, 2022

Time: 9:00 – 9:45
Speaker: Nishimura, Jun (KEK and SOKENDAI)
Title: Quantum tunneling in the real-time path integral by the Lefschetz thimble method
Abstract: Quantum tunneling is mostly discussed in the Euclidean path integral formalism, for instance, by using instantons. On the other hand, it is difficult to understand quantum tunneling based on the real-time path integral due to its oscillatory nature, which causes the notorious sign problem. We show that recent development of the Lefschetz thimble method enables us to investigate this issue numerically. In particular, we find that quantum tunneling occurs due to complex trajectories, which are actually observable experimentally by using the so-called weak measurement.

Time: 9:45 – 10:30
Speaker: Hirasawa, Mitsuaki (INFN - Milano Bicocca section)
Title: The emergence of expanding space-time in a novel large-N limit of the Lorentzian type IIB matrix model
Abstract: The Lorentzian type IIB matrix model is a promising candidate for a nonperturbative formulation of superstring theory. However, it was recently found that a Euclidean space-time appears in the conventional large-N limit. In this work, we add a Lorentz invariant mass term and consider the limit in which the coefficient of the mass term vanishes at large N. By performing complex Langevin simulations to overcome the sign problem, we observe the emergence of expanding space-time with Lorentzian signature.

Time: 10:30 – 11:15
Speaker: Tekel, Juraj (Comenius University)
Title: Towards removal of striped phase in matrix model description of fuzzy field theories
Abstract: he UV/IR-mixing phenomenon of noncommutative field theories is manifested by existence of a nonlocal, striped phase in the scalar field theory, where the field does not oscillate around the same value in the whole space. We will consider modifications of the standard "kinetic term plus potential" actions for Hermitian matrix models which describe theories free of the UV/IR-mixing and discuss the expected receding of the striped phase in the phase diagram. We will present results for the case of the modified theory on the fuzzy sphere and for the truncated Heisenberg algebra formulation of the Grosse-Wulkenhaar model on the plane.

Time: 11:45 – 12:30
Speaker: Vaidya, Sachindeo (Indian Institute of Science, Bangalore)
Title: Chaotic Dynamics in the SU(2) Gauge Matrix Model
Abstract: The SU(2) gauge matrix model is a non-linear model describing the extreme low energy sector of the SU(2) Yang-Mills theory on S^3 x R. We show that the Hamiltonian of this model has an unexpected tetrahedral symmetry T_d. The classical orbits can be organized into various classes in terms of T_d and its subgroups, and they become chaotic as the energy increases. We show the emergence of chaos for each class of orbits and in particular identify one such class as undergoing the period doubling route, whose Feigenbaum constant can be computed analytically. Finally, we remark on the possible loss of ergodicity, and a connection to phases of the quantized counterpart.

Time: 12:30 – 12:55
Speaker: Kovacik, Samuel (Comenius University Bratislava)
Title: The Fuzzy Onion
Abstract: Matrix models of field theories on the fuzzy sphere have been investigated thoroughly before. Here we propose a matrix model for a 3-dimensional rotationally invariant space that is composed of concentric fuzzy spheres of increasing radius. We discuss the recent results of simple field theories in this space.

Time: 16:30 – 17:15
Speaker: Hanada, Masanori (U Surrey)
Title: Flux tube and chiral symmetry breaking in the partially-deconfined phase of Yang-Mills theory
Abstract: TBA

Time: 17:15 – 18:00
Speaker: Fioresi, Rita (University of Bologna)
Title: Quantum Minkowski Superspace
Abstract: We construct the quantum Minkowski superspace with N=1, 2 SUSY. We discuss quantum differential calculus and quantum metric tensors on N=1, 2 chiral superfields and their classification. This is a joint work with: Latini, Lledo, Razzaq.

Time: 18:20 – 19:05
Speaker: Gubitosi, Giulia (Università di Napoli Federico II)
Title: Interplay between spacetime curvature, speed of light and quantum deformations of relativistic symmetries
Abstract: Starting from the Poincaré algebra of special-relativistic symmetries, one can toggle the curvature parameter, the Planck-scale quantum deformation parameter and the speed of light parameter to obtain different models that could describe the relativistic symmetries of spacetime in various regimes. These include the (quantum) Poincaré algebra, the (quantum) (A)dS algebra, the (quantum) Galilei and Carroll algebras and their curved versions. In this talk, I will survey the properties and relations of these algebras of relativistic symmetries and their associated spacetimes, emphasizing the nontrivial effects of interplay between curvature, quantum deformation and speed of light parameters.

Time: 19:05 – 19:30
Speaker: Much, Albert (Leipzig University)
Title: Noncommutative QFT and Curved Spacetimes
Abstract: A deformation quantization, in the sense of Rieffel, was recently achieved for de-Sitter spacetime. In this work, we generalize these results to \textitall globally hyperbolic spacetimes and apply the deformation to quantum field theories and their respective states. It turns out that the deformed state (i.e.\a state in non-commutative spacetime) has a singularity structure resembling Minkowski, i.e.\is \textitHadamard, if the undeformed state is Hadamard. This proves that the Hadamard condition, and hence the quantum field theoretical implementation of the equivalence principle is a general concept that even holds in spacetimes with quantum features (i.e. a non-commutative spacetime).

2.3 Wednesday, September 21, 2022

Time: 9:00 – 9:45
Speaker: Wu, Siye (National Tsing Hua University)
Title: Gauge theory, sigma models and generalised geometry
Abstract: When the target space is a generalised Kahler manifold, there are two topological twists of a supersymmetric

sigma model, generalising the constructions of the A-model and B-model on a Kahler manifold. To explain geometric Langlands programme by electric-magnetic duality, Kapustin and Witten considered a reduction of a 4-dimensional N=4 gauge theory to such sigma models. The target space is Hitchin's moduli space, which is hyper-Kahler, and the sigma model at low energies is either a B-model or the B-field transform of an A-model, all of which are anomaly-free. In this talk, we consider the reduction of the N=4 gauge theory on a 4-manifold containing embedded orientable and non-orientable surfaces. The resulting theory is a sigma model on a world sheet whose boundary lives on branes from Hitchin's moduli space but for non-orientable surfaces. We show that these branes are supported on submanifolds preserved by the generalised complex structures and that the low energy theory remains anomaly-free at the quantum level.

Time: 9:45 – 10:30
Speaker: Strobl, Thomas (ICJ Lyon)
Title: Angular momenta as constraints and the induced forest of ghosts
Abstract: We consider mechanical systems on the cotangent bundle of R^3 using angular momenta as first class constraints. How to describe this singular constraint system correctly in the cohomological BFV approach? We show that the first two naive approaches of introducing ghosts lead to wrong results. It turns out that in a consistent approach one needs an infinite tower of ghosts and that, somewhat surprisingly, these ghosts can be identified with a forest of decorated trees. We provide explicit recursive formulas for the BFV charge and the BFV extension of the classical Hamiltonian.

Time: 10:30 – 11:15
Speaker: Skvortsov, Evgeny (UMONS)
Title: Strong homotopy algebras in conformal field theory and higher spin gravity
Abstract: I will review two recent applications of strong homotopy algebras: (1) as a realization of the slightly-broken higher spin symmetry of (Chern-Simons) vector models, which allow one to prove, at least in the large-N limit, the recently conjectured three-dimensional bosonization duality; (2) a closely related application is to construct chiral higher spin gravity as an AKSZ-type sigma model. A wide range of methods from non-commutative geometry is needed to construct these strong homotopy algebras.

Time: 11:45 – 12:30
Speaker: Perez Martin, Carmelo (Universidad Complutense de Madrid)
Title: UV/IR mxing and noncommutative gauge theories defined by using the Seiberg-Witten map
Abstract: I shall review the current status of the study of the UV/IR mixing in noncommutative gauge theories for simple gauge groups. The talk will be based on the following paper Eur.Phys.J.C 81 (2021) 10, 878 and references therein.

Time: 12:30 – 12:55
Speaker: Boffo, Eugenia (Charles University Prague)
Title: Spin field for the N=1 particle in the worldline
Abstract: In this talk I will address the problem of Ramond-Ramond backgrounds in string theory, from the simplified viewpoint of the N=1 spinning particle. These fields can arise as 2-particles excitations of the ground state. BRST cohomology leads to the right equations for the R-R fields, and deformations or twistings of the BRST differential by the latter can also be implemented consistently. Based on joint work with Ivo Sachs, arXiv:2206.03243.

Time: 16:30 – 17:15
Speaker: Lledo, Maria Antonia (Universitat de Valencia and IFIC (CSIC-UVEG))
Title: A star product on N=1 chiral superspace
Abstract: We give a description of a quantum N=1 chiral superspace in terms of generators and relations, with a deformation coming from a quantum supergroup, which has a quadratic Poisson bracket. We are able to give an explicit formula for the star product realizing this deformation.

Time: 17:15 – 18:00
Speaker: Tran, Tung (UMONS)
Title: A twistorial higher-spin theory from the IKKT-matrix model
Abstract: At the interface between three theories: higher-spin gravity, twistor theory, and matrix model is a higher-spin theory induced by the IKKT matrix model (HS-IKKT) on a covariant fuzzy 4-sphere/fuzzy twistor space. We show that the HS-IKKT is a higher-spin extension of N=4 SYM with vertices with more than two derivatives. The spacetime action of the HS-IKKT obtained by Penrose transform, allows us to study the tree-level amplitudes of the HS-IKKT in the flat limit. The self-dual sector of the HS-IKKT model is obtained by dropping some parts of the cubic- and the quartic

interactions, which is shown to reduce to a BF-type action on commutative deformed projective twistor space.

Time: 18:20 – 19:05
Speaker: Van Suijlekom, Walter (Radboud University Nijmegen)
Title: Spectral truncations in noncommutative geometry
Abstract: We extend the traditional framework of noncommutative geometry in order to deal with spectral truncations of geometric spaces. In our approach the traditional role played by C*-algebras is taken over by so-called operator systems. We study the convergence aspects and find general conditions on sequences of operator system spectral triples that allows one to prove a result on Gromov-Hausdorff convergence of the corresponding state spaces when equipped with Connes' distance formula. We exemplify this result for spectral truncations of the circle.

Time: 19:05 – 19:30
Speaker: Razzaq, Junaid (University of Bologna)
Title: N = 2 Minkowski Superspace and its Quantization
Abstract: It is well-known in classical setting, we can identify complex Minkowski space as the big cell inside grassmannian Gr(2,4) which admits a natural action of complex special linear group SL4(C) and then one can realize real Minkowski space as an open set in some real form of it ([3] Ch. 2). In our recent work [1], we construct the Minkowski superspace M with 2 odd dimensions as the big cell inside grassmannian supermanifold Gr(2|0, 4|2), and then quantize it via the construction of quantum principal bundles as given in [2]. I would like to present an overview of this work. References: [1] R. Fioresi, M. A. Lledo, J. Razzaq, N = 2 Quantum Chiral Superfields and Quantum Super Bundles. https://arxiv.org/abs/2204.01242, 2022. [2] P. Aschieri, R. Fioresi, E. Latini, Quantum Principal Bundles on Projective Bases. Communications in Mathematical Physics, Springer, 2021. [3] R. Fioresi, M. A. Lledo, The Minowski and Conformal Superspaces: The Classical and Quantum Descriptions. World Scientific Publishing Co., 2015.

2.4 Thursday, September 22, 2022

Time: 9:00 – 9:45
Speaker: Kowalski-Glikman, Jerzy (Institute for Theoretical Physics, University of Wroclaw and National Centre for Nuclear Research, Warsaw)
Title: A few remarks on kappa
Abstract: TBA

Time: 9:45 – 10:30
Speaker: Lukierski, Jerzy (Wroclaw University)
Title: Quantum-deformed phase spaces with noncommutative coordinates and momenta
Abstract: We present the models of quantum-deformed relativistic phase spaces (kappa-deformed, Snyder, Yang and their generalizations) with noncommutative space-times and commutative or noncommutative momenta. We will describe briefly also SUSY extensions which lead to quantum-deformed super-phase spaces, in particular to quantum-deformed spinors.

Time: 10:30 – 10:55
Speaker: Hersent, Kilian (IJCLab, France)
Title: Quantum properties of U(1)-like gauge theory on kappa_x0014_-Minkowski
Abstract: TBA

Time: 11:25 – 12:10
Speaker: Jurco, Branislav (Charles University, Prague)
Title: On the category of BV-theories (aka quantum L-infinity algebras)
Abstract: We propose an enhancement of (odd) sympelctic category (in the spirit of Severa and Weinstein) and discuss its relation to homological perturbation theory.

Time: 12:10 – 12:35
Speaker: Kurkov, Maxim (University of Naples Federico II)

Title: Poisson gauge models and the Seiberg-Witten map
Abstract: Poisson gauge theory is a semiclassical limit of full non-commutative gauge theory. We review the construction of Poisson gauge theories focusing on the geometric structures involved, in particular, on the symplectic embeddings. We present an explicit form of the gauge Lagrangian for any non-commutativity of the Lie algebraic type. We address the arbitrariness in the construction of Poisson gauge models in terms of Seiberg-Witten maps, i.e., invertible field redefinitions mapping gauge orbits onto gauge orbits.

Time: 16:30 – 17:15
Speaker: Sitarz, Andrzej (Jagiellonian University)
Title: Spectral Einstein Tensor.
Abstract: Using the noncommutative residue we define functionals over vector fields and differential forms, which, for the even-dimensional Riemannian manifolds yield the Einstein tensor. Further, we generalize the notion to study them over noncommutative generalizations of manifolds. In particular, we prove that for the noncommutative two-torus with a conformally rescaled metric the Einstein tensor vanishes. Based on a joint work with Ludwik Dabrowski and Pawel, Zalecki.

Time: 17:15 – 18:00
Speaker: Perez-Sanchez, Carlos I. (U. Heidelberg)
Title: A Yang-Mills(-Higgs) matrix model
Abstract: The problem of quantization of noncommutative spaces (spectral triples) is addressed first in a finite-dimensional, Euclidean setting (thus referred to as random noncommutative geometry, or Dirac ensambles). To address the problem of quantization of a space with gauge fields, first the structure that in the smooth (i.e. commutative) spacetime case is well-known to yield the Yang-Mills(-Higgs) theory, namely almost-commutative manifolds, has to be replaced by its 'fuzzy' counterpart already the classical level. We provide new the structure that allows this, whose quantisation turns out to be lead to a multimatrix ensemble.

Time: 18:20 – 19:05
Speaker: Borowiec, Andrzej (Wroclaw University, Institute of Theoretical Physics)
Title: Twisted differential geometry and dispersion relations in kappa-deformed cosmology
Abstract: The talk will be based on the following two publications: 1. P. Aschieri, A. Borowiec and A. Pachol J. High Energ. Phys. 2017, 152 (2017) [arXiv:1703.08726] 2. P. Aschieri, A. Borowiec and A. Pachol JCAP 04 (2021) 025 [arXiv:2009.01051]

Time: 19:05 – 19:30
Speaker: Valach, Fridrich (Imperial College London)
Title: On supersymmetric sigma models and the AKSZ construction
Abstract: I will discuss a super-extension of the AKSZ construction and show how to - recover the string sigma model with N=(1,1) worldsheet supersymmetry on the boundary of a 3-dimensional topological theory, paralleling the construction of Ševera in the bosonic string case - obtain a BV version of the Grassi-Maccaferri construction of the super Chern-Simons theory. This is a joint work with O. Hulík and J. Svoboda.

2.5 Friday, September 23, 2022

Time: 9:00 – 9:45
Speaker: Ramgoolam, Sanjaye (Queen Mary University of London)
Title: Partition algebras and Permutation symmetry in Matrix Quantum Mechanics
Abstract: With motivations from holography and many-body quantum physics, I describe the implications of permutation symmetry for the state space and dynamics of quantum mechanical systems of matrices of general size N. The permutation invariant sector of the Hilbert space, for general Hamiltonians, can be described using partition algebra diagrams forming the bases of a tower of partition algebras Pk(N). The integer k is interpreted as the degree of matrix oscillator polynomials in the quantum mechanics. The talk will be based on the paper https://arxiv.org/abs/2207.02166

Time: 9:45 – 10:30
Speaker: Saemann, Christian (Heriot-Watt University)
Title: T-Duality as a Correspondence of Higher Principal Bundles

Abstract: In this talk, I provide a description of a very general notion of T-duality in terms of higher geometry. This form of T-duality comprises topological T-duality with geometric and non-geometric backgrounds as well as the differential refinement involving B-field and metrics. Our construction is manifestly covariant under the full T-duality group and it has interesting mathematical and physical implications.

Time: 10:30 – 11:15
Speaker: Vysoky, Jan (Czech Technical University)
Title: Palatini variation in supergravity
Abstract: Generalized geometry proved to be a right mathematical tool for the description of an action and equations of motion of the bosonic sector of supergravity. In particular, the action can be written in the Einstein-Hilbert fashion using the particular class of Levi-Civita Courant algebroid connections on a generalized tangent bundle. To justify these choices, we resort to a simple idea. One can consider a general Courant algebroid and write an action for three independent dynamical fields - a volume form on the base manifold, a generalized metric and a general Courant algebroid connection. Amazingly, the corresponding equations of motion tie those fields together in a way resembling the well-known Palatini variation in general relativity. Necessary mathematical notions are recalled in this talk.

2.6 Saturday, September 24, 2022

Time: 9:00 – 9:45
Speaker: Dimitrijevic Ciric, Marija (Faculty of Physics University of Belgrade)
Title: Quantization of braided noncommutative field theories
Abstract: Braided noncommutative field theories are defined via the corresponding braided L-infinity algebra. In this talk we review the most important properties of these theories and discuss their quantization.

Time: 9:45 – 10:30
Speaker: Pinzul, Aleksandr (University of Brasilia)
Title: Noncommutative AdS_2/CFT_1 duality
Abstract: We discuss the duality between (unspecified) CFT_1 and non-commutative AdS_2. For the case of free (massive and massless) scalar and massless spinor fields, we obtain the exact solutions to the field equations on quantized two-dimensional anti-de Sitter space and then apply the AdS/CFT correspondence principle to get exact non-perturbative (in the parameter of noncommutativity) answers for the two point correlation functions of the associated operators on the boundary. The results strongly support the conclusion that conformal symmetry on the boundary is not spoiled by quantization of the bulk. We also discuss some preliminary perturbative results for the interacting scalar field. It is confirmed that to the leading order in noncommutative corrections, the 3-point correlation function also has the form that is assumed by some dual CFT.

Time: 10:30 – 11:15
Speaker: Franchino-Vinas, Sebastian (Helmholtz-Zentrum Dresden-Rossendorf)
Title: Recent results on noncommutativity and curved momentum spaces
Abstract: It is well-known that noncommutative spaces have a close connection with curved momentum spaces. In this talk we will present some recent results that pursue further this link. In particular we will mention the cases of k-Poincaré and Snyder, showing also some phenomenological results.

Time: 11:45 – 12:30
Speaker: Weber, Thomas (University of Turin)
Title: Principal differential calculi over projective bases
Abstract: In noncommutative differential geometry Hopf-Galois extensions generalize the concept of principal bundle. Given a covariant first order differential calculus on the total space algebra there are natural notions of base forms and horizontal forms. If the covariant calculus on the structure Hopf algebra is compatible with the former, in the sense that the vertical map constitutes a short exact sequence, we have a principal differential calculus. Then, the faithfully flat Hopf-Galois extension amplifies to a Hopf-Galois extensions of graded objects. In this talk we give a sheaf-theoretic approach to principal differential calculi. This is required in the presence of projective bases, where global sections are trivial and the local information is crucial. The theory is elucidated by the explicit example of q-deformed SL(2,C). The presentation is based on a collaboration with Aschieri, Fioresi and Latini.

Time: 12:30 – 12:55
Speaker: Chakraborty, Anwesha (S. N. Bose National Centre for Basic Sciences)
Title: Fingerprints of the quantum space-time in time dependent quantum mechanics: An emergent geometric phase
Abstract: In the vicinity of Planck length scale, only where the quantum gravitational effects are expected to be observed, any attempt towards localization of an event inevitably results in gravitational collapse. To avoid such a scenario one needs to postulate noncommutative algebra between space-time coordinates, which are now promoted to the level of operators. On the other hand, a consistent formulation of Quantum mechanics itself, with time being an operator , is a challenging and longstanding problem. Here we have given a systematic way to formulate non-relativistic quantum mechanics on 1+1 dimensional "quantum" space-time (Moyal type noncommutativity) in a user friendly way, which mandates the formulation of an equivalent commutative theory. Although the effect of noncommutativity of space-time should presumably become significant at a very high energy scale, it is intriguing to speculate that there should be some relics of the effects of quantum spacetime even in a low energy regime. With this motivation in mind we undertake the study of time dependent system, for example forced harmonic oscillator in quantum space-time, where time is also an operator and have shown the emergence of geometric phase, which vanishes if the noncommutative parameter is put to zero, proving the fact that, occurrence of geometric phase for the above system is totally dependent on the non-commutativity of spacetime.

Time: 16:30 – 17:15
Speaker: Dobrev, Vladimir (INRNE, BAS)
Title: Invariant Differential Operators: An Overview
Abstract: The present talk is an overview of the project of systematic construction of invariant differential operators symmetric under non-compact semisimple Lie algebras. We give the main multiplets of indecomposable elementary representations. This includes the explicit parametrization of the invariant differential operators between the elementary representations.

Time: 17:15 – 18:00
Speaker: Fiore, Gaetano (INFN University of Napoli)
Title: General O(D)-equivariant fuzzy hyperspheres via confining potentials and energy cutoffs
Abstract: We simplify our construction of new, fully O(D)-equivariant fuzzy hyperspheres S^d_L, for all dimensions d=D-1, which is based on imposing a suitable energy cutoff on a quantum particle in R^D subject to a confining potential well V(r) with a very sharp minimum on the sphere of radius r=1 (the cutoff and the depth of the well diverge with the natural number L). We show that the (reducible) representation of O(D) on the Hilbert space H_L of the particle is isomorphic to the irreducible representation p_L of O(D+1) on the space of harmonic homogeneous polynomials of degree L in the Cartesian coordinates of R^D+1; we express the latter using equivariant, completely symmetric, trace-free projections. Moreover, we show that the algebra of observables is isomorphic to p_L(Uso(D+1)). As L diverges (commutative limit) also the dimension of H_L does, and we recover ordinary quantum mechanics on S^d; more formally, we have a fuzzy quantization of a coadjoint orbit of O(D+1) that goes to the classical phase space T^*S^d.

Time: 18:00 – 18:45
Speaker: Castellani, Leonardo (East Piedmont University and INFN, Torino)
Title: Noncommutative Hamiltonian for noncommutative gravity
Abstract: We present a covariant canonical formalism for noncommutative gravity, and in general for noncommutative geometric theories based on a twisted $\star$-wedge product between forms. Noether theorems are proved in the noncommutative setting, and gauge generators are constructed in a twisted phase space, where a deformed Poisson bracket is defined. This formalism is applied to noncommutative vierbein gravity, and allows to find the canonical generators of the tangent space $\star$-gauge group.
