Corfu2023: Workshop on Noncommutative and Generalized Geometry in String theory, Gauge theory and Related Physical Models

SEPTEMBER 18 - SEPTEMBER 25, 2023

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Scientific Programme

1 Program Summary

Tuesday, September 19, 2023

9:00	9:40	Steinacker, Harold	3+1-dimensional quantum gravity on quantum space-time from the IKKT model
9:40	10:20	Lukierski, Jerzy	Doubly kappa-deformed Yang models
10:20	11:00	Lizzi, Fedele	Quantum Observers in Noncommutative Geometry
11:00	11:30	**Coffee Break**	
11:30	12:10	O'Connor, Denjoe	Lessons from Matrix Models on the confining/de-confining phase transitions of gauge theories
12:10	12:50	Martinetti, Pierre	Wick rotation in noncommutative geometry from torsion
12:50	13:30	Hersent, Kilian	UV/IR mixing for ϕ^4 theory on Lie algebra-type noncommutative space-times
13:30	16:00	**Lunch**	
16:00	16:40	Rivasseau, Vincent	Random tensor and stochastic analysis
16:40	17:20	Kovacik, Samuel	The Fuzzy Onion
17:20	17:50	**Coffee Break**	
17:50	18:30	Asano, Yuhma	Perturbative superstring theory and the IKKT matrix model
18:30	19:10	Scala, Luca	Bicrossproduct structure of rho-Poincar and the associated star-product

Wednesday, September 20, 2023

9:00	9:40	Nishimura, Jun	1/D expansion and the emergent space-time in the Lorentzian type IIB matrix model
9:40	10:20	Hirasawa, Mitsuaki	The effects of SUSY on the emergent spacetime in the Lorentzian type IIB matrix model
10:20	11:00	Tsuchiya, Asato	Renormalization group and quantum error correction
11:00	11:30	**Coffee Break**	
11:30	12:10	Watanabe, Hiromasa	Toward the application of large-N deconfinement to SU(N=3) QCD
12:10	12:50	Tekel, Juraj	Correlation functions in fuzzy scalar field theories
12:50	16:00	**Lunch**	
16:00	16:40	Sato, Matsuo	String Geometry Theory and The String Vacuum
16:40	17:20	Flood, Keegan	Principal symbols in noncommutative geometry
17:20	17:50	**Coffee Break**	
17:50	18:30	Dolan, Brian	The fractional quantum Hall effect on a sphere and the Atiyah-Patodi-Singer index theorem
18:30	19:10	Nieuviarts, Gaston	Spectral triple-based Noncommutative Gauge Field Theories on AF-algebras
20:00	23:00	**Welcome Reception**	

Thursday, September 21, 2023

9:00	9:40	Kowalski-Glikman, Jerzy	Why there is (almost) noting rather than something?
9:40	10:20	Ramgoolam, Sanjaye	Classical and quantum detection of high dimension states in AdS/CFT holography
10:20	11:00	Iorio, Alfredo	Classical gravitational anomalies of Liouville theory
11:00	11:30	**Coffee Break**	
11:30	12:10	Kurkov, Maxim	Lie-Poisson gauge theories and k-Minkowski electrodynamics
12:10	12:50	Prekrat, Dragan	(Non)renormalizable noncommutativity in (non)uniform phase
12:50	13:30	Bortolotti, Nicola	Probing space-time non-commutativity through Pauli exclusion principle
13:30	20:30	**Excursion**	
20:30	0:30	**Greek Night**	

Friday, September 22, 2023

9:00	9:40	Bonechi, Francesco	Equivariant extension of abelian Yang Mills theory
9:40	10:20	Jurco, Branislav	Double Copy from Tensor Products of Metric BV-box algebras
10:20	11:00	Dimitrijevic Ciric, Marija	Advances in quantization of braided noncommutative field theories
11:00	11:30	**Coffee Break**	
11:30	12:10	Fioresi, Rita	Quantum differential calculus on quantum principal bundles on projective bases
12:10	12:50	Platania, Alessia	Asymptotic constraints on quantum black holes
13:30	16:00	**Lunch**	
16:00	16:40	Arzano, Michele	Entanglement entropy and horizon temperature in conformal quantum mechanics
16:40	17:20	Franchino-Vinas, Sebastian	Quantum Field Theory in Snyder spaces
17:20	17:50	**Coffee Break**	
17:50	18:30	Borowiec, Andrzej	Quantum deformations of BMS algebras
18:30	19:10	Bukor, Benedek	A less commutative version of quarkonium masses

Saturday, September 23, 2023

9:00	9:40	Berenstein, David	Staggered bosons and Kahler-Dirac bosons
9:40	10:20	Cederwall, Martin	The teleparallel complex
10:20	11:00	Skvortsov, Evgeny	Noncommutative geometry and higher spin gravity/symmetry
11:00	11:30	**Coffee Break**	
11:30	12:10	Fiore, Gaetano	Twisted (anti-)de Sitter spaces
12:10	12:50	Hassler, Falk	Supergeneralized geometry and dualities
12:50	13:30	Osten, David	On exceptional QP-manifolds
13:30	16:00	**Lunch**	
16:00	16:40	Boffo, Eugenia	Gauge theories from spinning particles
16:40	17:20	Vysoky, Jan	Graded Jet Geometry
17:20	17:50	**Coffee Break**	
17:50	18:30	Valach, Fridrich	Generalised geometry for the group E_7
18:30	19:10	Mori, Haruka	Doubled Structures of Algebroids in Gauged Double Field Theory

Sunday, September 24, 2023

9:00	9:40	Castellani, Leonardo	Quantum histories and entropy of temporal entanglement
9:40	10:20	Bieliavsky, Pierre	TBA
10:20	11:00	Liu, Chengcheng	Quantum Kaluza-Klein Theory with M2(C)
11:00	11:30	**Coffee Break**	
11:30	12:10	Iseppi, Roberta	Towards the BV formalism for gauge theories on noncommutative manifolds
12:10	12:50	Segreto, Sebastiano	Non-commutative GUP quantization and application to minisuperspace models
12:50	13:30	Rist, Dominik	Non-abelian gerbes with connections in higher gauge theory
13:30	14:10	Reyes-Lega, Andres Fernando	Renormalization on the DFR Quantum Spacetime

2 Detailed Program with Abstracts

2.1 Tuesday, September 19, 2023

Time: 9:00 – 9:40
Speaker: Steinacker, Harold (University of Vienna)
Title: 3+1-dimensional quantum gravity on quantum space-time from the IKKT model

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Time: 9:40 – 10:20
Speaker: Lukierski, Jerzy (Wroclaw University)
Title: Doubly kappa-deformed Yang models
Abstract: We propose the generalization of Yang model by adding the pair of kappa-deformations, one in quantum coordinates and second in quantum momenta sectors. Such generalization can be described algebraically by suitable modification of the \hat o(5,1) algebra basis. Two different kappa-deformations can be linked by the Born map. The model provides new type of noncommutative relativistic (D=4) quantum-deformed phase space. (Based on the paper in preparation by J.Lukierski, S.Meljanac, S.Mignemi, A.Pachol and M.Woronowicz).

Time: 10:20 – 11:00
Speaker: Lizzi, Fedele (INFN, Napoli)
Title: Quantum Observers in Noncommutative Geometry
Abstract: I will argue that a quantum spacetime, as the one described by a noncommutative geometry, requires not only quantum symmetries, but also a quantization of the observers, or reference frames. I will discuss the cases of $kappa$, θ and ϱ. Minkowski spacetimes, and their deformation of the symmetries.

Time: 11:30 – 12:10
Speaker: O'Connor, Denjoe (Dublin Institute for Advanced Studies)
Title: Lessons from Matrix Models on the confining/de-confining phase transitions of gauge theories
Abstract: I will discuss the confining/deconfining phase transition in gauged matrix models.

Time: 12:10 – 12:50
Speaker: Martinetti, Pierre (Università di Genova & INFN)
Title: Wick rotation in noncommutative geometry from torsion
Abstract: The twist of the spectral triple of the Standard Model generates a torsion term, that induces a transition from the Euclidean to the Lorentzian signature.

Time: 12:50 – 13:30
Speaker: Hersent, Kilian (IJClab, France)
Title: UV/IR mixing for ϕ^4 theory on Lie algebra-type noncommutative space-times
Abstract: We study ϕ^4 theory on noncommutative space-times with Lie algebra-type noncommutativity of coordinates. The bracket of coordinates is kept of general form. Thus, we go to momentum space to study the one-loop behaviour of the theory. The planar diagram turns out to have the same behaviour as the commutative ones. The non-planar diagram shows a deformed version of the conservation of momentum. This deformation is the one generating the UV/IR mixing in κ-Minkowski, ρ-Minkowski and even Moyal.

Time: 16:00 – 16:40
Speaker: Rivasseau, Vincent (Université Paris-Saclay)
Title: Random tensor and stochastic analysis
Abstract: I shall present an overview of random tensors. Then I shall present a stochastic analysis approach to tensor field theories in a constructive spirit.

Time: 16:40 – 17:20
Speaker: Kovacik, Samuel (Comenius University Bratislava)
Title: The Fuzzy Onion
Abstract: We propose a matrix realisation of a three-dimensional quantum space. It has an onion-like structure composed

of concentric fuzzy spheres of increasing radius. The angular part of the Laplace operator is inherited from that of the fuzzy sphere. The radial part is constructed using operators that relate matrices of various sizes using the matrix harmonic expansion. As an example of this approach, we produce a numerical simulation of a scalar field theory, the heat transfer, study the hydrogen atom, and consider some analytical aspects of the scalar field theory on this space.

Time: 17:50 – 18:30
Speaker: Asano, Yuhma (University of Tsukuba)
Title: Perturbative superstring theory and the IKKT matrix model
Abstract: In this talk, we revisit the "derivation" of the IKKT matrix model from perturbative string theory and discuss how we should define the path integral of the matrix model. In course of the "derivation," we will see that kappa symmetry is formally enhanced and that there is a subalgebra of the gauge symmetry closed off-shell, in sharp contrast to the fact that the kappa symmetry in the Nambu-Goto/Polyakov-type Green-Schwarz formalism is closed only on-shell. This allows us to utilise the BRST quantisation for the perturbative superstring and provides a construction of vertex operators in the matrix model.

Time: 18:30 – 19:10
Speaker: Scala, Luca (University of Wroclaw)
Title: Bicrossproduct structure of rho-Poincaré and the associated star-product

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2.2 Wednesday, September 20, 2023

Time: 9:00 – 9:40
Speaker: Nishimura, Jun (KEK, SOKENDAI)
Title: 1/D expansion and the emergent space-time in the Lorentzian type IIB matrix model
Abstract: The type IIB matrix model is a promising candidate for a nonperturbative definition of superstring theory. The Lorentzian version, however, is not well defined as it is, and it was recently proposed to introduce a Lorentz invariant mass term in the action as an IR regulator. Numerical studies of the model thus regularized suggest the possibility of the emergence of (3+1)-dimensional expanding space-time. Here we investigate the same model except for omitting fermions by the 1/D expansion and investigate the emergent space-time analytically at N=2.

Time: 9:40 – 10:20
Speaker: Hirasawa, Mitsuaki (INFN Milano-Bicocca)
Title: The effects of SUSY on the emergent spacetime in the Lorentzian type IIB matrix model
Abstract: The Lorentzian type IIB matrix model is a promising candidate for a nonperturbative formulation of superstring theory. Recently we have performed complex Langevin simulations by adding a Lorentz invariant mass term as an IR regulator, and found that (1+1)-dimensional spacetime appears when the fermionic contribution is omitted. In this talk, we will show the results obtained by simulations including fermionic contribution, and discuss how the (3+1)-dimensional spacetime emerges in the Lorentzian type IIB matrix model.

Time: 10:20 – 11:00
Speaker: Tsuchiya, Asato (Shizuoka University)
Title: Renormalization group and quantum error correction
Abstract: Tensor network models (MERA, HaPPY code, random tensor network, etc.) are considered as giving networks that can be interpreted as discrete bulk geometry emerging from a boundary theory through quantum entanglement. It is needed to construct a continuum analog of tensor network to obtain continuum bulk geometry. The scale dependence of a wave functional is expected to give such a continuum network. It has also been discussed that quantum error correction plays a crucial role in the correspondence between bulk and boundary. In this talk, we derive an exact renormalization group equation that can determine the scale dependence of wave functionals and discuss the structure of quantum error correction in continuum networks.

Time: 11:30 – 12:10
Speaker: Watanabe, Hiromasa (YITP, Kyoto U)
Title: Toward the application of large-N deconfinement to SU(N=3) QCD
Abstract: It is generally known for U(N) gauge theory at finite temperature that phase transitions are manifested by taking the large-N limit. Since the large-N theory undergoes two thermodynamic phase transitions, a nontrivial intermediate

phase can be realized in addition to the phases classified as the conventional confined and deconfined phases. In this talk, we discuss that a similar picture can be applied to QCD with N=3. In particular, we analyze the gauge configurations of lattice QCD calculations involving dynamical quarks and show the results of an analysis of the deviation due to finite-temperature effects from the Haar randomness expected at zero temperature in SU(N) gauge theory, using physical pictures suggested by the large-N theory.

Time: 12:10 – 12:50
Speaker: Tekel, Juraj (Comenius University, Bratislava)
Title: Correlation functions in fuzzy scalar field theories
Abstract: Non-commutative field theories have very different properties from their commutative counterparts thanks to their non-local interactions. This difference moreover survives the commutative limit due to the UV/IR-mixing phenomenon. This situation is quite well understood for the spontaneous symmetry breaking patterns in the phi-4 scalar field theory, which has been analyzed numerically and analytically using the matrix model description of the system. We build on this work to analyze the properties of the correlation functions in this theory, which have been previously explored numerically. Also here, different properties – namely different critical exponents at the phase transition – have been observed. We also analyze the GW model, described as a matrix model using the truncated Heisenberg algebra, where the UV/IR-mixing is not present.

Time: 16:00 – 16:40
Speaker: Sato, Matsuo (Hirosaki University)
Title: String Geometry Theory and The String Vacuum
Abstract: String geometry theory is a candidate of the non-perturvative formulation of string theory. In this theory, strings constitute not only particles but also the space-time. In this talk, we identify perturbative vacua and fix backgrounds to them, and derive the path-integrals of all order perturbative strings on the corresponding string backgrounds by considering the fluctuations around the vacua. On the other hand, the most dominant part of the path-integral of string geometry theory is the zeroth order part in the fluctuation of the action, which is obtained by substituting the perturbative vacua to the action. This part is identified with the effective potential of the string backgrounds and obtained explicitly. The global minimum of the potential is the string vacuum. The urgent problem is to find the global minimum and we introduce both analytical and numerical methods. Especially, we analyze the potential when we assume the torus compactification as the simplest approximation. As a result, we find that the potential is bounded below and has a global minimum where non-trivial fluxes are determined. This fact supports that our approach is right.

Time: 16:40 – 17:20
Speaker: Flood, Keegan (UniDistance Suisse)
Title: Principal symbols in noncommutative geometry
Abstract: We construct an N-indexed family of endofunctors on the category of left modules over a unital associative algebra equipped with a differential calculus. These jet functors give rise to a category of linear differential operators between left modules which satisfy many properties one might expect, and in particular most maps which are expected to be differential operators (connections, differentials, partial derivatives, Spencer operators), indeed are. We also discuss principal symbols, representability, vector fields, and Lie brackets in this setting. Principal symbols will be shown to play a key role in the construction of the Lie bracket. This is joint work with M. Mantegazza and H. Winther.

Time: 17:50 – 18:30
Speaker: Dolan, Brian (School of Theoretical Physics, Dublin Institute for Advanced Studies)
Title: The fractional quantum Hall effect on a sphere and the Atiyah-Patodi-Singer index theorem

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Time: 18:30 – 19:10
Speaker: Nieuviarts, Gaston (DIMA (Genova))
Title: Spectral triple-based Noncommutative Gauge Field Theories on AF-algebras
Abstract: Non-commutative geometry (NCG) provided a powerful framework for the reformulation of the Standard Model of Particle Physics (SMPP), taking into account general relativity, in a single "geometric" representation. This talk intends to present a method, recently developed by Thierry Masson and myself, which proposes a general scheme to elaborate Grand Unified Theories in the framework of NCG. This concerns the study of Non-Commutative Gauge Field Theories based on a special kind of inductive sequence of algebras: approximately finite C*-algebras (AF-algebras), using spectral triples technics. Particular attention will be given to highlighting how the Lie algebra of a particular step of the AF algebra sequence is immersed in the Lie algebra of the next step, while showing how the associated gauge theories are related.

2.3 Thursday, September 21, 2023

Time: 9:00 – 9:40
Speaker: Kowalski-Glikman, Jerzy (University of Wroclaw, NCNR Warsaw)
Title: Why there is (almost) noting rather than something?
Abstract: In my talk I will first briefly recall what the cosmological constant problem is. Then I will present a new approach to this problem based on a regularized count of vacuum states in phase space. Bounding this number with entropy of de Sitter universe one obtains an upper bound on the value of cosmological constant which agrees with the present observation. The talk is based on our recent papers Phys.Rev.D 107 (2023) 12, 126016 • e-Print: 2212.00901 [hep-th] and 2303.17495 [hep-th].

Time: 9:40 – 10:20
Speaker: Ramgoolam, Sanjaye (Queen Mary, University of London)
Title: Classical and quantum detection of high dimension states in AdS/CFT holography
Abstract: Half-BPS states in N = 4 SYM with sufficiently large dimension correspond to giant gravitons or LLM geometries in the bulk gravitational spacetime. The identification of the gravity states through the measurement of the multi-pole moments of the gravity fields motivates the definition of a projector identification task in associative algebras, specifically centres of symmetric group algebras. The complexity of the task depends on structural properties of the centre of the group algebra of the symmetric group of permutations of n distinct objects. The structural properties are captured by a number sequence k*(n) which has been obtained computationally up to n = 80. Based on a heuristic estimate for k*(n) at large n it is shown that the quantum complexity of the task, computed using the standard quantum phase estimation technique in quantum computation, grows polynomially with n. The complexity of the state identification on the gravity side using the measurement of the values of the classical fields and a classical Fast Fourier transform also grows polynomially with n. The precise rules for these classical/quantum comparisons of complexity motivated by AdS/CFT remain to be clarified and the present results for the half-BPS sector provide a concrete setting for these discussions. The corresponding projector detection tasks for other algebras related to symmetric groups, relevant to large N multi-matrix and tensor models, are related to Littlewood-Richardson coefficients and Kronecker coefficients. The talk is based on the paper "The quantum detection of projectors in finite-dimensional algebras and holography" (e-Print:2303.12154 [quant-ph] and JHEP 05 (2023) 191) with Joseph Bengeloun.

Time: 10:20 – 11:00
Speaker: Iorio, Alfredo (Charles University, Prague)
Title: Classical gravitational anomalies of Liouville theory
Abstract: I will show that for classical Liouville field theory, diffeomorphism invariance, Weyl invariance and locality cannot hold together. This is due to a genuine Virasoro center, present in the theory, that leads to an energy-momentum tensor with non-tensorial conformal transformations, in flat space, and with a non-vanishing trace, in curved space. Our focus is on a field-independent term, proportional to the square of the Weyl gauge field that makes the action Weyl-invariant and was disregarded in previous investigations of Weyl and conformal symmetry. We show this term to be related to the classical center of the Virasoro.

Time: 11:30 – 12:10
Speaker: Kurkov, Maxim (University of Naples "Federico II")
Title: Lie-Poisson gauge theories and k-Minkowski electrodynamics
Abstract: We consider a Poisson gauge theory with a generic Poisson structure of Lie algebraic type. We prove an important identity, which allows to obtain simple and manifestly gauge-covariant expressions for the Euler-Lagrange equations of motion, the Bianchi and the Noether identities. We discuss the non-Lagrangian equations of motion, and apply our findings to the k-Minkowski case. We construct a family of exact solutions of the deformed Maxwell equations in the vacuum. In the classical limit, these solutions recover plane waves with left-handed and right-handed circular polarization, being classical counterparts of photons. The deformed dispersion relation appears to be nontrivial.

Time: 12:10 – 12:50
Speaker: Prekrat, Dragan (University of Belgrade)
Title: (Non)renormalizable noncommutativity in (non)uniform phase
Abstract: In this talk we will discuss how renormalizability is related to the extent of the striped phase in noncommutative theories. As an example, we will consider the matrix version of the Grosse-Wulkenhaar model on truncated Heisenberg space and present our recent numerical and analytical results on the structure of its phase diagram. Finally, we will see how these results might help in the formulation of a renormalizable gauge model on noncommutative space.

Time: 12:50 – 13:30
Speaker: Bortolotti, Nicola (Sapienza University of Rome)
Title: Probing space-time non-commutativity through Pauli exclusion principle
Abstract: Non-commutative geometries may entail the deformation of the space-time symmetries both at the algebra and at the co-algebra levels. On a phenomenological ground the latter eventuality is very appealing, as it is naturally connected to possible violations of the Pauli exclusion principle. After discussing the motivations behind this prediction, I will show how experimental observations are constraining and also excluding several models of non-commutative space-times.

2.4 Friday, September 22, 2023

Time: 9:00 – 9:40
Speaker: Bonechi, Francesco (INFN Firenze)
Title: Equivariant extension of abelian Yang Mills theory

Time: 9:40 – 10:20
Speaker: Jurco, Branislav (Charles University, Prague)
Title: Double Copy from Tensor Products of Metric BV-box algebras
Abstract: Field theories with kinematic Lie algebras, such as field theories featuring colour-kinematics duality, possess an underlying algebraic structure known as BV-box algebra. If, additionally, matter fields are present, this structure is supplemented by its module. We explain this perspective, expanding on our previous work. We also show how the tensor product of two metric BV-box algebras yields the action of a new syngamy field theory, a construction which comprises the familiar double copy construction and provide examples. More generally, we touch the topic od kinematic L-infinity algebras.

Time: 10:20 – 11:00
Speaker: Dimitrijevic Ciric, Marija (University of Belgrade)
Title: Advances in quantization of braided noncommutative field theories
Abstract: We discuss braided (quantum) field theories and their BV (algebraic) quantization. We use the homological (L-infinity algebra) description and the homological perturbation theory. Examples of scalar field theories in 4 and in 6 dimensions are presented and their renormalizability properties are analyzed. The obtained results are compared with the results already present in the literature.

Time: 11:30 – 12:10
Speaker: Fioresi, Rita (Università di Bologna)
Title: Quantum differential calculus on quantum principal bundles on projective bases
Abstract: In this talk we give a sheaf theoretic definition of quantum differential calculus which enables us to consider also the case of quantum calculi on quantum principal bundles over projective bases. Key examples are examined and discussed. This is a joint work with Aschieri (Uniupo), Latini (Unibo), Weber (Unibo).

Time: 12:10 – 12:50
Speaker: Platania, Alessia (Perimeter Institute for Theoretical Physics)
Title: Asymptotic constraints on quantum black holes
Abstract: We tackle the question of whether regular black holes or other alternatives to the Schwarzschild solution can arise from an action principle in quantum gravity. Focusing on an asymptotic expansion of such solutions and inspecting the corresponding field equations, we demonstrate that their realization within a principle of stationary action would require either fine-tuning, or strong infrared non-localities in the gravitational effective action. We will also show that the black hole entropy of theories displaying such infrared non-localities diverge. The principle of least action and the consistency of Wald entropy thus yield non-trivial asymptotic constraints on the metric of quantum black holes.

Time: 16:00 – 16:40
Speaker: Arzano, Michele (Università di Napoli "Federico II")
Title: Entanglement entropy and horizon temperature in conformal quantum mechanics
Abstract: The generators of radial conformal symmetries in Minkowski space-time can be put in correspondence with generators of time evolution in conformal quantum mechanics. Within this correspondence I show that in conformal quantum mechanics the state corresponding to the inertial vacuum for a conformally invariant field in Minkowski

spacetime has the structure of a thermofield double. The latter is built from a bipartite "vacuum state" corresponding to the ground state of the generators of hyperbolic time evolution. These can evolve states only within a portion of the time domain. When such generators correspond to conformal Killing vectors mapping a causal diamond in itself and generators of dilations, the temperature of the thermofield double reproduces, respectively, the diamond temperature and the Milne temperature found for massless fields in Minkowski spacetime. Moreover we calculate the entanglement entropy associated to the thermofield double states and obtain a UV divergent logarithmic behaviour analogous to known results in two-dimensional conformal field theory in which the entangling boundary is point-like.

Time: 16:40 – 17:20
Speaker: Franchino-Vinas, Sebastian (Helmholtz-Zentrum Dresden-Rossendorf)
Title: Quantum Field Theory in Snyder spaces
Abstract: We review how to build a self-interacting scalar quantum field theory in Snyder spaces and generalizations thereof. Analyzing the one-loop renormalization of the model, we derive some phenomenological consequences on the H_0 tension.

Time: 17:50 – 18:30
Speaker: Borowiec, Andrzej (Wroclaw University)
Title: Quantum deformations of BMS algebras

Time: 18:30 – 19:10
Speaker: Bukor, Benedek (Comenius University)
Title: A less commutative version of quarkonium masses
Abstract: Quarkonium bound states are especially promising candidates to test the probable quantum structure of space-time, since they represent a system with reasonably small characteristic distance. The quantum mechanical interaction between the quarks is heuristically described by the Cornell potential. Here, we insert this system in a 3-dimensional rotationally invariant space which is composed of concentric fuzzy spheres of increasing radius called the fuzzy onion in order to extract some consequences of the non-trivial structure on its properties. The talk will be based on joint work with Juraj Tekel, arXiv:2209.09028.

2.5 Saturday, September 23, 2023

Time: 9:00 – 9:40
Speaker: Berenstein, David (University of California at Santa Barbara)
Title: Staggered bosons and Kahler-Dirac bosons
Abstract: I will describe a novel way to think about bosonic lattice theories in Hamiltonian form where each lattice site has only a half boson degree of freedom. The construction requires a non-trivial Poisson bracket between neighboring sites. I will also describe a bosonic version of Kalher-Dirac fermions, dubbed Kahler-Dirac bosons that can be done on any triangulation of a manifold. This also leads to a straightforward implementation of supersymmetry on the lattice and one immediately deduces the Dirac equation of the corresponding Kahler-Dirac fermions..

Time: 9:40 – 10:20
Speaker: Cederwall, Martin (Chalmers Univ. of Technology)
Title: The teleparallel complex
Abstract: We formalise the teleparallel version of extended geometry (including gravity) by the introduction of a complex, the differential of which provides the linearised dynamics. The main point is the natural replacement of the two-derivative equations of motion by a differential which only contains terms of order 0 and 1 in derivatives. Second derivatives arise from homotopy transfer (elimination of fields with algebraic equations of motion). The formalism has the advantage of providing a clear consistency relation for the algebraic part of the differential, the "dualisation", which then defines the dynamics of physical fields. It remains unmodified in the interacting BV theory, and the full non-linear models arise from covariantisation. A consequence of the use of the complex is that symmetry under local rotations becomes as good as manifest, instead of arising for a specific combination of tensorial terms, for less obvious reasons.

Time: 10:20 – 11:00
Speaker: Skvortsov, Evgeny (UMONS)
Title: Noncommutative geometry and higher spin gravity/symmetry

Abstract: I will talk about two recent advances in the study of higher spin symmetries and their relation to noncommutative geometry: 1) Chern-Simons vector models are linked by the three-dimensional bosonization duality and, at least in the large-N limit, the duality can be explained by a new type of a symmetry — slightly-broken higher spin symmetry, whose mathematical implementation is via a certain A/L-infinity algebra; 2) gauging higher spin symmetry leads to toy models of quantum gravity, higher spin gravities. I will review the basic features of chiral higher spin gravity, the A/L-infinity algebra that underlies it; show how the structure maps are related to Grassmannian and the A/L-infinity relations can be proven via Stokes theorem in analogy with Kontsevich formality theorem.

Time: 11:30 – 12:10
Speaker: Fiore, Gaetano (Università di Napoli "Federico II", and INFN, Sezione di Napoli)
Title: Twisted (anti-)de Sitter spaces

Time: 12:10 – 12:50
Speaker: Hassler, Falk (University of Wroclaw)
Title: Supergeneralized geometry and dualities
Abstract: Generalized Geometry has become a powerful tool to study solutions of supergravity and their transformation under duality symmetries of string and M-theory. Its success originates from unifying all bosonic symmetries, consisting of diffeomorphisms and form-field gauge transformations. This idea can be pushed further by including supersymmetry to obtain supergeneralized geometry. After reviewing its salient features, I show how it captures fermionic T-dualities and allows to describe integrable superstrings (called eta- and lambda-deformation) without the ambiguities one faces in generalized geometry.

Time: 12:50 – 13:30
Speaker: Osten, David (University of Wroclaw)
Title: On exceptional QP-manifolds
Abstract: This talk will discuss two topics in mathematical physics and their connection: namely tensor hierarchies (which arise in gauged supergravities, or more generally, when one tries to formulate Leibniz gauge theories) and certain differential graded manifold, namely QP-manifolds that come up for example in the AKSZ-construction. The connection between two recent descriptions of tensor hierarchies – namely, infinity-enhanced Leibniz algebroids, given by Bonezzi & Hohm and Lavau & Palmqvist, and the p-brane QP-manifolds constructed by Arvanitakis – is made precise. This is done by presenting a duality-covariant version of latter.

Time: 16:00 – 16:40
Speaker: Boffo, Eugenia (Comenius University Bratislava)
Title: Gauge theories from spinning particles
Abstract: A spinning particle is a classical, relativistic particle with a supersymmetric worldline. Upon first quantization, its first quantized states are either spinors, fulfilling the Dirac equation, or a set of forms satisfying some differential equations. When N=2 and a convenient subspace is selected, these turn into Maxwell or Yang-Mills fields equations. In this talk I will address two points. First, the physical states can be counted by direct computation and by the Hilbert series. In second place, I will describe how the background fields can be constrained.

Time: 16:40 – 17:20
Speaker: Vysoky, Jan (Czech Technical University)
Title: Graded Jet Geometry
Abstract: We start by a general graded vector bundle over a general graded manifold and show how one can define differential operators on its sheaf of sections. This can be used to define graded jet bundles. One must avoid the traditional fiber-wise construction to do so. Instead, we show how everything can be done on the level of sheaves of its sections. All necessary notions from graded geometry are recalled.

Time: 17:50 – 18:30
Speaker: Valach, Fridrich (Imperial College London)
Title: Generalised geometry for the group E_7
Abstract: Various aspects of string theory (especially those pertaining to its massless sector) can be conveniently described using the so-called generalised geometry. Embedding the setup into the framework of Courant algebroids, one obtains in addition a useful handle for the study of dualities. The corresponding story in the case of (reductions of) M-theory, called exceptional generalised geometry due to the presence of exceptional U-duality groups, is much less developed. Only recently it was understood what is the right generalisation of Courant algebroids in this context. However, due to

issues related to the dual graviton, this understanding works only for groups with rank<7. I will describe what is the relevant type of structure for the case n=7, and how it relates to the Poisson-Lie U-duality and consistent truncations of M-theory.

Time: 18:30 – 19:10
Speaker: Mori, Haruka (Kitasato University)
Title: Doubled Structures of Algebroids in Gauged Double Field Theory
Abstract: Double field theory (DFT) is an effective theory of string theory. It has a manifest symmetry of T-duality. The gauge symmetry in DFT is related to some kind of algebroid structures, and they have a doubled structure. In this talk, we focus on the gauge algebra of the O(D, D + n) gauged DFT and discuss an extension of the doubled structure. The gauge algebra of the O(D, D + n) gauged DFT has been described by the twisted C-bracket. This bracket is related to some algebroid structures. We show that algebroids defined by the twisted C-bracket in the gauged DFT are built out of a direct sum of three (twisted) Lie algebroids. They exhibit a "triple", which we call the extended double, rather than a "double" structure. We also consider the geometrical realization of these structures in a (2D+n)-dimensional manifold.

2.6 Sunday, September 24, 2023

Time: 9:00 – 9:40
Speaker: Castellani, Leonardo (Universita' del Piemonte Orientale and INFN)
Title: Quantum histories and entropy of temporal entanglement

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Time: 9:40 – 10:20
Speaker: Bieliavsky, Pierre (Universite Catholique de Louvain)
Title: TBA

Time: 10:20 – 11:00
Speaker: Liu, Chengcheng (Queen Mary University of London)
Title: Quantum Kaluza-Klein Theory with M2(C)
Abstract: Following steps analogous to classical Kaluza-Klein theory, we solve for the quantum Riemannian geometry(QRG) on tensor product algebra C^\infty(M)\tens M2(C). Fixing a standard form of quantum metric on M2(C), we show that the cross term of metric amounts to a 1-form Aμ on M, which we regard as like a gauge-fixed background field. We show in this case that a real scalar field on the product algebra with its noncommutative Laplacian decomposes on M into two real neutral fields and one complex charged field minimally coupled to Aμ. We show further that the quantum Ricci scalar on the product decomposes into a classical Ricci scalar on M, the Ricci scalar on M2(C), the Maxwell action of Aμ and a higher order term. Another solution of the QRG on the product has Aμ=0 and a dynamical real scalar field φ on M which imparts mass-splitting to some of the components of a scalar field on the product.

Time: 11:30 – 12:10
Speaker: Iseppi, Roberta (Gottingen U)
Title: Towards the BV formalism for gauge theories on noncommutative manifolds
Abstract: The Batalin - Vilkovisky (BV) formalism was first introduced to face the problem of the appearance of divergences when trying to quantise a gauge theory via a perturbative approach to the path integral computation. In this talk we will outline a possible approach to the description of this formalism in the context of spectral triples. After a brief introduction to the BV formalism, we will present some results for the case of gauge theories induced by finite spectral triples.

Time: 12:10 – 12:50
Speaker: Segreto, Sebastiano (University of Rome "La Sapienza")
Title: Non-commutative GUP quantization and application to minisuperspace models
Abstract: In this work, we examine a GUP theory that represents one of the most general formulations satisfying the Jacobi identity. This formulation can be seen as an extension of the original theory, which is derived from the modified uncertainty principle in accordance with the low energy limit of String theory. Firstly, we demonstrate that a natural formulation of the theory in an infinite momentum space does not result in the emergence of a non-zero minimal uncertainty in position. Subsequently, we develop a truncated formulation of the theory in momentum space, proving that only in this case we can recover the desired feature of the presence of a non-zero minimal uncertainty in position. Both

formulations are implemented in a two-dimensional context, where non-commutativity naturally arises in the coordinate operators. We comprehensively investigate various "geometric" quantities, the minimization of which holds physical significance and the relative "maximally localized states" as meaningful objects used to recover localization information. Then we apply the developed machinery to a simple cosmological model, to describe its behavior and explore the novel effects arising from GUP quantization.

Time: 12:50 – 13:30
Speaker: Rist, Dominik (Heriot-Watt University)
Title: Non-abelian gerbes with connections in higher gauge theory

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Time: 13:30 – 14:10
Speaker: Reyes-Lega, Andres Fernando (Universidad de los Andes)
Title: Renormalization on the DFR Quantum Spacetime
Abstract: An approach to renormalization of scalar fields on the Doplicher-Fredenhagen-Roberts (DFR) quantum spacetime is presented. The effective non-local theory obtained through the use of states of optimal localization for the quantum spacetime is reformulated in the language of (perturbative) Algebraic Quantum Field Theory. The structure of the singularities associated to the non-local kernel that codifies the effects of noncommutativity is analyzed using the tools of microlocal analysis (joint work with Juan F. Lopez). Ref: arXiv:2302.09386 [math-ph]
