The 8th Mandelstam Theoretical Physics School and Workshop and 34th Chris Engelbrecht Summer School 2026

January 8 - 14, 2026
NITheCS, Merensky Building, Stellenbosch University, Stellenbosch, South Africa

Schedule of Program

	Jan8	Jan 9	Jan 12	Jan 13	Jan 14
	Thursday	Friday	Monday	Tuesday	Wednesday
9:00 - 9:15	Coffee/Tea	Coffee/Tea	Coffee/Tea	Coffee/Tea	Coffee/Tea
9:15 - 9:30	Welcome Remarks	Coffee/Tea	Coffee/Tea	Coffee/Tea	Coffee/Tea
9:30 - 9:45	Di Pietro	Di Pietro	Papageorgakis	Papageorgakis	Zhou
9:45 - 10:00	Di Pietro	Di Pietro	Papageorgakis	Papageorgakis	Zhou
10:00 - 10:15	Di Pietro	Di Pietro	Papageorgakis	Papageorgakis	Zhou
10:15 - 10:30	Di Pietro	Di Pietro	Papageorgakis	Papageorgakis	Zhou
10:30 - 10:45	Coffee/Tea	Coffee/Tea	Coffee/Tea	Coffee/Tea	Coffee/Tea
10:45 - 11:00	Coffee/Tea	Coffee/Tea	Coffee/Tea	Coffee/Tea	Coffee/Tea
11:00 - 11:15	Kim	Kim	Kim	De Mello Koch	Anous
11:15 - 11:30	Kim	Kim	Kim	De Mello Koch	Anous
11:30 - 11:45	Kim	Kim	Kim	De Mello Koch	Anous
11:45 - 12:00	Kim	Kim	Kim	De Mello Koch	Anous
12:00 - 12:15	Basu	Zoubos	Longia	Van Leuven	Van Zyl
12:15 - 12:30	Basu	Zoubos	Longia	Van Leuven	Van Zyl
12:30 - 13:00	Lunch/Discussions	Lunch/Discussions	Lunch/Discussions	Lunch/Discussions	Lunch/Discussions
13:00 - 14:00	Lunch/Discussions	Lunch/Discussions	Lunch/Discussions	Lunch/Discussions	Lunch/Discussions
14:00 - 14:15	Jevicki	Zhou	Anous	Zhou	Free Time/ Discussions
14:15 - 14:30	Jevicki	Zhou	Anous	Zhou	
14:30 - 14:45	Jevicki	Zhou	Anous	Zhou	
14:45 - 15:00	Jevicki	Zhou	Anous	Zhou	
15:00 - 15:15	Coffee/Tea	Coffee/Tea	Coffee/Tea	Coffee/Tea	
15:15 - 15:30	Rodrigues	Di Pietro	Papageorgakis	Anous	
15:30 - 15:45	Rodrigues	Di Pietro	Papageorgakis	Anous	
15:45 - 16:00	Rodrigues	Di Pietro	Papageorgakis	Anous	
16:00 - 16:15	Rodrigues	Di Pietro	Papageorgakis	Anous	
16:15 - 16:30	Free Time/ Discussions	Free Time/ Discussions	Free Time/ Discussions	Free Time/ Discussions	
16:30 - 16:45					
17:00 - 21:00					Dinner

Titles and Abstracts of Talks

Lorenzo Di Pietro (Trieste University, Italy)	
Pedagogical Lecture 1	Title: QFT in AdS: Kinematics
	Abstract: AdS geometry: bulk and boundary; Isometry constraints on correlation functions; Bulk state / Boundary operator correspondence; Boundary operator product expansion
Lorenzo Di Pietro (Trieste University, Italy)	
Pedagogical Lecture 2	Title: QFT in AdS: Dynamics
	Abstract: OPE decomposition of bulk 2 pt functions and boundary 4pt functions; Example of the free scalar; Example of the O(N) model: various phases and their boundary interpretation.
Lorenzo Di Pietro (Trieste University, Italy)	
Research Seminar	Title: The AdS perspective on Confinement
	Abstract: I will discuss four dimensional non-abelian gauge theories in the background of Anti-de Sitter space. I will review how, imposing a Dirichlet boundary condition at small radius, there is a deconfinement/confinement transition as the radius is increased, while imposing a Neumann boundary condition a continuous extrapolation to the flat space limit is expected. I will then review recent investigations of this setup using both perturbation theory and nonperturbative methods.
Seok Kim (Seoul National University, China)	
Pedagogical Lecture 1	Title: Hairy black holes in AdS
	Abstract: I will talk about the black hole instabilities in AdS and the new hairy black hole configurations which we suggest to be the endpoints. Based on these findings, I will suggest better pictures on the spectral/ entropic structures of the AdS quantum gravity.
Seok Kim (Seoul National University, China)	
Pedagogical Lecture 2	Title: Black hole microstates from cohomologies and their applications
	Abstract: I will explain the cohomology program for the BPS black hole states in AdS/CFT. After explaining its general structures and examples, I will explain how to better understand the hairy BPS black hole states in this setup.
Seok Kim (Seoul National University, China)	
Research Seminar	Title: BPS phases and fortuity in ABJ higher spin holography
	Abstract: I will explain the large N BPS phases of the ABJ vector Chern-Simons model dual to a higher spin gravity, from the saddle points of its index. Their physical aspects are discussed from the viewpoint of trace relations and fortuitous operators. I will compare them with the AdS string theory and its black holes.

Costis Papageorgakis (Queen Mary University London, UK)	
Pedagogical Lecture 1	Title: The Conformal Bootstrap at Zero Temperature
	Abstract: I will introduce conformal field theories and the constraints imposed by conformal symmetry on correlation functions. After discussing primary operators, the operator product expansion, and conformal blocks, I will present the crossing equation for four-point functions. I will explain how unitarity – which guarantees positivity of OPE coefficients squared– enables the linear functional method to extract rigorous, non-perturbative bounds on CFT data.
Costis Papageorgakis (Queen Mary University London, UK)	
Pedagogical Lecture 2	Title: Finite Temperature CFT and Neural Networks
	Abstract: I will introduce CFTs at finite temperature, where the KMS condition replaces crossing symmetry as the central consistency constraint. Unlike at zero temperature, thermal OPE coefficients can have either sign, invalidating the linear functional approach. I will discuss neural networks as universal function approximators and explain how physics-informed neural networks (PINNs) can enforce the KMS condition directly. This sets the stage for the deep bootstrap framework presented in the main seminar.
Costis Papageorgakis (Queen Mary University London, UK)	
Research Seminar	Title: Deep Finite Temperature Bootstrap
	Abstract: We introduce a novel method to bootstrap crossing equations in Conformal Field Theory and apply it to finite temperature theories on S1×Rd−1. Traditional bootstrap approaches relying on positivity constraints or truncation schemes are not applicable to this problem. Instead, we capture infinite towers of operators using suitable tail functions, which are bootstrapped numerically together with explicit CFT data. Our method employs three key ingredients: the Kubo-Martin-Schwinger (KMS) condition, thermal dispersion relations, and Neural Networks that model spin-dependent tail functions. We test the method on Generalized Free Fields and apply it to bootstrap double-twist thermal data in holographic CFTs.
Xinan Zhou (Shanghai Technical University, KITP - UCAS, China)	
Pedagogical Lecture 1	Title: Holography, bootstrap and defects
	Abstract: In this series of lectures (and seminar) I will cover the following. I will discuss the basics of perturbation theory in AdS and how bootstrap ideas can be used to efficiently compute holographic correlators. The example of 4d N=4 SYM in the dual supergravity limit will be analyzed in detail. I will also discuss how the bootstrap approach can be extended to include holographic defects. In particular, I will present the recent progress on giant graviton correlators.
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Tarek Anous (Queen Mary University London, UK)	
Pedagogical Lecture 1	Title: QFT in dS: The basics
	Abstract: In this lecture we will introduce basic facts about QFT in de Sitter, highlighting the main differences with its flat-space counterpart. We will start by discussing the geometry of dS, its isometries, and the admissible particle representations. We will also discuss the maximally analytic vacuum of any interacting QFT: the Bunch Davies state.
Tarek Anous (Queen Mary University London, UK)	
Pedagogical Lecture 2	Title: QFT in dS: The Issues
	Abstract: The focus of this lecture will be on the various issues that arise when working with interacting QFTs on de Sitter using perturbation theory. Time permitting, we will also discuss the Euclidean approach to de Sitter QFT.
Tarek Anous (Queen Mary University London, UK)	
Research Seminar	Title: The case for integrability in dS
	Abstract: In this lecture we will present what can be learned from exactly solvable models on de Sitter, working through examples.
Joao Rodrigues (University of the Witwatersrand, South Africa)	
Research Seminar	Title: Large N Master Field Optimization for Multi-Matrix Systems
	Abstract: It is shown how large N properties of multi-matrix systems can be obtained by minimization of a loop truncated effective Hamiltonian expressed directly in terms of gauge invariant operators. The large N loop space constraints are handled by the use of master variables. For two and three massless Yang-Mills coupled matrices, highly accurate results for large N planar correlators, as well as spectrum, are presented. Generalization to larger number of matrices, relevant for systems such as BFSS, are discussed.
Antal Jevicki (Brown University, USA)	

Research Seminar	Title: Finiteness of Hilbert Space in Bi-Local Holography
	Abstract: Vector field theories, dual to Higher Spin gravity are considered at Finite N. In the collective field representation a reduction of Hilbert space is discussed with implications on finiteness of the Trace and Entropy in this holographic representation.
Robert de Mello Koch (HuZhou University, China)	
Research Seminar	Title: Secondary Invariants, trace relations and fermions
	Abstract: In this talk we describe the secondary invariants in bosonic vector models by employing a duality between bosonic and fermionic vector models. In this picture the set of bosonic secondary invariants are mapped, one-to-one, to the states of a fermionic bilinear color-singlet Hilbert space. We describe how the trace relations in the two descriptions are related.
Vamika Longia (IISER Mohali, India)	
Research Seminar	Title: Configurational Temperature Diagnostics for Lattice Gauge Theories
	Abstract: Built from the gradient and Hessian of the Euclidean action, a new temperature estimator for lattice gauge theories is being introduced. Drawing from geometric statistical methods, the estimator offers a gauge-invariant and momentum-free tool for checking thermodynamic consistency in Monte Carlo simulations. Rather than adjusting temperature indirectly through lattice size or coupling, this estimator pulls an effective temperature directly from field configurations. This allows for an independent evaluation of thermalization and sampling accuracy. In this work, the estimator is used with compact U(1) lattice gauge theories in one, two, and four dimensions. The measured temperatures are compared to input values across a wide range of couplings and lattice sizes. The method consistently produces target temperatures and is reliable against discretization effects and algorithmic artifacts. The estimator also acts as a tool to identify sampling defects, slow thermalization, and implementation errors in large-scale simulations. Future possibilities include extensions for non-Abelian gauge theories, anisotropic lattices, and inclusion in hybrid Monte Carlo workflows.
Pallab Basu (University of the Witwatersrand, South Africa)	
Research Seminar	Title: Diagonalization as RG
	Abstract: We investigate large-N spin models that parallel the Sachdev–Ye–Kitaev construction and provide a controlled setting for studying many-body chaos. By implementing a Pandey–Mehta–type large-N crossover, we interpolate between distinct random-matrix universality classes and track how spectral correlations evolve with the crossover parameter. Using the adjacent-level spacing r-ratio and Krylov complexity as complementary probes of static and dynamical chaos, we demonstrate a clear progression from weakly correlated spectra to fully developed quantum scrambling.
Jaco van Zyl (University of Cape Town, South Africa)	
Research Seminar	Title: Spread complexity in tensor product systems

	Abstract: Spread complexity can be solved for analytically in the case of simple Hamiltonians (i.e. Hamiltonians that are elements of some rank 1 algebra). For general Hamiltonians the Lanczos algorithm provides an algorithmic way to compute the Krylov basis and thus the spread complexity. A natural question to ask is what happens when one considers a Hamiltonian that is formed from a direct sum of subsystems for which the Krylov bases are known. In this talk I will discuss some general results that hold for such systems and under what conditions they simplify.
Sam van Leuven (University of the Witwatersrand, South Africa)	
Research Seminar	Title: Residue sums for superconformal indices
	Abstract: In this talk, I will present a method to evaluate superconformal indices of four-dimensional N=1 superconformal field theories in closed form. For the (1/8 BPS) Macdonald index of the N=4 SU(2) super Yang-Mills theory, the resulting expression manifests features of the BPS spectrum at non-zero Yang-Mills coupling. I will argue that the expression suggests the absence of "fortuitous" or non-graviton operators in this sector, which have been recently proposed as dual operators to (supersymmetric) black hole microstates in AdS5. If time permits, I will also discuss closed form expressions for the index in a simple subsector of the 1/16 BPS sector of the N=4 SU(N) theory for low values of N. For these cases, we are able to subtract off the "graviton index" from the full index, thus obtaining a closed form expression for the non-graviton index. The resulting expression reveals structural features of the non-graviton spectrum in this sector.
Konstantinos Zoubos (University of Pretoria, South Africa)	
Research Seminar	Title: Spin chains for general N=2 quivers
	Abstract: The mapping of the dilatation operator of planar N=4 SYM to an integrable spin chain has led to tremendous progress in understanding the spectrum of the theory, both perturbative and non-perturbative. Gauge theories will less supersymmetry have received less attention. In this talk I will review recent progress in understanding the spin chains for planar N=2 superconformal theories obtained by orbifolding N=4 SYM and then marginally deforming. Although these spin chains have not been shown to be integrable, they still have more structure than one would naively expect. I will discuss a range of techniques, including the Bethe ansatz and the superconformal index, which can be used to extract relevant information about the spectrum of these theories.