Personal details

Personal details

First / given name	Zhuochen
Second given name	
Third given name	
Surname/family name	Yao
Date of birth	26 October 2002
Preferred first/given name	Zhuochen
Previous surname	
Country of birth	China
Legal nationality	Chinese
Dual nationality	
Country of residence	China
Have you previously studied with us at the University of Bristol?	No

Contact details

Home address

Please provide your permanent residential address. If you have another address and would prefer for us to contact you at that address instead you have the opportunity to add a correspondence address in the next section.

Country	China
Postcode	311835
Address Line 1	No.3 Junlian Road
Address Line 2	
City	Zhuji
County	China
Telephone	

If you would like us to send any postal correspondence to an address which is not your home address please enter an alternative address here. If you want us to send correspondence to your home address then please select No.

Do you want to add a correspondence address?	Yes
Country	England
Postcode	SW3 3BS
Address Line 1	31 Draycott Avenue
Address Line 2	
City	London
County	
Telephone	

Agent

Agent details

Agency Name	
Email address	

Other information

Additional Documents

Please upload required documents as outlined in your admissions statement

Mode of study

How would like to study this programme?	Full Time

Qualifications

Qualifications

Institution	Qualification	Type	Subject	Actual/predicted	Grade	Start date	End date
Imperial College London	Master's Degree (PG)	Academic Qualification	Mathematics	Predicted	1st class	03/Oct/2020	28/Jun/2024

If these qualifications have altered since your last application please note the changes in the free text box here.

English Language

Is English your first language? No
What is your first language? Chinese
Did you study at school/university where you were taught in English? Yes
For how many years? 4
Have you sat a relevant English language test? No

TOEFL (internet-based)

Registration number
Date of TOEFL test
TOEFL reading score
TOEFL listening score
TOEFL speaking score
TOEFL writing score
TOEFL total score

IELTS (International English Language Testing System)

Test report form (TRF) number
UKVI number (if applicable)
Date of IELTS test
IELTS listening score
IELTS reading score
IELTS writing score
IELTS speaking score
IELTS total score

Pearson Test of English

Score report code
Date of Pearson test
Pearson listening score
Pearson reading score
Pearson speaking score
Pearson writing score
Pearson overall score

Other English Language test

Name of course

Registration number	
Date of test	
Listening score	
Writing score	
Reading score	
Total score	

Experience

Current Employer

Employer name and address	/
Job title and main duties	/
Full time/Part time	
Date of Appointment	
End date (if applicable)	

Previous employment 1

Employer name and address	
Job title and main duties	
Full time/Part time	
Date of Appointment	
End date (if applicable)	

Previous employment 2

Employer name and address	
Job title and main duties	
Full time/Part time	
Date of Appointment	
End date (if applicable)	

Previous employment 3

Employer name and address	
Job title and main duties	
Full time/Part time	
Date of Appointment	
End date (if applicable)	

Other Experience

Do you have any other relevant work experience to support your application?	No
Please provide details	

Personal statement

Personal details

Do you have a personal statement to upload?	Yes
Please type your personal statement in the box	

Research proposal

Research proposal

Proposed supervisor 1	Tim Dokchitser
Proposed supervisor 1	
Proposed project title (max 150 chars)	

Passport and visa

Visa required

Do you require a visa to study in the UK?	Yes

Please fill out your passport details below. If you are unable to provide these at the current time you will have another opportunity to upload your passport after you submit the form. If you do not provide us with this information we will be unable to issue you with your confirmation of acceptance number and you will be unable to obtain a visa.

Passport details

Passport number	EH5659838

Further details

Have you previously studied in the UK?	Yes
What was the highest level of study in the UK?	Master in Science
Please confirm the total length of your UK study in years	3

Referees

Referee 1

Do you have a reference to upload?	No
Type of reference	Academic
Referee title	Dr
Forename	Oliver
Surname	Gregory
Position	Heilbronn Research Fellow
Institution/Company	Imperial College London
Email address	o.gregory22@imperial.ac.uk
Country	England

Referee 2

Do you have a second reference to upload?	No
Type of reference	Academic
Referee title	Professor
Forename	Colin
Surname	Cotter
Position	Professor of Computational Mathematics
Institution/Company	Imperial College London
Email address	colin.cotter@imperial.ac.uk
Country	England

Funding

Funding 1

What is your likely source of funding?	Yourself/family
Please give the name of your scholarship or Studentship	
Please specify	
Percentage from this source	40
Is this funding already secured?	Yes

Funding 2

What is your likely source of funding?	University of Bristol scholarship
Please give the name of your scholarship or Studentship	
Please specify	
Percentage from this source	30
Is this funding already secured?	No

Funding 3

What is your likely source of funding?	Scholarship
Please give the name of your scholarship or Studentship	Heilbronn Doctoral Partnership
Please specify	
Percentage from this source	30
Is this funding already secured?	No

Other funding

I would like to be considered for other funding opportunities	Yes

Submission

Documents

Document type	File name
Transcript	Transcript.pdf
Curriculum vitae	CV.pdf
Research proposal	Research_statement.pdf
Personal statement	Personal Statement.pdf
Passports and visas	BRP.docx
Passports and visas	Passport.pdf

By ticking the checkbox below and submitting your completed online application form, you acknowledge the University of Bristol will use the information provided from time to time, along with any further information about you the University may hold, for the purposes set out in the University's full Data Protection Statement. Applicants applying to the collaborative programmes of doctoral training should also read the Data Protection Statement for collaborative programmes of doctoral training.

The information that you provided on your application form will be used for the following purposes:

- To enable your application for entry to be considered and allow our Admissions Advisors, where applicable, to assist you through the application process;
- To enable the University to compile statistics, or to assist other organisations to do so. No statistical information will be published that would identify you personally;
- To enable the University to initiate your student record should you be offered a place at the University.

All applicants should note that the University reserves the right to make without notice changes in regulations, courses, fees etc at any time before or after a candidate's admission. Admission to the University is subject to the requirement that the candidate will comply with the University's registration procedure and will duly observe the Charter, Statutes, Ordinances and Regulations from time to time in force.

By ticking the checkbox below and submitting your completed online application form, you are confirming that the information given in this form is true, complete and accurate and that no information requested or other material information has been omitted. You are also confirming that you have read the Data Protection Statement and you confirm the statement below.

I can confirm that the information I have provided is true, complete and accurate. I accept that the information given in my application will be stored and processed by the University of Bristol, in accordance with the *UK General Data Protection Regulation and Data Protection Act 2018*, in order to:

- Consider my application and operate an effective and impartial admissions process;
- Monitor the University’s applicant and student profile;
- Comply with all laws and regulations;
- Ensure the wellbeing and security of all students and staff;
- If my application is successful to form the basis of the statement made within my application.

If the University of Bristol discovers that I have made a false statement or omitted signification information from my application, for example examination results, I understand that it may have to withdraw or amend its offer or terminate my registration, according to circumstances.

Zhuochen Yao

zy3220@ic.ac.uk; +44 07536344720/+86 13567576618

Add.: Room 218, No. 168 Yugu Road, Xihu District, Hangzhou, Zhejiang, China, 310013

EDUCATION BACKGROUND

Imperial College London Oct. 2020-Jun. 2024

- ✧ Master of Science in Mathematics
- ✧ Numeric Average Mark: 68/100

Honor: The Winton Prize-Outstanding Undergraduate Second Year Group Project Prize in Mathematics

RESEARCH EXPERIENCES

Undergraduate Research Opportunities Programme: Support Vector Machine Jul. 2022-Aug. 2022

Supervisor: Dr. Riccardo Passeggeri

- ✧ Investigated the theoretical foundations of support vector machine (SVM) and applied it to the related optimization problem
- ✧ Applied the Karush-Kuhn-Tucker (KKT) conditions to transform optimization problem of SVM, and used the sequential quadratic programming to obtain the numerical solutions and implement it via Python

Year 2 Group Research Project: Fractional Brownian Motion Jun. 2022- Jul. 2022

Supervisor: Prof. Xue-Mei Li

- ✧ Focused on the theory and the application of Fractional Brownian motion (fBm), aiming to provide a valuable reference for readers interested in fBm and its applications in different settings
- ✧ Constructed arbitrage strategies in the context of the fBm market to optimize profit in investment processes
- ✧ Developed arbitrage examples based on the fBm model, showcasing its relevance in real-world scenarios

Year 1 Individual Project: Laplace Holiday Jun. 2021- Jul. 2021

Supervisor: Dr. Sam Brzezicki

- ✧ Focused on the Laplace's equation with several different boundary conditions like Drichlet condition and Neumann condition
- ✧ Researched various approaches to the diffusion equation under mixed conditions, calculated the analytic solution using the method of separation of variables, and simulated the numerical solution through finite difference methods in Python
- ✧ Compared the numerical solution and analytical solution for each case, and summarized the findings and conveyed them through a comprehensive poster presentation

SKILLS&INTERESTS

- ✧ Python, Piano

If someone asks me why I like mathematics, I wouldn't say that doing math is a sense of mission or anything as heavy as that. However, math does mean something to me. It has gradually become an important part of my life and will undoubtedly accompany me for the rest of my days.

My first enjoyment of math dates back to high school when I immersed myself in the joy of solving problems, such as Euclidean geometry or elementary number theory puzzles. Sometimes, I would spend entire afternoons or even days pondering a single problem. Afterward, I realized that I could achieve a remarkable level of concentration, an experience I had never encountered before. I also participated in various math competitions and earned some modest achievements during my high school years. While such math training partially developed my basic math intuition, it soon became mundane. Unsatisfied with the level of math taught in high school, I naturally pursued math in my undergraduate studies.

The past three years in Imperial has brought me lot, I tasted the flavor of the modern math and began to learn how to think like a mathematician. In the first two years, I loves algebra a lot. From groups to rings and modules, I'm always excited to study such algebra structures, considering them as languages and tools serving more advanced constructs. Furthermore, their interconnections also fascinate me. Witnessing a new definition aligning consistently or comparably with a previously learnt one felt like a reminiscent experience. Later, I discovered that such connections exist in every realm of pure mathematics, inspiring me to contemplate the relationships between new theories I encountered and others. In year 3, I come into contact with geometry which becomes my interest as well as algebra. As a preliminary for algebraic geometry, algebraic curves have started to provide a dictionary between the geometry of algebraic variates and the algebra of functions. So it investigates the geometric property via the algebraic property and shows the power of algebra. Algebraic topology is another geometric topic that employs algebra. One result impressed me is that Galois correspondence appears in classification of the covering spaces, I never imaged that the Galois correspondence could be presented in such a manner before! Now in year 4, I have embarked on the study of commutative algebra, which serves as the foundational language to describe the modern theory of algebraic geometry. I'm surprised that this course adopts a constructive approach to introduce commutative algebra, I see how to use Gröbner basis to solve ideal membership problem and even give the proof of the famous Hilbert's Nullstellensatz. In contrast to the traditional abstract language, this constructive method sounds more down to earth and is easily embraced by beginners.

Nevertheless, my journey in learning mathematics has not always been smooth sailing. There were moments when I struggled to grasp the purpose of a certain theory or understand its underlying intuition. While I could seek help from professors or discuss these issues with my colleagues, ultimately, I had to chew on these challenges and digest them on my own. Overcoming these obstacles deeply motivated me. I am

also enthusiastic about sharing my mathematical knowledge with others. I explain my understanding of newly acquired knowledge to my friends as clearly as possible, and they help pinpoint errors in the details while presenting their perspectives. Through these discussions, I realized that I am not alone in my mathematical pursuits; mathematics is a subject that brings people together.

In addition to my academic coursework, I have actively engaged in various research projects to further develop my research skills. In year 2, I participated in a group project (M2R), which focused on Fractional Brownian Motion (fBm) and aimed to serve as a comprehensive guide for readers interested in fBm and its varied applications. Within this project, I was responsible for its application in Finance, which is also one of the most important applications for fBm. I constructed arbitrage strategies within the context of the fBm market to optimize profits in investment processes. Furthermore, I provided arbitrage examples based on the fBm model, demonstrating its practical relevance in financial settings. Our group also won the Winton Price which awards for the outstanding group in M2R, I think this to some extend reflects my ability to team work. In summer vacation of 2022, I participated in the Undergraduate Research Opportunities Program (UROP), where I conducted an in-depth study on support vector machine (SVM) in machine learning. My research focused on the optimization problem of SVM, aiming to summarize its theoretical solutions. To tackle this challenge, I applied the Karush-Kuhn-Tucker (KKT) conditions to transform the SVM optimization problem. This transformation allowed me to obtain numerical solutions via the utilization of sequential quadratic programming techniques. This project is a nice challenge for me since it was my first time to handle a statistical research, I learnt how to get the main idea of a paper when this paper involves a lot detailed proofs or elaborate calculations. Recently, I'm doing my year 4 project which based on Monsky-Washnitzer cohomology and zeta functions. This project brings me to the beautiful and complicated world of p-adic cohomology. My first goal is understanding what a Weil cohomology is and deduce a Lefschetz trace formula from the axioms of Weil cohomology. The next step is exploring the ways in which the algebraic de Rham cohomology of a characteristic 0 lift fails to give a Weil cohomology theory, and introducing a fix for each type of failure, finally end up with Monsky-Washnizter cohomology for smooth affine varieties. After absorbing the above knowledge, I'll implement Kedlaya's algorithm for computing the zeta function of a hyperelliptic curve as an application.

Pursuing a Ph.D. in pure mathematics has been a long-held dream of mine, and I believe I am well-suited for it. I possess the patience and persistence required for long-term thinking. I prefer to delve deeply and comprehensively into questions, even if it takes extra time. I aspire to develop innovative mathematical thinking during my Ph.D. studies. As for my career aspirations, I have a strong desire to pursue an academic path that involves teaching and conducting research. My ultimate goal is to delve into cutting-edge mathematical trends and develop the skills necessary to think and research like a real mathematician. Upon the successful completion of my PhD studies, I aspire to undertake postdoctoral research in a distinguished academic institution. As I progress in my academic journey, my enthusiasm for mathematics will remain steadfast, and I am committed to dedicating myself wholeheartedly to the math.

Research statement

Zhuochen Yao

March 18, 2024

Although I currently do not have a specific research topic in my mind, I'm glad to share what I find fun in my recent (year 4) study and project. Please bear with the lack of rigorousness in the content that follows, as this is not a formal article but rather a statement.

We know the famous Weil conjecture: The Zeta function

$$Z(X,t) = \exp(\sum_{r=1}^{\infty} \frac{\#X(\mathbb{F}_{q^r})t^r}{r})$$

is a rational function , i.e., $Z(X,t) \in \mathbb{Q}(t)$, where X is a smooth projective variety of dimension n over a finite field $\mathbb{F}_q$, $q = p^t$ for some prime p. (Please forgive me I'm not familiar with scheme language, so I only focus on smooth projective case. Also, there're three more parts in Weil's conjectures, I omit them here.) Around 1960's, Dwork firstly proved the rationality via p-adic analysis. Later, Serre and Grothendieck brought cohomology theory (étale cohomology) to algebraic geometry to simplify and finish the proof of Weil conjectures. In general, the Weil cohomology theory is introduced. Interestingly, I saw the definition of Weil cohomology before learning our classical de Rham cohomology (in my differential topology course), so, it made me feel uncomfortable and confusing about the a series of axioms that Weil cohomology should satisfy. I had no clues that where these properties come from until studying de Rham cohomology for smooth manifolds.

For instance, if M is a smooth manifold with dimension n, we have a bilinear map

$$\smile: \qquad H^p_{dR}(M) \times H^q_{dR}(M) \to H^{p+q}_{dR}(M) \qquad ([\omega],[\eta]) \mapsto [\omega \wedge \eta]$$

which satisfies $[\omega] \smile [\eta] = (-1)^{pq}([\eta] \smile [\omega])$. Here $H^p_{dR}(M)$ just means the p-th de Rham cohomology group of M. Similarly, in Weil cohomology (), we define the **cup product** $\smile: H^i(X) \times H^j(X) \to H^{i+j}(X)$ which render $H^*(X)$ a graded-commutative ring. Apart from this, we can also see the Poincaré duality holds for orientable n-manifold M, i.e., $H^p(M) \cong H^{n-p}(M)^*$, while in Weil cohomology, we ask the cup product $H^i(X) \times H^{2n-i}(X) \to K$ is non-degenerate. After learning these properties about de Rham cohomology I just

suddenly realise, oh, the characteristic 0 (algebraic) de Rham cohomology is a special case of Weil cohomology! It gives me a sense of flavour why we need to define and consider about the Weil cohomology theory. Also, such a experience teaches me that sometimes before learning a more advanced theory it'd better to look into same special cases or baby versions of it since then you have enough intuition and motivation to learn their generalisation.

Next, in the proof of Weil conjecture, we need an important formula named after Lefschetz (Lefschetz trace formula): Let H^* denote any Weil cohomology, then, for an endomorphism ϕ of a smooth projective variety X of dimension n, the intersection number of Γ_ϕ and the diagonal Δ is

$$(\Gamma_\phi \cdot \Delta) = \sum_{i=0}^{2n} (-1)^i \mathrm{tr} H^i(\phi)$$

In particular, it's useful for point counting, more precisely, to compute $\#X(\mathbb{F}_{q^r})$, the $\mathbb{F}_{q^r}$-rational points of X. However, the ℓ-adic cohomology is not suitable for concrete calculations, we need a de Rham-like cohomology theory to help us handle it. Therefore, **Monsky-Washnitzer cohomology** (MW cohomology) appears on the stage. However, the development of MW cohomology is not easy to arrive and let's talk about it briefly. Begin with algebraic de Rham cohomology over finite field, clearly it's resulting functor is not well-behaved since the cohomology group is usually infinite dimensional (so it's not a Weil cohomology). Naturally, we want to lift our variety to a appropriate characteristic 0 field. Thanks to Witt (and Serre, his "Local Fields" helps me a lot, I really like this book), we can lift $\mathbb{F}_q$ to the Witt ring $W(\mathbb{F}_q) = \mathbb{Z}_q$, which is a complete discrete valuation ring (DVR) of characteristic 0. Also, it has residue field $\mathbb{Z}_q/(p) = \mathbb{F}_q$. However, it's not enough, in order to make use of trace formula, we also need to lift **Frobenius map** of X. Unfortunately, $\mathbb{Z}_q$ doesn't admit a Frobenius lift, we solve this by apply the weak completion to our coordinate ring. In fact, such lift itself is canonical. Moreover, it admits homotopic Frobenius lift, which means they induce the same map on cohomology group. Finally, we build a cochain complex in similar way as algebraic de Rham cohomology, we derived the desired MW cohomology.

Let me stop my sharing here. In my future life, I really want to explore more in algebraic geometry, algebraic number theory and homological algebra if I have a chance.

Imperial College London

Academic Transcript (pre-award)

Student Details

Family name:	Yao
Given name(s):	Zhuochen
Date of birth:	26 October 2002
Level:	Undergraduate
Imperial student ID:	01873784
HESA student ID:	
Start date:	03 October 2020
Expected completion date:	28 June 2024

Award Aim

Award aim:	Master in Science (MSci)
Award status:	Not yet awarded

This is a pre-award transcript and cannot be used as evidence of qualification.

Programme of Study

Programme title:	Mathematics
Department:	Department of Mathematics

Module	Year	Mark	Credit
An Introduction to Applied Mathematics	2020-2021	79.38	5.00
Analysis 1	2020-2021	70.23	10.00
Calculus and Applications	2020-2021	58.21	10.00
Individual Research Poster Project	2020-2021	70.00	5.00
Introduction to Computation	2020-2021	56.54	5.00
Introduction to University Mathematics	2020-2021	Pass	5.00
Linear Algebra and Groups	2020-2021	70.51	10.00
Probability and Statistics	2020-2021	67.36	10.00
Analysis 2	2021-2022	69.13	10.00
Dynamics of Imagery in Arts and Design	2021-2022	47.83	5.00
Group Research Project	2021-2022	87.40	5.00
Groups and Rings	2021-2022	86.78	5.00
Lebesgue Measure and Integration	2021-2022	87.58	5.00
Linear Algebra and Numerical Analysis	2021-2022	59.29	10.00
Multivariable Calculus and Differential Equations	2021-2022	67.88	10.00
Probability for Statistics	2021-2022	74.76	5.00
Statistical Modelling 1	2021-2022	69.30	5.00
Algebra 3	2022-2023	55.58	7.50
Algebraic Curves	2022-2023	63.38	7.50
Algebraic Topology	2022-2023	60.63	7.50
Functional Analysis	2022-2023	78.79	7.50
Galois Theory	2022-2023	57.50	7.50
Geometry of Curves and Surfaces	2022-2023	96.95	7.50
Group Representation Theory	2022-2023	56.91	7.50
Group Theory	2022-2023	70.71	7.50

Imperial College London

Academic Transcript (pre-award)

Programme Year Overall Mark

Year 1 67.14
Year 2 72.59
Year 3 67.56

Please note that any Programme Year Overall Mark reported to the Imperial College London Registry prior to the 2018/19 academic year will only be visible in the Programme of Study section of this transcript, where relevant

Prizes, Distinctions and Post-nominal Awards

Prizes and distinctions:
The Winton Prize - Outstanding Undergraduate Second Year Group Project Prize in Mathematics

Authorisation

This pre-award transcript was issued by Imperial College London using Advanced Secure technology; you can verify key information about the student using the barcode below. If you would like to view this transcript using the College's online verification portal, please ask the student to provide you with access to their documents as a third-party connection.

David Ashton
Academic Registrar

Issued on 30 August 2023
Document ID: 70567463-01-0835

End of document

Huxley Building 612
Imperial College London
South Kensington Campus
London
SW7 2AZ

March 6, 2024

To whom it may concern,

I am writing to support the application of Zhuochen Yao for a PhD position. I am a research fellow at Imperial College London working in arithmetic geometry (specifically: p-adic cohomology, p-adic Hodge theory and motivic cohomology). I have known Zhuochen since June 2023 when I became his masters project supervisor. Since June we have had fortnightly meetings discussing the material in his project, so I have perhaps had more opportunity to have mathematical conversations with Zhuochen than his other letter writers. What I write below is my impression of Zhuochen from our interactions in those meetings. I have not had any contact with him outside of our supervision so cannot speak of his class work apart from being able to tell you that he has good grades; you will see from his transcript that his current mark puts him at roughly a 1st (the highest grade possible in the UK university system). I hope that at least one of Zhuochen's other letter writers can offer you more insight into his class work.

Zhuochen's masters project is an introduction to the world of p-adic cohomology. Specifically, he is learning about Monsky-Washnitzer cohomology with the view to understanding Kedlaya's algorithm for determining the zeta function of hyperelliptic curves over finite fields (or what is the same: counting points on them). This is an ambitious project but Zhuochen has made good progress so far. He has successfully explained to me the concepts of (p-adic) completion and weak completion, and more importantly *why* the latter notion is needed in Monsky-Washnitzer cohomology. From what I have seen so far, I expect Zhuochen to complete his project to a good standard.

In our fortnightly discussions I have found Zhuochen to be a very willing learner. At the beginning of the term I presented material to him which he quickly learned and uses confidently. Later I changed our meetings to the format that I would ask him to prepare material to present to me. He communicates mathematics well, although he tends toward presenting concepts in austere generality; it is my current battle to try to get him to present more examples and analogies (but I think this will come with experience).

From the above evidence, I summarise by saying that I believe that Zhuochen is a good candidate for a PhD position at a good university.

Yours sincerely,

Dr Oli Gregory

Imperial College London

Department of Mathematics
Imperial College London
South Kensington London
SW7 2AZ
(020)75943468

March 19, 2024

To whom it may concern,

I write to provide my letter of reference for the application of Zhuochen (Bruce) Yao to your graduate programme.

Bruce has been my personal tutee since his registration on our MSci Mathematics programme in academic year 2020/2021. This means that I have monitored his progress through our degree and we have met regularly to discuss how he has been getting on.

Bruce is enrolled on our undergraduate MSci Mathematics programme where all students cover a broad base of pure and applied mathematics and statistics before specialising the 3rd year. This is a very competitive programme, and we require A* in A level Mathematics and Further Mathematics as well as an A in another subject; we also shortlist candidates using the Mathematics Admissions Test originally developed for the Oxford admissions process but has been used by Imperial College as well for some years.

Bruce is a positive and engaging person who has a real passion for pure mathematics, and this really comes across in my meetings with him. He is highly motivated to dig into pure mathematics topics and really understand them. Bruce has performed well on our programme: his year totals were: 67% in Year 1, 73% in Year 2, 68% in Year 3. In Year 1, all but three of his modules were above 70%, with Calculus and Applications and Introduction to Computation pulling the average down (Probability and Statistics was just below 70). In Year 2, he generally scored highly in pure courses: 87% for Groups and Rings, 88% for Lebesgue Measure, and 69% for Analysis 2. Of the remaining marks, only two courses were pulling the average below 70%, one of which was Linear Algebra and Numerical Analysis (I have not seen the breakdown between the pure and applied parts of this course, but he tells me he did not enjoy the Numerical Analysis part as much as the rest of his programme) and a multidisciplinary Horizons course "Dynamics of Imagery in Arts and Design", where Bruce tells me that his group did not function very

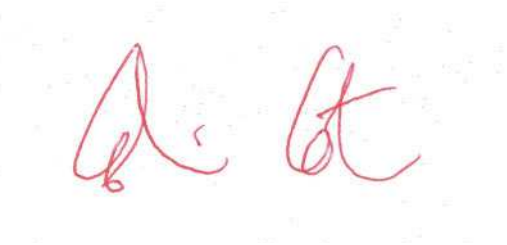
well (clearly not a general problem for him since his Group Research Project mark was 87%). In the third year, Bruce did not shy away from challenging pure mathematics courses and was led by his curiosity for pure mathematics rather than picking courses strategically as many students do. He excelled in Functional Analysis (78%) and Geometric of Curves and Surfaces (97%). Based on his current performance I predict that Bruce will get a First class overall mark for his MSci.

I think that Bruce is a bright and engaged student who would be a great addition to the PhD programme. His communication skills are excellent, and he is strongly motivated to study challenging concepts in pure mathematics.

Please let me know if you require further information about Bruce.

Yours sincerely,

Prof. Colin Cotter



RESIDENCE PERMIT

RW6490899

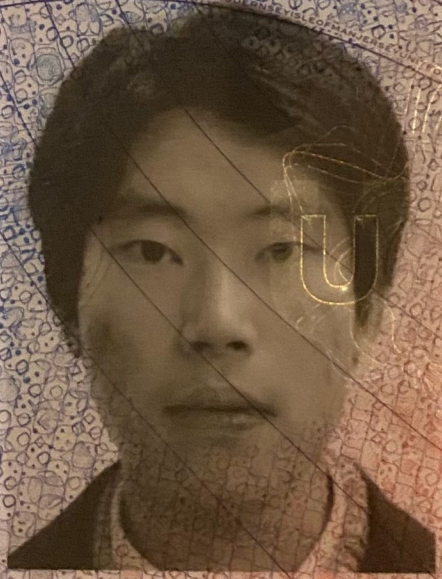
NAME
YAO
ZHUOCHEN

VALID UNTIL
28-10-2024

PLACE AND DATE OF ISSUE
UK 25-10-2022

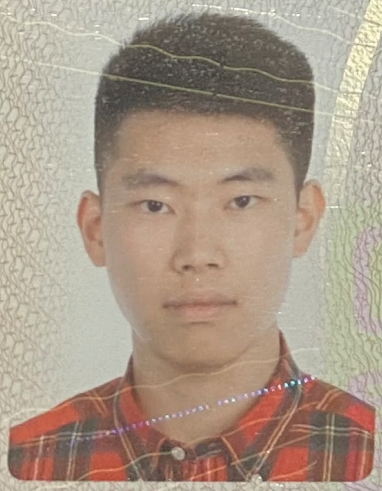
TYPE OF PERMIT
STUDENT
LEAVE TO REMAIN

REMARKS
WORK 20 HRS MAX
IN TERM-TIME
1E82R2BR6



中华人民共和国 PEOPLE'S REPUBLIC OF CHINA

护 照
PASSPORT



类型/Type
P

国家码/Country Code
CHN

护照号码/Passport No.
EH5659838

姓名/Name
姚 卓 辰
YAO, ZHUOCHEN

性别/Sex
男/M

国籍/Nationality
中国/CHINESE

出生日期/Date of birth
26 OCT 2002

出生地点/Place of birth
浙江/ZHEJIANG

签发日期/Date of issue
08 10月/OCT 2019

签发地点/Place of issue
浙江/ZHEJIANG

有效期至/Date of expiry
07 10月/OCT 2029

签发机关/Authority
中华人民共和国国家移民管理局
National Immigration Administration,PRC

持照人签名/Bearer's signature
姚卓辰

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