

I am currently a Master's student at the University of Bonn and I previously did my Bachelor's at the University of Warwick. I am interested in arithmetic geometry and algebraic number theory and my goal is to pursue a doctorate and a career in academia.

One of the highlights of my undergraduate at Warwick was the second-year essay. This was a small research project which I decided to write on the p -adic numbers, where I also studied completions of the rational numbers more generally. At the time, the p -adic numbers seemed fascinating to me because of their abstract definition as a completion of the rationals, an analogous construction to that of the reals, yet having such a different topology. Ostrowski's Theorem pointed out their importance, and it made me excited to learn more about them in the future. From this project, I also really enjoyed studying maths independently and presenting my topic, since it was exciting to introduce other students to a new topic and show them my own view on it.

Having had such a good experience with the essay made me want to know more about research in mathematics, and I had the opportunity to do so in the summer of 2022 at the Institute of Mathematical Sciences in Madrid (ICMAT). Under the supervision of Dr Ángel González-Prieto, I learned about character varieties arising from knot theory and focused on arithmetic techniques to study their invariants. A lesson I learned then was that, when reading a paper, I shouldn't try to understand everything perfectly as I read, unlike I did with my lecture courses. It was often more efficient to skip some parts, continue reading, and then discuss them in the next meeting.

For my Master's I decided to move to Bonn. Apart from the high level of the Master's, a two-year programme was appealing to me as it gave me more time to decide on the area of my Master's Thesis. In my second semester, I took Dr Giacomo Mezzedimi's course on rational points which had Silverman's *The Arithmetic of Elliptic Curves* and Poonen's *Rational Points on Varieties* as the main references. I really enjoyed this course as it demonstrated the power of algebraic geometry and class field theory—both courses I had taken in the previous semester—to construct powerful machinery and obtain results such as the failure of the local-global principle for cubic curves (using the Tate-Shafarevich group).

Wanting to learn more about rational points, I am doing my Master's Thesis on rational points on K3 surfaces supervised by Dr Giacomo Mezzedimi. Currently, I am reading a paper on the case where the K3 surface admits an elliptic fibration, which is one of the two situations in which potential density of rational points is known (the other one being when the automorphism group of the surface is infinite); it is very interesting because one can transfer much of the theory of elliptic curves and their rational points to elliptic fibrations. The aim of the project is to study the set of rational points on other types of K3 surfaces, with finite automorphism group and no elliptic fibration. I am really enjoying working at my own pace and asking many questions to my supervisor, and it is very exciting to be learning research-level mathematics. Like at the ICMAT, I am approaching this differently to lecture courses, for instance by first reading through the main theorem, since its proof follows immediately from previous propositions, before working my way backwards from there.

In the rational points course we were also introduced to abelian varieties (for which we proved weak Mordell-Weil using torsors), and I continued learning them about in Dr Lassina

Dembélé's course in the Preliminary Arizona Winter School in October 2023. This was very interesting and quite advanced, so I really appreciated meeting students from other universities with similar interests to me and with whom I could discuss the content and the exercise sheets. Our different backgrounds helped to give each other new perspectives and ideas.

As part of a seminar on cubic hypersurfaces, I recently gave a 90-minute talk on automorphisms and deformations of smooth projective varieties with some specific results about hypersurfaces, following the book *The Geometry of Cubic Hypersurfaces* by Daniel Huybrechts. The preparation for the talk was challenging and demanding, as I had never before given a graduate-level talk and the main reference excluded many details, probably clear to experts. However, through discussions with the lecturers and hard work, I started to understand the underlying arguments and became very excited about the talk, and also about the prospect of sharing what I had learned with other students. This made me realise that the process of learning an advanced topic is often non-linear; many days it felt like I was making no progress. It also reminded me that asking questions and learning about how other people think about a specific idea can be very enriching.

I am currently preparing my next talk for a seminar on class field theory and quadratic forms, in which I will introduce ring class fields and use them to characterise the prime numbers of the form $p = x^2 + ny^2$ for any integer $n > 0$. Having the opportunity to participate in seminars during my Master's has made me gain confidence in my ability to present and explain mathematics. I look forward to taking part in more seminars in the future and also to eventually teaching at university.

To summarise, I am interested in doing research in topics related to elliptic curves and rational points, and I am also eager to continue exploring my interests within number theory and arithmetic geometry. I am particularly drawn to Bristol due to the great reputation, size and research interests of its number theory group, and I would be very excited to have the opportunity to work with Prof Tim Dokchitser or Dr Céline Maistret.