

**Alexander Miranthis**

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**Work and Research Experience:**

**University of Cambridge, PhD student (Ongoing)**

- Title: 'Projected Bispectrum Estimator for LSS'
- Supervisors: Professor Paul Shellard and Professor James Fergusson

**Summary:**

My work builds off of the MODAL Bispectrum estimator method developed by my supervisors and used in the Planck CMB non-Gaussianity analysis (arXiv:1905.05697). I have been adapting the method for LSS analyses, in particular to create a tomographic Bispectrum estimator between different redshifts. This introduces complications via the need to solve certain integrals for general window functions. I have developed an extension of the MODAL Code that uses an FFTLog algorithm (arXiv:1705.05022) to solve these integrals as well as having the ability to cross correlate between different tomographic shells. I am currently working on a paper to demonstrate our methodology and preliminary results in applying this to projected CMASS mocks and data (arXiv:1208.0022).

My funding is provided by the CDT in Data Intensive Sciences and the STFC. As part of the funding I have also taken courses related to Machine Learning, Data Science and Bayesian Inference.

I have supervised Part IA 'Dynamics and Relativity', Part IB 'Fluid Dynamics' and Part II Cosmology from the Maths Tripos. I have supervised Part IA 'Maths B' from the Natural Sciences Tripos.

**University of Cambridge, Part III Research Project:**

- Title: 'Biases to primordial non-Gaussianity from CMB secondary anisotropies'
- Supervisors: Dr William Coulton and Prof. Anthony Challinor
- arXiv: 2208.12270

**Summary:**

We considered the effects of extragalactic effects present in the CMB (secondary anisotropies) on measurements of the Bispectrum and in particular on the biases of Local, Equilateral and Orthogonal non-Gaussianity. While we found that while Planck results were likely uncontaminated, upcoming experiments were likely to have biases present at  $O(1)$ -sigma levels for Orthogonal non-Gaussianity.

**University of Cambridge, CATAM projects:**

A set of programming projects designed to solve mathematical problems with computational aid:

**Part II projects:**

- 'Black Hole Orbits': Estimated in-fall (proper) times, minimum impact parameters, and innermost circular orbits of particles and photons in the Schwarzschild metric.
- 'Gravitational Radiation': Estimated rate of decrease of semi-major axis of binary systems due to energy lost through gravitational waves to solve for in-spiral times of astrophysical systems
- Overall mark: 114/120

**KPMG Bermuda, Actuarial Department, Summer Internship (2018 and 2019):**

- Created macros and functions in Excel to assist with the actuarial modelling (e.g. bootstrapping, curve/tail-fitting, specific formatting tools for loss triangles, etc.)
- Gained some experience in distributing software though only to a small team

**Education:****University of Cambridge, Emmanuel College (2016 – Present):**

- Current PhD Student in Applied Mathematics and Theoretical Physics under the supervision of Professor Paul Shellard and Dr James Fergusson (2020-Present).
- Part III Astrophysics (Honors Pass; 180/210, 2019-2020)  
Courses: Cosmology, Field theory in Cosmology, General Relativity, QFT, Galaxy Formation and Evolution, Black Holes
- 2.1 in Part II Astrophysics
- 2.1 Part IA and IB Maths

**Sevenoaks School UK (2014 – 2016):**

- 41 in International Baccalaureate diploma with 7/7/7 in HL Maths, Physics and Chemistry
- Extended Essay in Maths on Catalan Numbers and their relation to paths on a grid

**Relevant Skills:**

- Experience with programming in MATLAB, Python, C, C++ and Visual Basic. Experienced also with Linux systems.
- Supervision and teaching experience in both online and in-person settings.

**Extra-Curricular and Hobbies:**

- I am a semi-professional pianist and aim to give yearly recitals. I achieved an ATCL in 2016 with distinction; though now I play at a standard closer to that of a FTCL/FARSM. I also compose pieces and accompany other musicians for exams and performances.
- I assisted with teaching in local Cambridge schools, as part of the STIMULUS programme, during my undergraduate degree.