# NATHAN **MOYNIHAN**

CV

## INFO


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Cape Town, South Africa

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## ACHIEVEMENTS

**Gordon Rogers Scholarship**
A £3,000 scholarship awarded to the five final year students with the best academic record.

**Nelkon Prize**
Awarded to the single student with the best academic performance in final year undergraduate physics.

**Best talk by a PhD student**
Awarded for the best talk, decided by a panel of judges at the the 2nd Mandelstam Theoretical Physics Workshop.

## RESEARCH VISITS

**Tokyo University / YITP**
Host: Tatsuma Nishioka
June - July 2019

**Perimeter Institute**
Host: Dr Tibra Ali (Graduate Fellowship)
May - September 2018

**Nottingham University**
Host: Prof Tony Padilla
July 2017

## SKILLS

- Mathematica
- C / C++ / C#
- Java / Javascript / Python
- LaTeX

## PROFILE

I am a highly self-motivated and independent researcher, with the ability to devise and execute my own research ideas, as well as to lead projects with collaborators. I have outstanding written and oral communication skills and it is always a pleasure to give talks or seminars related to my research. I have experience of a wide range of topics within physics and I can typically dive into an unknown area without issue.

## RESEARCH INTERESTS

- Scattering amplitudes in gauge theory and gravity.
- Using on-shell amplitudes as an analytical tool to probe gravitational phenomena arising from e.g. the post-Newtownian expansion.
- Gravitational soft-theorems and their applications.
- Theories of gravity beyond GR, viewed through the lens of modern amplitude techniques.
- The double copy and its application in gravity and supergravity.

## EDUCATION

2015-2019 **PhD in Applied Mathematics, University of Cape Town**
*Supervised by Amanda Weltman and Jeff Murugan*
The main topic of my PhD was to study scattering amplitudes in gravity using the full arsenal of modern on-shell techniques, including both quantum and classical loop effects. I also had a brief foray into the world of quantum information and its definition in quantum field theories.

2010-2014 **MSCi Physics, King's College London**
*Supervised by Nick Mavromatos*
My masters thesis was on leptogenesis in the early universe as generated by fermions coupling to Kerr black holes.

## CONFERENCE TALKS & PRESENTATIONS

**Talk: "Scattering Amplitudes in Einsteinian Cubic Gravity: Loops, Black Holes and Leading Singularities"**
*Tokyo University, 2019*
A talk about our work on probing Einsteinian cubic gravity using loop amplitudes (leading singularities).

**Talk: "Taming Higher-Derivative Gravity: Amplitudes, soft theorems and on-shell equivalence"**
*BRICS Symposium, 2018*
A talk detailing our recent paper using the soft theorems and on-shell methods to determine the equivalence of gravitational theories.

Some of my code, e.g. tools to compute CHY amplitudes and quantities in gravity, can be found at **http://github.com/nmoynihan**. My chrome extension used to add references/bibtex to arxiv pages can be found at **the chrome store**.

## REFERENCES


### Prof. Amanda Weltman
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### Prof. Jeff Murugan
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### Dr Shajid Haque
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**Talk: "Scattering Amplitudes in Massive Gravity"**
*The 2nd Mandelstam Theoretical Physics Workshop, 2018*
A talk detailing our work on the on-shell formalism for massive particles, specifically our derivation of the vDVZ discontinuity. Awarded the prize for best talk by a PhD student.

**Talk: "Amplitudes and Gravity"**
*King's College London, 2017 & Nottingham University, 2017*
A talk discussing our recent calculation of gravitational wave deflection using on-shell amplitude techniques.

**Poster: "Why is the universe only made of matter?"**
*Strasbourg University, 2014*
Poster presentation on the baryon asymmetry problem (the topic of my masters thesis) at the European summer school on spontaneous symmetry breaking.

## PUBLICATIONS


- D. J. Burger, W. T. Emond and N. Moynihan. *Rotating Black Holes in Cubic Gravity* (2019). [arXiv:1910.11618]
- N. Moynihan. *Kerr-Newman from Minimal Coupling*. Accepted JHEP (2019). [arXiv:1909.05217]
- T. Ali, A. Bhattacharyya, S. S. Haque, E. H. Kim, N. Moynihan and J. Murugan. *Chaos and Complexity in Quantum Mechanics* (2019). [arXiv:1905.13534]
- W. T. Emond and N. Moynihan. *Scattering Amplitudes, Black Holes and Leading Singularities in Cubic Theories of Gravity*. Accepted JHEP (2019). [arXiv:1905.08213]
- R. Carballo-Rubio, F. Di Filippo and N. Moynihan. *Taming higher-derivative interactions and bootstrapping gravity with soft theorems*. JCAP, 1910(10):030 (2019). [arXiv:1811.08192]
- T. Ali, A. Bhattacharyya, S. Shajidul Haque, E. H. Kim and N. Moynihan. *Post-Quench Evolution of Distance and Uncertainty in a Topological System: Complexity, Entanglement, and Revivals* (2018). [arXiv:1811.05985]
- T. Ali, A. Bhattacharyya, S. Shajidul Haque, E. H. Kim and N. Moynihan. *Time Evolution of Complexity: A Critique of Three Methods*. JHEP, 04:087 (2019). [arXiv:1810.02734]
- D. J. Burger, N. Moynihan, S. Das, S. Shajidul Haque and B. Underwood. *Towards the Raychaudhuri Equation Beyond General Relativity*. Phys. Rev., D98(2):024006 (2018). [arXiv:1802.09499]
- N. Moynihan and J. Murugan. *Comments on scattering in massive gravity, vDVZ and BCFW*. Class. Quant. Grav., 35(15):155005 (2018). [arXiv:1711.03956]
- D. J. Burger, R. Carballo-Rubio, N. Moynihan, J. Murugan and A. Weltman. *Amplitudes for Astrophysicists: Known Knowns*. General Relativity and Gravitation, 50(12):156 (2017). ISSN 1572-9532. [arXiv:1704.05067]