

# CURRICULUM VITAE

## Yue-Kin Tsang

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### Employment

- Research Associate in Fluid Dynamics, July 2022 — present  
School of Mathematics, Statistics and Physics, Newcastle University
- Research Fellow, June 2017 — March 2022  
School of Mathematics, University of Leeds
- Associate Research Fellow, February 2015 — May 2017  
Department of Mathematics, University of Exeter
- Research Assistant, September 2013 — January 2015  
School of Mathematics, University of Edinburgh
- Research Fellow, September 2011 — August 2013  
School of Mathematics and Statistics, University of St Andrews
- Research Associate, August 2010 — August 2011  
Department of Physics, The Chinese University of Hong Kong
- Postdoctoral Fellow, September 2006 — June 2010  
Scripps Institution of Oceanography, University of California, San Diego
- Postdoctoral Fellow, January 2005 — August 2006  
Courant Institute of Mathematical Sciences, New York University

### Education

- Ph.D., Physics, University of Maryland, College Park, August 2004  
Thesis: *Two-Dimensional Turbulence with Drag*  
Advisor: Prof. Edward Ott
- M.Phil., Physics, The Chinese University of Hong Kong, July 1996  
Thesis: *Fluctuation Statistics of Scalar Advected by Different Prescribed Velocity Fields*  
Advisor: Prof. Emily S.C. Ching
- B.Eng. (Hon.), Electronic Engineering, The Chinese University of Hong Kong, July 1994  
Thesis: *Fluorination of  $YBa_2Cu_3O_{7-\delta}$*   
Advisor: Prof. S.P. Wong

### Other Experience and Training

- *Induction Course for New Lecturers in the Mathematical Sciences*  
Isaac Newton Institute for Mathematical Sciences, Cambridge, UK (2018):  
a two-day course endorsed by the Royal Statistical Society and the London Mathematical Society for teaching mathematics and statistics within UK higher education

## Grants and Awards

- *Met Office CASE award*, Primary supervisor (2019):  
a partnership between academic and non-academic organisations in which the Met Office contributes extra funding towards the NERC Panorama Doctoral Training Partnership (DTP) project ‘A stochastic Lagrangian scheme for parametrizing cloud micro- and macro-physics in the Unified Model’
- *Research Visitor Centre Fund (2019)*:  
awarded by the Research and Innovation Committee, University of Leeds to organise the Leeds Convection Conference, £3180
- *PRACE Distributed European Computing Initiative (DECI)*, Principal Investigator (2016):  
a competitive award of high-performance computing resources for the project ‘Particle diffusion and dispersion in magnetohydrodynamic turbulence’, 13500000 core-hours
- *EPSRC Feasibility Grant*, Principal Investigator (2015):  
awarded through the EPSRC Network: Research on Changes of Variability and Environmental Risk for the project ‘Rainfall variability in a changing climate: stochastic versus deterministic dynamics’, £15609
- *1st Place in Best Poster Competition*, Dynamics Days: an International Conference on Chaos and Nonlinear Dynamics, Chapel Hill, North Carolina, USA, (2004):  
‘Intermittency and multifractality in two-dimensional turbulence with drag’

## Student Supervision

- *Undergraduate Summer Bursary Scheme* at the School of Mathematics, University of Leeds:
  - Kasia Nowakowska, *Mathematical modelling of how rocks flow in the Earth’s crust* (co-supervised with Sandra Piazzolo, School of Earth and Environment), 2020
  - Joe Penn, *Advection–condensation of water vapour in a model of oscillating Hadley circulation*, 2019

I proposed and supervised original summer research projects for undergraduate students funded by this competitive scheme. I met with the students weekly over a 10-week period during summers to provide guidance on their research. At the end of the projects, I advised them on how to write a report and give an oral presentation.

## Outreach Activities

- *Year 10 Summer Mathematics Residential*, University of Exeter (2015):  
I taught probability theory to advanced sixth-form students from the Exeter Maths School during their visit to the University in this 3-day program. I designed and delivered the lectures. I also developed a Matlab code for a practical session on random walk.
- *Fife Science Festival—Science Discovery Day* and *Dundee Science Festival—Family Fun Days*, University of St Andrews (2012, 2011):  
I staffed the booth of the Vortex Dynamics Research Group and spoke to the general public about the sciences behind our fluid dynamics demonstrations.
- *Docent at the Astronomy Observatory*, University of Maryland (2002–2004):  
I spoke to visitors about basic astronomy and helped them with operating the telescopes at the Observatory during the biweekly Open House and other public events such as the New Telescope Owners Nights (2003), Mars Opposition (2003) and Venus Transit (2004).
- *Maryland Day* (2003):  
I was involved in various events at this annual Open Day of the University of Maryland.

## Professional Services

- *Organising committee member of the British Applied Mathematics Colloquium (BAMC) 2024:*  
I am fully responsible for the planning and the implementation of the accessibility aspect of the conference. This ranges from making sure the venue is wheelchair-accessible to the availability of private spaces for delegates with special needs. The details are at: <https://conferences.ncl.ac.uk/bamc2024/practicalinformation/conferencecentre>
- *Member of the Newcastle University Advanced and High-Performance Computing Steering Group:*  
This steering group meets monthly to advise the Newcastle University IT Service on the strategic direction of the University's high-performance computing facilities, e.g. recent focus is on the purchase and installation of a new computing cluster.
- *Mentor in the School Mentor Scheme at Newcastle University:*  
I completed the online training sessions for mentors and was then paired with a first-year PhD student. My duties include regular informal meetings to offer advices and to support the student's development throughout their studies.
- *Member of the Teaching Study Group: Inclusion and Diversity at the University of Leeds:*  
This study group meets regularly for discussion and proposes recommendations to the University's Teaching and Learning Committee, e.g. converting all teaching material to meet digital accessibility regulations.
- *Interviewer of undergraduate admission for the Natural Sciences Program, University of Leeds:*  
I evaluated individual prospective students by discussing mathematics questions with them. This also involves introducing the University and explaining the structure of the Program to the students.
- *Member of the interview panel for the NERC Panorama DTP:*  
As one of the two mathematicians on the panel, my responsibility is to interview and rank prospective PhD students for the Panorama DTP. I have taken the training on unconscious bias required for interviewers.
- *Organiser of the biweekly group meeting of the Astrophysical and Geophysical Fluid Dynamics group at the University of Leeds (2018–2021):*  
I revamped the format of the meeting and implemented the policy of requiring every PhD student to present at least once a year. I also make sure to invite senior academic staffs to speak so that group members of all career stages are actively participating.
- *Reviewer of research grant proposals:*  
I was invited to review proposals submitted to the National Science Foundation (NSF) of the United States and the Hong Kong Research Grants Council (RGC).
- *Reviewer of scientific journals including:*  
Journal of Fluid Mechanics, Physics of Fluids, Journal of Physical Oceanography, Geophysical & Astrophysical Fluid Dynamics, Physical Review (PRL, PRE), Fluid Dynamics Research, Royal Astronomical Society Techniques and Instruments, Nature Scientific Reports, IEEE Transactions on Biomedical Engineering.

## Publications

1. Passive scalar conditional statistics in a model of random advection  
Emily S.C. Ching and Y.K. Tsang, *Physics of Fluids* **9**, 1353 (1997)
2. Intermittency of a passive scalar advected by a quasifrozen velocity field  
Emily S.C. Ching, C.S. Pang, Y.K. Tsang and X.H. Wang, *Physics of Fluids* **11**, 2263 (1999)
3. Nondestructive determination of the longitudinal chromatic dispersion distribution along an optical fiber  
P.K.A. Wai, F. Moldoveanu, H.H. Chen and Y.K. Tsang, *Microwave and Optical Technology Letters* **30**, 312 (2001)
4. Exponential decay of chaotically advected passive scalars in the zero diffusivity limit  
Yue-Kin Tsang, Thomas M. Antonsen, Jr., Edward Ott, *Physical Review E* **71**, 066301 (2005)
5. Intermittency in two-dimensional turbulence with drag  
Yue-Kin Tsang, Edward Ott, Thomas M. Antonsen, Jr., Parvez N. Guzdar, *Physical Review E* **71**, 066313 (2005)

6. Bounding biomass in the Fisher equation  
Daniel Birch, Yue-Kin Tsang and William R. Young, *Physical Review E* **75**, 066304 (2007)
7. Multifractality and scale invariance in human heartbeat dynamics  
Emily S.C. Ching and Yue-Kin Tsang, *Physical Review E* **76**, 041910 (2007)
8. Near-inertial parametric subharmonic instability  
William R. Young, Yue-Kin Tsang and Neil J. Balmforth, *Journal of Fluid Mechanics* **607**, 25 (2008)
9. Energy-enstrophy stability of  $\beta$ -plane Kolmogorov flow with drag  
Yue-Kin Tsang and William R. Young, *Physics of Fluids* **20**, 084102 (2008)
10. Forced-dissipative two-dimensional turbulence: a scaling regime controlled by drag  
Yue-Kin Tsang and William R. Young, *Physical Review E* **79**, 045308(R) (2009)
11. Predicting the evolution of fast chemical reactions in chaotic flows  
Yue-Kin Tsang, *Physical Review E* **80**, 026305 (2009)
12. Non-universal velocity probability densities in forced two-dimensional turbulence: the effect of large-scale dissipation  
Yue-Kin Tsang, *Physics of Fluids* **22**, 115102 (2010)
13. Scaling behavior in turbulent Rayleigh-Bénard convection revealed by conditional structure functions  
Emily S. C. Ching, Yue-Kin Tsang, T. N. Fok, Xiaozhou He and Penger Tong, *Physical Review E* **87**, 013005 (2013)
14. Ellipsoidal vortices in rotating stratified flows: beyond the quasi-geostrophic approximation  
Yue-Kin Tsang and David G. Dritschel, *Journal of Fluid Mechanics* **762**, 196 (2015)
15. The effect of coherent stirring on the advection–condensation of water vapour  
Yue-Kin Tsang and Jacques Vanneste, *Proceeding of the Royal Society A* **473**, 20170196 (2017)
16. A stochastic Lagrangian basis for a probabilistic parameterization of moisture condensation in Eulerian models  
Yue-Kin Tsang and Geoffrey K. Vallis, *Journal of the Atmospheric Sciences* **75**, 3925 (2018)
17. Characterising Jupiter’s dynamo radius using its magnetic energy spectrum  
Yue-Kin Tsang and Chris A. Jones, *Earth and Planetary Science Letters* **530**, 115879 (2020)
18. Scaling of the geomagnetic secular variation timescales  
Yue-Kin Tsang and Chris A. Jones, *Geophysical Journal International* **239**, 1 (2024)
19. Low inertia reversing geodynamos  
Chris A. Jones and Yue-Kin Tsang, *Physics of the Earth and Planetary Interiors* **360**, 107303 (2025)
20. Oscillatory double-diffusive convection in a rotating spherical shell at low Rayleigh numbers  
Yue-Kin Tsang, Céline Guervilly and Graeme R. Sarson, *Journal of Fluid Mechanics*, in preparation (2025)
21. Secular variation spectrum of the magnetic field in a dynamo model of Jupiter  
Yue-Kin Tsang, *Journal of Geophysical Research: Planets*, in preparation (2025)

### **Selected Conference Presentations**

1. Revealing small-scale structures in turbulent Rayleigh-Bénard convection  
*The 25th Scottish Fluid Mechanics Meeting*, Edinburgh, UK, 2012
2. Ellipsoidal vortices in non-hydrostatic rotating stratified flows: can they survive?  
*IUGG Conference on Mathematical Geophysics*, Edinburgh, UK, 2012
3. Ellipsoidal vortices beyond the quasi-geostrophic approximation  
*American Physical Society Division of Fluid Dynamics 65th Annual Meeting*, San Diego CA, USA, 2012
4. Ageostrophic effects on the evolution of ellipsoidal vortices  
*IUTAM Symposium on Vortex Dynamics: Formation, Structure and Function*, Fukuoka, Japan, 2013

5. Improving global stability analysis of Kolmogorov flows Using enstrophy  
*British Applied Mathematics Colloquium*, Leeds, UK, 2013
6. An energy–enstrophy method for global Stability in two-dimensional hydrodynamics  
*Turbulent Mixing and Beyond Workshop*, ICTP, Trieste, Italy, 2014
7. Atmospheric moisture transport: stochastic dynamics of the advection-condensation equation  
*SIAM Conference on Nonlinear Waves and Coherent Structures*, Cambridge, UK, 2014
8. Impact of changes in the Hadley circulation on regional rainfall  
*Maths Foresees Workshop*, Leeds, UK, 2015
9. Particle diffusion in magnetohydrodynamic turbulence  
*UKMHD Meeting*, Newcastle, UK, 2015
10. Particle diffusion in magnetohydrodynamic turbulence: effects of a guiding magnetic field  
*XXXV Dynamics Days Europe*, Exeter, UK, 2015
11. Particle diffusion in strong field-guided magnetohydrodynamic turbulence  
*American Physical Society Division of Plasma Physics 57th Annual Meeting*, Savannah GA, USA, 2015
12. Advection–condensation of water vapor with coherent stirring: a stochastic approach  
*American Physical Society Division of Fluid Dynamics 68th Annual Meeting*, Boston MA, USA, 2015
13. Stochastic modelling and parametrization of atmospheric moisture transport  
*Mathematics of Dispersion in the Environment*, Birmingham, UK, 2016
14. Effects of a guided-field on particle diffusion in magnetohydrodynamic turbulence  
*UKMHD Meeting*, Glasgow, UK, 2016
15. Parametrization of stochastic effects in an advection-condensation model  
*The 4th Annual CliMathNet Conference*, Exeter, UK, 2016
16. Effects of a guided-field on particle diffusion in magnetohydrodynamic turbulence  
*17th MHD Days*, Göttingen, Germany, 2016
17. The quest for water vapour parametrization in weather and climate models  
*BRIM Workshop: The Influence of Weather and Climate Variability on Water Resources Management*, Exeter, UK, 2017
18. Probabilistic parametrization of condensation in coarse-grained moisture transport models  
*British Applied Mathematics Colloquium*, Surrey, UK, 2017
19. Magnetic power spectrum in a dynamo model of Jupiter  
*UKMHD Meeting/British Applied Mathematics Colloquium*, St Andrews, UK, 2018
20. How deep is Jupiter’s metallic hydrogen region?  
*The 16th Symposium of SEDI, Study of the Earth’s Deep Interior*, Edmonton, Canada, 2018
21. Parametrization of moisture condensation using stochastic Lagrangian models  
*The 6th Annual CliMathNet Conference*, Reading, UK, 2018
22. Determining the depth of Jupiter’s dynamo region  
*MHD Days and GdRI Dynamo Meeting*, Dresden, Germany, 2018
23. Characterising Jupiter’s dynamo radius using its magnetic energy spectrum  
*UK-SEDI*, London, UK, 2019
24. Spectra of magnetic energy and secular variation in a dynamo model of Jupiter  
*Compressible Convection Conference*, Newcastle, UK, 2019
25. Characterizing Jupiter’s dynamo radius using its magnetic energy spectrum  
*The Macau Forum for Planetary Sciences: The Interiors of Jupiter and Saturn*, Macau, China, 2019

26. Scaling of the geomagnetic secular variation time scales  
*INI Leeds Satellite Workshop: Fluid Flow and Magnetic Field Generation in Fluids and Plasmas*, Leeds, UK, 2022
27. Scaling of the geomagnetic secular variation time scales  
*EGU General Assembly*, Vienna, Austria, 2023
28. Oscillatory double-diffusive convection in a rotating spherical shell: a preliminary survey  
*UKMHD Meeting*, Leeds, UK, 2023
29. Scaling of the geomagnetic secular variation time scales  
UK-SEDI, Leeds, UK, 2024
30. Oscillatory double-diffusive convection in a rotating spherical shell at low Rayleigh numbers  
*Mathematical Aspects of Geophysical and Astrophysical Fluid Dynamics*, Newcastle, UK, 2024
31. Oscillatory double-diffusive convection in a rotating spherical shell  
*UKMHD Meeting*, Coventry, UK, 2024
32. Oscillatory double-diffusive convection in a rotating spherical shell  
*Geophysical and Astrophysical Fluids and Dynamos Meeting*, Leeds, UK, 2024

## Teaching Experience

- Newcastle University
  1. Group Project Module, Autumn 2024  
*3rd-year Mathematics module: supervise two groups of four students, design a project for each group, hold an advisory session with each group every week, guide the students to give an oral presentation, prepare a poster presentation and write a final report*
- University of Leeds
  1. Probability and Statistics I, Autumn 2021  
*1st-year Statistics module: lead discussion in tutorial sessions and mark homework*
  2. Modelling with Differential Equations, Spring 2021 — **Module leader**  
*1st-year Applied Mathematics module: adopt remote teaching by delivering one live online lectures and uploading one recorded lectures each week as well as running remote tutorial sessions, provide leadership for all tutors on the module, develop lecture notes, write and mark homework and exam*  
<https://www.mas.ncl.ac.uk/~nyt27/1400>
  3. Numerical Methods, Autumn 2019 — **Module leader**  
*3rd-year Applied Mathematics module: implement an innovative flipped learning approach, develop interactive classroom activities, create Python codes for use in class, setup online quizzes using the e-assessment tool Numbas, prepare lecture notes, write and mark exam*  
<https://www.mas.ncl.ac.uk/~nyt27/3476>
  4. Calculus and Mathematical Analysis, Autumn 2018  
*1st-year Mathematics module: lead discussion in tutorial sessions and mark homework*
  5. Numbers and Vectors, Autumn 2018  
*1st-year Mathematics module: lead discussion in tutorial sessions and mark homework*
- The Chinese University of Hong Kong
  1. Physics in Meteorology, Spring 2011 — **Principal lecturer**  
*4th-year Physics course: create a new set of lecture notes, deliver lectures, write and mark exam*  
<https://www.mas.ncl.ac.uk/~nyt27/4520>

- University of California, San Diego

1. Introduction to Applied Mathematics II, Winter 2008
2. Introduction to Applied Mathematics II, Winter 2007

*Graduate-level Applied Mathematics course for engineering and oceanography students: give mini-lectures in discussion sessions and prepare homework solutions*

- New York University

1. Geophysical Turbulence, Fall 2005

*Graduate-level Applied Mathematics course: deliver guest lectures on multiple-scale analysis, homogenization theory and eddy diffusion*

- University of Maryland, College Park

1. Experimental Physics II: Electricity and Magnetism, Spring 2004
2. General Physics II, Spring 2003
3. Quantum Mechanics I (graduate level), Fall 2001
4. Principles of Modern Physics, Spring 2001
5. Intermediate Theoretical Methods, Spring 2001
6. Chaotic Dynamics (graduate level), Spring 2000
7. Intermediate Theoretical Methods, Spring 2000
8. General Physics II, Fall 1999
9. Principles of Physics II, Spring 1999
10. Principles of Physics I, Fall 1998

*Undergraduate and graduate Physics courses: give mini-lectures in discussion sessions, create and grade quizzes, run laboratory sessions and grade lab reports, grade homework and exam*

- The Hong Kong Polytechnic University

1. Corporate Communication Network, Spring 1997

*Undergraduate course in Electrical Engineering: lead practical sessions on computer simulations using MATLAB*

- The Chinese University of Hong Kong

1. Mechanics, Spring 1996
2. Mechanics, Fall 1995
3. Perspective in Physics, Fall 1994

*Undergraduate Physics courses: give mini-lectures in tutorial sessions, prepare homework solutions, grade homework and exam*