The Oxford Mathematical Institute Fund

The University of Oxford would like to thank you for supporting the Oxford Mathematical Institute Fund (OMIF).

OMIF was established in November 2014, and since its inception more than 150 donors have contributed to the fund. The money is held in endowment and the revenue is used to fund DPhil students in mathematics. The flexibility of OMIF ensures that when the Mathematical Institute offers a place to a potential candidate, it can also offer scholarship funding. This encourages the best students to take up their place at the Mathematical Institute, regardless of financial circumstances.

This report provides updates from four students who are currently supported by OMIF. As these updates show, OMIF funding has been crucial in allowing our students to remain focused on their impressive and diverse research over the past year despite the challenges posed by the pandemic. Two students who featured in last year's report, Christian Goodbrake and Isabelle Scott, are due to graduate this summer.

Konstantinos Kartas (2018)

My research area is in model theory, algebraic geometry and number theory. I am supervised by Professor Ehud Hrushovski and Professor Jochen Koenigsmann.

I have completed three research papers, which have all been submitted to journals. The questions that interest me are those that relate to what computers can and cannot do when it comes to the existence of solutions of (polynomial) equations or more generally deciding the truth value of first-order sentences. My contribution in this area is using geometric ideas to address such decidability questions in the context of local fields (and their extensions). I find it particularly exciting when unexpected

connections arise in research, and I am very happy to have found a few such connections during my DPhil.

I presented my research at a conference held (virtually) at the Mathematical Sciences Research Institute, Berkeley.

I am grateful to OMIF for its generous support that has helped me to conduct my research without worrying about financial issues. I think it has improved the quality of my life and consequently the quality of my research.

Mattie Landman (2018)

I am currently in the midst of the third year of my DPhil studies, supervised by Dr Neave O'Clery and Professor Peter Grindrod.

As data is becoming more widely and more comprehensively available, we have exciting opportunities to better understand the complex systems in which we operate. My research is concerned with developing a mathematical tool that allows the pairwise comparison of these systems.

Using network science, I am developing a tool that investigates and compares a range of system features. The tool allows for the zooming in and out on agents within a system allowing for the comparison of an agent's influence within its direct neighbourhood, within a subset of the system and within the global system.

Over the last year, I have applied this technique to investigate how different industries within the South African labour market have been impacted by the implementation of an affirmative action policy. We investigated how the policy influenced the movement and hiring patterns of female workers within different industries. The movement of labour is a critical

factor in understanding the health of an economy. It is known to spread knowledge and innovation and is thereby key for economic growth. This research has been done in conjunction with the South African National Treasury and the United Nations University.

I am incredibly grateful for the funding provided for my DPhil through OMIF. This has helped with housing and living costs, which would otherwise have been a great financial burden. With this aid, I can fully partake in both my research and in university life.

Mateo Galdeano Solans (2018)

I am a third-year DPhil student in Mathematical Physics supervised by Professor Xenia de la Ossa. My research lies at the boundary of geometry and string theory and its purpose is twofold: on the one hand, I construct new string theory vacuum solutions which require a deep understanding of the underlying geometry; on the other hand, I use the physical information encoded in these solutions to shed light on the existence of certain manifolds.

This year has proved fruitful for me despite the circumstances. I finished my first paper and presented it as the inaugural talk in a new seminar series in Oxford bringing together PhD students in physics, geometry and number theory. I have almost finished a second paper and I will be presenting it at the Oxford-London Gauge Assembly this summer.

The future promises to be very exciting. I have been working for some months on a new project where we want to improve our understanding of different physical theories using a relationship known as T-duality. This is producing interesting results already and we expect to publish them before the end of the year.

Let me finish by thanking all the donors who contribute towards OMIF. My research would have not been possible without the support I have been receiving all these years, and for that I am extremely grateful. Thank you very much!

Zachary Chase (2019)
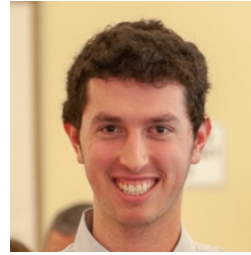
I am doing a DPhil in pure mathematics under the supervision of Professor Ben Green. My area of research is combinatorial number theory and theoretical machine learning. In the past year, I have written two papers at the intersection of these two fields, culminating in the best student paper award at the top computer science conference. I am excited to present my work at the conference this summer.

I am very thankful for OMIF's funding for my work. Economic situations have been significantly more difficult during the pandemic, and OMIF's funding has been essential to my continued research, for otherwise I would have to spend time working another job. I currently plan to continue exploring the fields of combinatorial number theory and theoretical machine learning and find more fruitful connections between the two.

'OMIF is tremendously valuable to the Mathematical Institute, giving us flexibility to ensure our graduate students are fully funded for the duration of their studies. Our DPhil students are key members of our research community and continue to drive forward our exploration of both pure and applied mathematics. We remain deeply grateful to all those who have supported OMIF and helped to remove the financial barriers for our students – enabling them to dedicate their focus to their research and to flourish whilst at Oxford.'

Professor Mike Giles, Professor of Scientific Computing, Head of the Mathematical Institute

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