KMPB – Day

Monday March 1st 2021, 9:30-16:15

Zoom 620 6802 9070 Password 019929

9:30 Geometric recursion, old and new applications

Gaetan Borot*, *HU Berlin

I will explain the virtues of Mirzakhani-McShane identity – a partition of unity on the Teichmüller space of bordered surfaces, which is recursive in the Euler characteristic – and some of its refinements, which one can use to study the statistics of simple closed curves on surfaces. This will lead us to discuss a more general recursive construction of functorial assignments from the category of bordered surfaces (with morphisms = isotopy class of diffeo) called geometric recursion which Andersen, Orantin and I proposed, which from the physical perspective implements an idea of cut/paste that should displayed by 2d QFT coupled to gravity.

10:45 Kaluza-Klein Spectrometry for String Theory Compactifications

Emanuel Malek*, *HU Berlin

In this talk, I will present a powerful new method for computing the Kaluza-Klein spectrum of string theory compactifications. This includes geometries with little to no remaining symmetries, hardly accessible to standard methods. I will discuss various applications of this method, including to non-supersymmetric AdS_4 vacua. As I will show, some of these AdS vacua are unstable due to tachyonic Kaluza-Klein modes, while others can be proven to be perturbatively stable. Finally, I will also discuss applications to supersymmetric AdS vacua and the AdS/CFT correspondence.

11:45 Lunch break

14:00 Division algebraic symmetry breaking

Nichol Furey*, *HU Berlin

Peering in from the outside, the Dixon algebra, R(x)C(x)H(x)O, looks to be an ideal mathematical structure for particle physics. It is 32C dimensional: exactly the size of a generation of fermions - including a RH neutrino. Its left- and right-multiplication algebras generate Cl(10), and so one has automatic access to Spin(10) and its descendants: the Pati-Salam model, the Georgi-Glashow SU(5) model, the LR symmetric model, and the standard model. It even contains extra algebraic structure, which is seen to break Spin(10) to Pati-Salam, and SU(5) to the standard model.
However, this line of research has been weighted down by a difficulty known as the single-copy problem. That is, a satisfactory description of spin has so far only been achieved by taking two copies of the algebra, instead of one. Arguably, this doubling of states ruins much the R(x)C(x)H(x)O's original appeal.
In this talk, we describe how we have solved the single-copy problem. We then explain two developments which ensued: (1) We demonstrate how a cascade of complex structures connect Spin(10), Pati-Salam, the LR symmetric model, the standard model + (B-L), and the standard model's unbroken gauge symmetries + (B-L). (2) We give a first explicit demonstration of a LR symmetric Higgs resulting from a phenomenon known as quaternionic triality.
This is joint work together with Dr Mia Hughes.

15:15 Finite-volume QFT and applications to Lattice QCD

Agostino Patella*, *HU Berlin

In the first part of this talk, I will introduce the lattice discretization of Quantum Field Theory as a theoretical tool, and as a tool for numerical simulations. Lattice simulations are routinely and successfully used for the calculation of nonperturbative observables in QCD.
Lattice simulations must be done in a finite-volume setup. Physical observables are the obtained in the infinite-volume limit. In order to control the systematic errors, one needs to have a solid theoretical understanding of how the infinite volume limit is approached. It turns out that finite-volume corrections can be understood asymptotically in terms of perturbative effective field theories and a complicated (for me!) diagrammatic analysis. I will focus on these techniques in the second part of my talk.

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