



## Liverpool Theoretical Physics PhD Annual Student Presentations II

### Talk Titles and Abstracts

1. 13:00-13:20 Colin Poole

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**Title:** 'The a-theorem in various dimensions'

**Abstract:** The a-theorem generalizes to other dimensions a property of 2D quantum field theories, namely that there exists a function of the couplings  $A$ , such that  $A$  decreases monotonically along RG flow, and at fixed points  $A=a/4$ , the coefficient of the Euler density in the trace anomaly. We investigate consequences of this generalization in  $D=4$ , where the result holds perturbatively;  $D=6$ , where  $A$  instead increases along RG flow; and  $D=3$ , where there is seemingly no natural quantity with which we may identify  $A$ .

2. 13:20-13:40 Maria Cerda Sevilla

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**Title:** 'Climbing NNLO of Weak decays'

**Abstract:** LHCb data have shown a significant tension with Standard Model expectations. These anomalies can be explained introducing new physics in the Wilson Coefficient  $C_9$ . Accurate calculation of this effective coupling in the Standard Model is required. We are focused on the calculation of two-loop Electroweak corrections for this semileptonic operator  $O_9$  in the SM.

3. 13:40-13:55 Matthew Leak

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**Title:** 'NNLO QCD corrections to Neutral Kaon Mixing Amplitude'

**Abstract:** Studies of Kaons have had a deep impact on the construction of the Standard Model. Kaon flavour eigenstates are not mass eigenstates, leading to the phenomenon of flavour mixing in 1-loop electroweak box diagrams. These oscillations provide a method by which CP violation can be studied. The pure electroweak process is already well-understood, and so we now wish to calculate the 3-loop box diagrams contribution at  $O(\alpha_s^2)$  in QCD.

4. 14:00-14:20 Panos Athanasopoulos

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**Title:** 'The correspondence between free fermionic models and orbifolds'

**Abstract:** Both the orbifold and the free fermionic formalism have been used widely to construct semi-realistic models in heterotic string theory. There have also been extensive scans in the space of these models in search for realistic ones. In this talk I will describe the correspondence between the two formalisms and briefly explain how to translate models from one to the other.

5. 14:20-14:40 Joshua Davies

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**Title:** 'Charged-Current Deep Inelastic Scattering at  $a_s^3$ '

**Abstract:** Deep Inelastic Scattering describes the interaction of leptons and nucleons. Here we study neutrino-proton scattering, and compute the third-order QCD corrections to the  $W^+$ - quark Coefficient Functions.