

# JAVIER CHICO VÁZQUEZ

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## EDUCATION

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**University of Oxford** **Oxford, UK | 2023 - 2027**

- **DPHil in Mathematics.** Supervised by Prof. Derek Moulton and Prof. Dominic Vella.
- **Teaching Experience:** TA: Viscous Flow, Applied PDEs. College tutor at Merton College.

**Massachusetts Institute of Technology** **Cambridge, MA, USA | 2021 - 2022**

- Exchange year at MIT, Department of Mathematics. **5.0 GPA**

**Imperial College London** **London, UK | 2019 - 2023**

- MSci in Mathematics **First Class**, overall 92.65%
- **Governor's Prize.** Awarded to the best MSci student in Mathematics. (Ranked first in my cohort)
- **Master Thesis** with Prof. D.T. **Papageorgiou** on ferrofluids.
- **Dean's list** in Y1,Y2,Y3,Y4. **G-RESEARCH academic excellence** prize. Selected for the MIT exchange.

## RESEARCH EXPERIENCE

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**Mathematical Institute, University of Oxford, *Doctoral Researcher*** ***September 2023-Present***

- **Fluid Dynamics of the inner ear** The fluid dynamics of human balance are studied to evaluate strategies to mitigate dizziness. The nonlinear PDEs governing the interaction between fluid flow and cupular deflection are reduced asymptotically to a one dimensional dynamical system for the cupular deflection.
- **Pollination in Rafflesia** As part of a collaboration with Chris Thorogood, head of the of the Oxford Botanical Garden, we have developed a model to understand how the biggest flowers in the world attract flies for pollination. This is a nonlinear stochastic differential equation with rotational diffusion. The aim of the project is to understand the role of floral shape and size in pollination.
- **Constriction in snakes** Non-venomous snakes subdue and kill their prey by coiling around it and exerting large pressures. A novel model linking the physiology of the snake with the prey's nonlinear elastic deformations is developed to predict if a constriction attempt will be successful.
- **Fluid jets** The trajectory of thin fluid jets is solved asymptotically, and their stability is under study. This is done in the context of spitting cobras, snakes that have modified fangs that allow them to spit venom to distances of around 3 meters with high accuracy. The venom, a complicated mix of proteins is understood to be a non-newtonian shear-thinning fluid, and the effects of this are interpreted in the modelling.

**Imperial College London, *MSc Researcher*** ***October 2022 - May 2023***

- **Ferrofluids** For my MSc project I worked with Prof. **Papageorgiou** on modelling free-surface ferrohydrodynamic problems driven by electric currents.
- Second Year Research project on **Stochastic Geometric mechanics** with Prof. D. **Holm**.

**Massachusetts Institute of Technology, *Undergraduate Researcher*** ***January - September 2022***

- UROP with Dr Andrew **Horning** on Spectral Density Estimation and Kernel Polynomial Methods. Developed a new result for the convergence in distribution of random variables transformed by Chebyshev polynomials.
- Summer research with Prof. Lydia **Bourouiba** on the Fluid Dynamics of Disease Transmission. Used network science to study diffusion on porous networks.

**Citigroup Global Markets Limited, *Summer Analyst & Spring Intern*** **London | *Summer 2021***

## AWARDS AND ACHIEVEMENTS

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- **Governor's Prize.** Awarded to the best MSci student in Mathematics at their final examinations.
- Graduated ranked first in my cohort.
- **UKRI/St John's College Doctoral Scholarship**
- **Imperial College Presidential Scholarship** (Rejected)
- **Turing Grant** Awarded as part of my exchange year at MIT (£3858.57)
- **Madrid Academic Excellence Grant** awarded by the Madrid Education Board (2100 €). (2019)
- **G-RESEARCH prize for academic excellence** in Year 2 (2021).
- **Wilhelm and Else Heraeus Foundation scholarship** to attend Dynamic Days Bremen 2024. (600 €)
- **Dean's list** in Y1, Y2, Y3 and MSc awarded for academic excellence.
- Selected for the MIT exchange (one spot in the Department).
- **Olympiads** Bronze medallist in the 2018 Madrid Chemistry Olympiad, participant in the National Olympiad.

## TEACHING EXPERIENCE

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Mathematical Institute, University of Oxford

*September 2023-Present*

- College Tutor for **Merton College** in Spring 2024 (Hillary term)
- Teaching assistant for **Viscous Flow, Applied PDEs, Mathematical Mechanical Biology.**
- Marker for **Applied Complex Variables.**

Department of Mathematics, Imperial College London

*September 2022-May 2023*

- **Peer Tutor** for two groups of first year students. Responsible for weekly meetings to help my tutees progress with problem sheets, extend their learning from lectures and prepare them for university examinations and the transition to university life.

## PROJECTS

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Most projects are available in my website: <https://javierchico.github.io>

- **Master Thesis** Ferrofluids on cylindrical domains with Prof. Papageorgiou.
- **Year 2 Research:** *The 1:1:2 resonance and the stepwise precession of the swing plane*, supervised by Prof. D. Holm. Developed a semi-empirical formula for the precession angle and studied the effects of including stochasticity into the classical problem of the elastic spherical pendulum.
- **Mathematics of Pelotons** As part of MIT's 18.355 Fluid Dynamics by Prof. Bush I research the aerodynamics of groups of cyclists, and studied their optimal shape, and the optimal position within the peloton.
- **Pattern formation in growing domains** under the guidance of Dr. Ousmane Kodio at MIT.
- **Weakly nonlinear analysis of SIS epidemic system** presented as the research project for 18.377 at MIT, under the supervision of Prof. Akylas.
- **Year 1 Research:** *Applications of the Weierstrass Approximation Theorem and Bernstein Polynomials.* I explored different ways to approximate continuous functions on compact intervals, and quantified the error.
- **ICDSS Insurance Pricing Competition 2020** Second prize in the nonlinear model category (2020). I used generalised linear models to build a predictive model from data from 80000 real drivers.
- **Aerodynamics II:** As part of MIT's 16.100's I designed a subsonic electric aircraft using high performance CFD software.
- **Aerodynamics I:** As part of my International Baccalaureate extended essay I developed a simple mathematical model which describes the lift produced by an aerofoil as a function of several variables such as speed, angle of attack and angle of the flaps. I designed a 3D model which was 3D printed and tested in a small wind to obtain empirical results. Computer simulations using commercial CFD were also produced to contrast the experimental findings.

## SKILLS AND INTERESTS

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**Languages** Bilingual in Spanish and English. **C1 Advanced** (English) Grade: A; Average Score: 209

### Technical skills

- Advanced: Python, MatLab, Excel, LaTeX & R.
- Intermediate: Julia, Mathematica.

### Python Libraries:

- Advanced: Numpy, Pandas, Scipy, Sympy, NetworkX, Tensorflow and sklearn.

### Memberships:

- Associate Member of **IMA** (AMIMA) (Institute of Mathematics and its Applications).
- Member of Imperial College **SIAM** student chapter.
- **Turing** Ambassador
- MathSoc Committee member (Social Events Officer)

### Interests

- Triathlon (runner up in the 2015 regional team championship), trail running and cycling (completed *La Perico Delgado* (164 km, 3000 m elevation) (2019)).