IQF 2019 Schedule

	Thursday	Friday
8:45 - 9:15 AM	Registration	
9:15 - 10:05 AM	Arkani-Hamed	Hanany
10:15 - 10:45 AM	Marinkovic	Howard
10:45 - 11:05 AM	Coffee	Coffee
11:05 - 11:55 PM	Schroers	Pachos
12:05 - 12:25 PM	Jubb	Ayeni
12:30 - 2:00 PM	Lunch	Lunch
2:00 - 2:50 PM	Taylor	Witek
3:00 - 3:20 PM	Pereira	Warbuton
3:25 - 3:45 PM	Usovitsch	Harte
3:50 - 4:10 PM	Coffee	Coffee
4:10 - 5:00 PM	Louko	O'Bannon
5:10 - 5:30 PM	Deelan Cunden	Kells
7:30 -	Dinner	

Titles and Abstracts

Speaker: Nima Arkani-Hamed

Title: Towards a common origin for quantum mechanics and spacetime

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Speaker: Babatunde Ayeni

Title: Phase diagrams of nonAbelian anyons.

Abstract: Non-Abelian anyons can exist as point-like particles in two-dimensional systems, and have particle exchange statistics which are neither bosonic nor fermionic. Like in spin systems, the role of fusion (Heisenberg-like) interactions between anyons has been well studied.

However, unlike our understanding of the role of bosonic and fermionic statistics in the formation of different quantum phases of matter, little is known concerning the effect of non-Abelian braid statistics. In my talk, I will show the role of braid statistics on a system of nonAbelian anyons using a system of two-legged ladder of Ising and Fibonacci anyons.

Speaker: Fabio Deelan Cunden

Title: Free fermions and α-determinantal processes

Abstract: Determinantal point processes were introduced in the '70s as a consistent description of non-interacting fermions in quantum mechanics. Determinantal processes arise naturally in several other settings, including eigenvalues of random matrices and nonintersecting paths. Another, perhaps not so well-known class of point processes are the so-called α-determinantal processes. Using the Gaussian case (harmonic oscillator) as paradigmatic example, I will illustrate a new limit procedure to construct α-determinantal processes out of excited states of free fermions. Joint work with Satya N. Majumdar and Neil O'Connell.

Speaker: Amihay Hanany

Title: Magnetic Quivers

Speaker: Abraham Harte

Title: Does geometric optics depend on geometry?

Abstract: If a high-frequency field is known to be compatible with a particular background metric, is it compatible with other metrics as well? In fact, the number of possibilities is enormous. For many observables, the class of allowed metrics involves seven free functions. Some of these functions may be identified with conformal and Kerr-Schild transformations, but there is much more besides. In asymptotically flat situations, supertranslations are one interesting example. Regardless, this implies that although geometric optics does depend on geometry, it does so only slightly.

Speaker: Mark Howard

Title: Fault-tolerant Quantum Computing

Abstract: Quantum computers can solve problems using fewer computational steps than their classical counterparts. In order to build a large device that can run these quantum algorithms, we must incorporate the principle of fault-tolerance i.e., we must make our computer behave reliably, even in the presence of imperfections affecting individual components. I will review some of the theoretical underpinnings of fault-tolerant quantum computing, and highlight some of the most promising approaches.

Speaker: Ian Jubb

Title: The problem of faster-than-light signals in QFT

Abstract: Unlike non-relativistic quantum mechanics, Quantum Field Theory (QFT) generically suffers from the problem of faster-than-light, or superluminal, signals when multiple measurements are made. In my talk I will illuminate in more detail how this problem arises, following Sorkin's general argument made in 1993. I will then go on to discuss recent work in which we explicitly realise this problem in a lattice model of fermionic QFT.

Speaker: Graham Kells

Title: Error generation and propagation in a Majorana based topological memory

Abstract: I will discuss quantum error correction and how it connects to a simple quantum memory based on topological superconductivity. I then review some recent results on internal error generation and propagation in such devices, distinguishing between errors that are detectable, at least in principle, and those that are not. If time permits I will also outline additional results that indicate that interaction-driven phase-errors will self-average to zero in the thermodynamic limit.

Speaker: Jorma Louko

Title: Waiting for Unruh

Abstract: How long does a uniformly accelerated observer need to interact with a quantum field in order to record thermality in the Unruh temperature? In the limit of large excitation energy, we show that the answer depends on whether (i) the switch-on and switch-off periods are stretched proportionally to the total interaction time T, or whether (ii) T grows by just stretching a plateau

in which the interaction remains at constant strength. Modelling an observer by a pointlike Unruh-DeWitt detector, coupled linearly to a massless scalar field in four spacetime dimensions and treated within first order perturbation theory, we show that a polynomial growth of T in the detector's energy gap E suffices in case (i) but not in case (ii), under mild technical conditions. These results limit the utility of the large E regime as a probe of thermality in time-dependent versions of the Hawking and Unruh effects, such as an observer falling into a radiating black hole. They may also have implications on the design of prospective experimental tests of the Unruh effect.

Based on arXiv:1605.01316 (published in Classical and Quantum Gravity)
with Christopher J Fewster and Benito A Juarez-Aubry.

Speaker: Marina Krstic Marinkovic

Title: Muon g-2: A Give-And-Take Between Theory and Experiment

Anomalous magnetic moment of the muon (muon g-2) is one of the most precisely measured quantities in particle physics. At the same time, it can be evaluated in the Standard Model with an unprecedented accuracy. The Muon g-2 experiment at Fermilab has started the major data collection and the aimed four-fold increase in precision will shed light on the current discrepancy between the theory prediction and the measured value. This renders a comparable improvement of the precision in the SM theory an essential ingredient in order to fully exploit the expected increase of precision in experimental results. For all these reasons, the muon g-2 is considered to be a great testing ground for new physics.

Hadronic contributions are the dominant sources of uncertainty in the theoretical prediction of the muon g-2. I will outline several promising approaches for a precise determination of the leading hadronic contribution to the muon g-2 using lattice gauge theories. I will then proceed with a discussion of a reciprocal effort to directly measure the hadronic contributions to the running of the fine structure constant proposed by the MUonE experiment at CERN. A hybrid strategy including both experimental and lattice data sets is expected to give an independent check of the dispersive results from e+e- annihilation, which dominate the current world average.

Speaker: Andy O'Bannnon

Title: Wilson Surface Central Charge from Holography

Abstract: M-theory is currently our best candidate for a theory of everything, but remains mysterious. We know M-theory has M2- and M5-branes. The low-energy theory on a stack of coincident M2-branes is well-understood: it is maximally supersymmetric Chern-Simons-matter

theory. However, the low-energy theory on a stack of coincident M5-branes remains poorly-understood: it is a maximally supersymmetric theory of self-dual strings with zero tension. In this talk I will discuss one type of probe of the M5-brane theory, namely self-dual strings with infinite tension. These play a role analogous to Wilson lines in gauge theories, but are two-dimensional surfaces rather than lines, and hence are called Wilson surfaces. I will describe holographic calculations of entanglement entropy associated with Wilson surfaces, from which we extract a key parameter characterizing them, namely their central charge. This provides a count of the number of massless degrees of freedom living on them, and thus may shed light on some of the fundamental degrees of freedom of M-theory. Along the way I will summarize recent developments in studying two-dimensional defects in conformal field theories more generally.

Speaker: Jiannis Pachos

Title: Interactions, integrability and quasiparticles in the extended XXZ model

Abstract: In this talk I will present the interaction distance, a diagnostic tool that helps to identify the short and long distance behaviour of interacting systems. As an example I will consider the extended XXZ model that is non-integrable and present how we can probe the size of its fermionic quasiparticles and the correlations between them. As an additional diagnostic tool I will introduce the integrability distance that quantifies how close the extended XXZ model is from being integrable and identifies the closest integrable model.

Speaker: Raul Pereira

Title: From conformal to p-integrals and back again

Abstract: In this talk I will explain how the symmetries of four-point conformal integrals allow us to fix the expansions of master two-point integrals. Then I will show how we can use those results for the OPE analysis of four-point correlators in N=4 SYM.

Speaker: Bernd Schroers

Title: A solvable model for magnetic skyrmions

Abstract:Magnetic skyrmions are topological solitons which occur in a large class of ferromagnetic materials and which are currently attracting much attention in the condensed matter community. The talk is about an integrable model for magnetic skyrmions, introduced in a recent paper (arxiv 1812.07268). Solutions can be written in terms of a fixed anti-holomorphic and an arbitrary holomorphic function. In the talk will explain the model and the geometry behind, and discuss some of the solutions.

Speaker: Marika Taylor

Title: Anomalous supersymmetry

Title: We show that supersymmetry is anomalous in N= 1 superconformal quantum field theories (SCFTs) with an anomalous R-symmetry. This anomaly was originally found in holographic theories: here we show that this anomaly is present in general and demonstrate it for the massless superconformal Wess-Zumino model via a one loop computation of four-point functions of two supercurrents with either R-currents. In fact, the Wess-Zumino consistency conditions together with the standard R-symmetry anomaly imply the existence of the anomaly. We outline the implications of this anomaly.

Speaker: Johann Usovitsch

Title: Integration-by-parts tackling multi-loop and multi-scale Feynman integrals

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Speaker: Niels Warburton

Title: Gravitational waves from near-extremal black holes

Speaker: Helvi Witek

Title: Strong gravity phenomena as probe for new physics

Abstract:
Despite the ever stronger observational support for general relativity (GR) as our standard model of gravity, open questions concerning, e.g., the nature of dark matter or the reconciliation of GR with quantum physics indicate the existence of a more fundamental theory of quantum gravity. While the exact theory is unknown, most candidate theories of quantum gravity predict modifications to GR. Black holes, and the gravitational wave signal emitted during their collision, provide a novel way to search for signatures of these underlying theories. To do so, however, requires accurate theoretical predictions of the waveforms, an undertaking that is still in its infancy. In this talk I will give a review on the latest progress in ``numerical relativity beyond GR''.