

J O H A N N E S E . M . M O S I G

AI/ML RESEARCHER

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PERSONAL INFORMATION

FULL NAME Johannes Ernst Manfred Mosig
LANGUAGES German (first language)
English (fluent, 2014 TOEFL iBT 113/120)

— Career objective —

Driven by my curiosity and the desire to help people, I have successfully worked on a very broad range of topics from particle physics, via general relativity, to ocean modelling. I am now eager to enter the field of machine learning / AI, because I believe this is the field with the greatest impact on the future of our civilization and I wish to contribute to making this impact a positive one.

HIGHLIGHTS

What follows is a brief listing of my skills and interests. Please refer to the subsequent pages for more detailed information.

— Hard skills —

🐍 Python, 🧠 Tensorflow, 📦 C++, 🖥️ Wolfram Language;
Mathematics (PhD), physics (MSc), computer science, machine learning, reinforcement learning.

— Soft skills —

Analytic thinking, teamwork and leadership, presenting and teaching, general curiosity;
Interested in martial arts, bouldering, and playing the piano.

— Projects —

[Neural processes](#) package 🐍🧠; [Rubik's Cube ML project](#) 🐍🧠; [Polynomial chaos](#) package 🖥️; [Multiplets](#) package 🖥️; [Article of the Week blog](#); Mathematical modelling of ocean-wave / sea ice interactions; Electronic properties of Graphene; Investigation of symmetries in Kerr spacetime using the spinor formalism of general relativity; Calculation of a hadronic scattering cross-section within an effective quantum field theory; Organization of the [NZMASP'16 conference](#) in New Zealand.

CAREER SUMMARY

— Degrees —

- 2014 – 2018 Doctor of Philosophy (PhD), Mathematics, University of Otago
*For my work on “Contemporary wave–ice interaction models” I received the **exceptional thesis award** from the University of Otago. During my time as a PhD student I investigated three distinct classes of mathematical models for the prediction of ocean wave / sea ice interactions, leading to **four articles** [1, 3, 5, 6] in high-impact journals of the field, as well as two conference papers [7, 8]. Furthermore, I have presented my work at six conferences in various countries, from New Zealand and Australia, to Croatia, Great Britain, and China. In addition to my PhD work, I also helped Christian Fräßdorf with a project about the electronic properties of graphene at the Free University of Berlin. Our work resulted in **two additional articles** in high-impact journals [2, 4].*
- 2011 – 2014 Master of Science (MSc), Physics, University of Potsdam / Max-Planck-Institute for Gravitational Physics
*I received the **best possible grade (1.0)** on my thesis about “Spin Fields and Hidden Symmetries in Curved Spacetime”, where I explored mathematical methods that might help solve the stability problem of rotating black holes within the framework of general relativity. I spent most of the time working at the Max-Planck-Institute for Gravitational Physics.*
- 2007 – 2011 Bachelor of Science (BSc), Physics, Free University of Berlin / Uppsala University
*My desire to learn more led me to extend the usual physics curriculum with a **student exchange** to Uppsala University, financially supported by the ERASMUS programme of the European Union. Subsequently, I spent three months at the York University in Toronto, writing a program for the numerical calculation of effective scattering potentials of Beryllium-like ions. My stay was financed by the DAAD – RISE in North America programme. I later returned to Sweden to write my bachelor’s thesis about chiral perturbation theory in particle physics, with Prof. Stefan Leupold. In my thesis, I calculated a certain scattering cross-section and compared the result with experimental data. The thesis received the **best possible grade (1.0)**.*

— Work experience —

- 2019 **Freelancer**
*Presently, I work on several **machine learning projects** and self-study **Bayesian statistics, information theory, Python, and Tensorflow**. Meanwhile, I am working as a private tutor for mathematics and physics for the ABACUS institute.*
- 2018 **Software developer** at the Forschungsgesellschaft für Energie und Umwelttechnologie (FGEU) mbH in Berlin
Here I implemented an upgrade to the 3D graphics module of the FGEU’s software WinField, that is used to calculate electromagnetic fields of various facilities, such as landlines and transformer stations.
- 2018 **Tutor** for undergraduate physics at the University of Otago’s Disability Information and Support Office

- 2018 **Teaching Fellow** at the University of Otago
In this position I taught the mathematics summer school on analysis.
- 2016 – 2017 “Technology Evangelist” for **Wolfram Research**
*Wolfram Research **recruited me** after their Software and Resource Development manager, Prof. Craig Bauling, had seen both my presentation and programming skills in action. As a Wolfram Evangelist I have demonstrated to researchers at the NIWA Institute in Christchurch how I use Wolfram’s flag-ship product, **Mathematica**, for data analysis and problem solving.*
- 2015 – 2017 **Tutor** for mathematics at the University of Otago
- 2012 – 2014 **Software developer** at the FGEU mbH in Berlin
*The FGEU mbH **recruited me** as software developer (Delphi) and scientific adviser.*
- 2011 – 2013 **Tutor** for undergraduate physics at the University of Potsdam

SKILLS AND ADDITIONAL INVOLVEMENTS

— Analytic, clear thinking —

- With an exceptional **PhD in mathematics** and a Master of Science in theoretical **physics** I am highly trained in clear and abstract thinking.
- Since 2019 I am an active member of the [Berlin Rationalist Community](#) (Less Wrong Berlin), where I have organized two workshops on “overcoming bias” (recently rated 4.8 out of 5.0).

— Teamwork and leadership —

- From 2015 to 2016 I was elected **head of the conference organising committee** for the New Zealand Mathematics and Statistics Postgraduate Conference ([NZMASP’16](#)). Participants rated the event with 4.7 out of 5.0 points.
- During the International Summer Student Programme at the Helmholtz Graduate School for Hadron and Ion Research in 2011 I was elected **chief editor** of the “Book of reports”.
- Between 2016 and 2017 I **collaborated** with Christian Fräßdorf on a project about the electronic properties of graphene at the Free University of Berlin. Our work resulted in **two articles in high-impact journals** [2, 4].
- In 2018 I **joined** Prof. Mike Maylan and Prof. Luke Bennetts to **work** on a project during the “Mathematics of Sea Ice Phenomena” workshop in Cambridge. Our collaboration **resulted in a journal article** [3].

— IT and software development —

- I am working on a [machine learning project about the Rubik’s Cube](#), as part of which I develop a [python package for neural processes](#).
- On my [“Article of the Week” blog](#) I regularly summarize materials about machine learning and AI.

- Since 2018 I participate regularly in an Advanced **Machine Learning** [study group](#) in Berlin.
- I developed a Mathematica package for [Multiplets and Young Tableaux](#)
- Another Mathematica package of mine is about [Generalized polynomial chaos](#) methods
- The **Wolfram Language** (a.k.a. **Mathematica**) is a multi-paradigm symbolic computation language that I have used to solve a wide range of tasks from creating vector-graphics and analysing data to solving integro-differential equations, abstract algebra and differential geometry tasks. Wolfram Research recruited me as Wolfram “Evangelist” and advertized for their software with my PhD thesis.
- During high school, I won the 2nd prize of the 23rd federal competition “Bundeswettbewerb für Informatik 2004/2005” for my **C++** application. I also developed 3D computer games using a language similar to **C**.
- I gained more than three years of experience in software development with **Delphi** at the FGEU mbH.
- Since before my time as a doctoral student, I am using **L^AT_EX** and **Git** on a regular basis.
- I am familiar with **Windows** as well as **Linux** (Ubuntu) operating systems.

— **Presenting and teaching** —

- In 2018 I taught analysis as a **teaching fellow** at the University of Otago. To illustrate mathematical concepts, I created a sequence of **interactive simulations** using the Wolfram Language.
- I have four years worth of experience in **tutoring** mathematics and physics at two different universities.
- Throughout my PhD, I **presented** my work at eight conferences and multiple other occasions (department internal meetings, Abbey College).
- In 2014 I **volunteered** as a demonstrator at the Dunedin Science Festival.

— **Curiosity** —

- Curiosity motivated me to work successfully on projects about **quantum mechanics** (bachelor thesis), **atomic physics** (DAAD student exchange to York University in Toronto), **general relativity** (master thesis), **solid state physics** (graphene project with Christian Fräßdorf), and **ocean / sea ice modelling** (PhD thesis).
- In 2012 I participated in the Summer school on Complex Quantum Systems (CoQuS) at the University of Vienna.

— Theses —

- PhD [Exceptional thesis award](#) on *Contemporary wave-ice interaction models*, at the University of Otago
- MSc **Best possible grade (1.0)** on *Spin Fields and Hidden Symmetries in Curved Spacetime*, at the University of Potsdam and the **Max-Planck-Institute** for Gravitational Physics
- BSc **Best possible grade (1.0)** on *Electromagnetic Processes with Hadronic Final State Pion, Kaon, Antikaon* at Uppsala University

— Journal articles —

- [1] **Mosig, J. E. M.**, F. Montiel, and V. A. Squire. 2019. “A transport equation for flexural-gravity wave propagation under a sea ice cover of variable thickness.” *Wave Motion*. Recently accepted.
- [2] Fräßdorf, Christian, and **J. E. M. Mosig**. 2018. “Keldysh Functional Renormalization Group for Electronic Properties of Graphene.” *Physical Review B* 95 (12). DOI: [10.1103/PhysRevB.95.125412](https://doi.org/10.1103/PhysRevB.95.125412).
- [3] Meylan, M. H., L. G. Bennetts, **J. E. M. Mosig**, W. E. Rogers, M. J. Doble, and M. A. Peter. 2018. “Dispersion Relations, Power Laws, and Energy Loss for Waves in The Marginal Ice Zone.” *Journal of Geophysical Research: Oceans*. DOI: [10.1002/2018JC013776](https://doi.org/10.1002/2018JC013776).
- [4] Fräßdorf, Christian, and **J. E. M. Mosig**. 2017. “Chemical-Potential Flow Equations for Graphene with Coulomb Interactions.” *Physical Review B* 27 (23), DOI: [10.1103/PhysRevB.97.235415](https://doi.org/10.1103/PhysRevB.97.235415).
- [5] **Mosig, J. E. M.**, F. Montiel, and V. A. Squire. 2016. “Water Wave Scattering from a Mass Loading Ice Floe of Random Length Using Generalised Polynomial Chaos.” *Wave Motion*. DOI: [10.1016/j.wavemoti.2016.09.005](https://doi.org/10.1016/j.wavemoti.2016.09.005).
- [6] **Mosig, J. E. M.**, F. Montiel, and V. A. Squire. 2015. “Comparison of Viscoelastic-Type Models for Ocean Wave Attenuation in Ice-Covered Seas.” *Journal of Geophysical Research: Oceans* 120 (9): 6072–90. DOI: [10.1002/2015JC010881](https://doi.org/10.1002/2015JC010881).

— Conference papers —

- [7] **Mosig, J. E. M.**, F. Montiel, and V. A. Squire. 2015. “On the transport of energy by surface Flexural-gravity waves.” 32nd International Workshop on Water Waves and Floating Bodies IWWWFB 2017. Dalian, China.
- [8] **Mosig, J. E. M.**, F. Montiel, and V. A. Squire. 2015. “Rheological Models of Flexural-Gravity Waves in an Ice Covered Ocean on Large Scales.” 7th International Conference on Hydroelasticity in Marine Technology HYEL 2015. Split, Croatia.

— Conference presentations —

- 2018 3rd *Australian Conference on Wave Science* ([KOZWaves](#)), Auckland, New Zealand
- 2017 *Mathematics of Sea Ice Phenomena*, Isaac Newton Institute, University of Cambridge
- 2017 32nd *International Workshop on Water Waves and Floating Bodies* ([IWWWFB](#)), Dalian, China
- 2016 *New Zealand Mathematics and Statistics Postgraduate Conference* ([NZMASP'16](#)), Queenstown, New Zealand
- 2015 2nd *Australian Conference on Wave Science* ([KOZWaves](#)), Adelaide, Australia
- 2015 *New Zealand Mathematics and Statistics Postgraduate Conference* (NZMASP'15), Taupo, New Zealand
- 2015 7th *International Conference on Hydroelasticity* ([HYEL](#)), Split, Croatia
- 2014 *Mathematical Sciences Symposium*, Auckland, New Zealand