

Nathan Moynihan

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EDUCATION

UNIVERSITY OF CAPE TOWN

PHD IN APPLIED MATHEMATICS

Quantum Gravity & Strings Lab
Ongoing (2nd year) | Cape Town, SA

KINGS COLLEGE LONDON

MSCI IN PHYSICS (1ST CLASS)

2010-2014 | London, UK
4-year average of 83/100.

COURSES

3RD YEAR

Mathematical Methods in Physics	94
Statistical Mechanics	90
Spectroscopy/Quantum Mechanics . . .	94
Particle Physics	93
Optics	91
Solid State Physics	74
General Relativity and Cosmology	98

4TH YEAR

Standard Model Physics and Beyond . .	78
Advanced Quantum Theory	72
Quantum Field Theory	88
Advanced Quantum Field Theory	65
Advanced Cosmology	79
Relativity and Gravitation	89

ATTENDED

2014 European Summer School on Spontaneous Symmetry breaking. Presented a poster titled 'Why is the Universe made only of matter?'

2016 ICTP Spring School on Superstring Theory and Related Topics

2016 Workshop on Topics in Three Dimensional Gravity

2016 7th Joburg Workshop on String Theory

2017 The First Mandelstam Theoretical Physics School and Workshop

CV Last Updated 1st April 2017

RESEARCH

PHD (ONGOING)

AMPLITUDES, ENTANGLEMENT ENTROPY AND THE WEB OF DUALITIES

2015 - Ongoing

My current research is divided into two main areas: modern scattering amplitude method - for example BCFW recursion, BCJ duality, CHY amplitudes etc, with a special focus on understanding gravity. The second is looking at entanglement entropy and other information theoretic quantities in quantum field theories, in particular trying to understand how these quantities hold up under various dualities.

MASTERS PROJECT

LEPTOGENESIS IN A BACKGROUND KERR GEOMETRY AS AN EXPLANATION FOR THE BARYON ASYMMETRY PROBLEM

2014 | Supervisor: Prof Nick Mavromatos

This project involved exploring the possibility that Leptogenesis at an early stage of the Universe could have been induced by non-trivial geometries. In essence, this involved coupling fermions to a background geometry (Kerr, Bianchi) and studying the production rates of particles vs antiparticles. Mathematica was used extensively to calculate vierbeins and the spin connection etc, a package I wrote specifically for this task is available on github.

LITERATURE REVIEW

PARTICLE PHYSICS OF THE STANDARD MODEL AND BEYOND

2013 | Supervisor: Dr Bobby Acharya

The literature review involved writing a brief overview of the standard model of particle physics, including the Higgs mechanism and its detection. The focus of the review was to critically appraise some of the theories beyond the standard model and to see if they can go some way to explaining anomalous results surrounding the recent Higgs particle discovery at the LHC. The main theories focused upon were the MSSM and NMSSM, both theories based on the idea of supersymmetry. It was found that the NMSSM more naturally explains the results where as the MSSM would require some adjustment in order to agree with experiment.

RESEARCH INTERESTS

- Modern Amplitude methods (BCFW, CHY etc) and what they can tell us about gravity
- Entanglement entropy and other information theoretic quantities in QFT and Gravity
- Features of low dimensional QFTs - bosonisation, particle-vortex dualities, anomalies.
- The black hole information paradox and its most recent approaches (Complementarity, Firewalls, ER = EPR)
- The classical double copy - applying the BCJ duality classical theories.
- Quantum Gravity - Topological, Massive, 3D etc

AWARDS

Nelkon Prize

Awarded to the single student with the best academic performance in the final examinations of the final (undergraduate) year in physics.

Gordon Rogers Scholarship

A £3,000 scholarship awarded to the five MSci students with the best academic record