Dipl.-Ing. Dr. Christopher Albert

CONTACT

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BORN

September 25, 1986 in Graz, Austria

SUMMARY

Physicist with several years of experience in plasma theory and numerics, physics-informed machine learning, acoustics, and software development. My main interest lies in plasma kinetic theory for fusion energy research. Recently, I've been working on reduced complexity models applicable in cross-disciplinary areas. Former projects include R&D in the automotive sector and developing noise and vibration measurement systems and e-learning software. I enjoy finding connections between different fields and working with students.

EDUCATION

Graz University of Technology

Doctoral Programme of Sciences - Physics — 2014 - 2017
Hamiltonian methods for fusion plasmas with non-axisymmetric perturbations

BSc and MSc Technical Physics — 2006 - 2012
Specialization on theory and numerics, Master's thesis on coupled vibro-acoustic systems

Interuniversity Exchange

Erasmus at Université de Genève (e.g. history of quantum physics) — 2009 - 2010

Internship at University of Innsbruck (assembly of a fiber laser amplifier) — 2008

WORK EXPERIENCE

Graz University of Technology - Inst. of Theoretical and Computational Physics

Tenure Track Professorship (head of plasma physics group) — since 2021

University Assistant (research and teaching) — 2014 - 2018

Teaching Assistant (development of e-learning software) — 2008 - 2012

Max Planck Institute for Plasma Physics - Numerical Methods in Plasma Physics

Postdoctoral researcher — 2018 - 2021
Machine learning for reduced complexity models within a cross-disciplinary
Helmholtz society project, structure-preserving methods in plasma simulation

Virtual Vehicle Research GmbH

Junior Researcher (24h weekly, vehicle acoustics) — 2012 - 2014

Master's Thesis (industrial collaboration, acoustics of poroelastic foams) — 2011 - 2012

Dr. Pfeiler GmbH Civil Engineering

Measurement and Simulation Engineer (16h weekly, engineering acoustics) — 2012 - 2014

Software Developer (part-time, developing data acquisition systems) — 2006 - 2012

TEACHING EXPERIENCE

7 years of lecturing in theory, plasma physics and programming at TU Graz

(Co-)supervision of students at TU Graz, LMU München and TU München

4 PhD theses (MHD and kinetic equilbria, particle orbits, data science) — since 2018

10 Master theses (theory, numerics, plasma, acoustics, machine learning) — since 2017

22 Bachelor theses (theory, numerics, plasma, acoustics) — since 2015

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RESEARCH INTERESTS AND ACHIEVEMENTS	**Fusion plasma physics** Application of Hamiltonian mechanics, perturbation theory, chaos and fractal geometry to fusion plasmas. Developed unified kinetic theory for resonant transport in tokamaks with non-axisymmetric perturbations at reactor-relevant collisionality. Significantly accelerated computations of energetic alpha particles for stellarator optimization by combining symplectic integration with classification of Poincaré sections.

Physics-informed machine learning
Regression and interpolation of equations representing laws of physics via Gaussian processes and artificial neural networks. Applied Bayesian methods for uncertainty quantification and reliability studies in an interdisciplinary environment. Developed specialized kernel approach to physics-informed Gaussian process regression. Introduced symplectic GP regression as a structure-preserving emulator for Hamiltonian systems.

Structure-preserving numerics
Numerical methods that retain the mathematical and physical structure of the underlying system, thereby improving reliability and performance. Developed Fourier-Finite-Element code for use in iterative magnetohydrodynamic and kinetic computations. Developed symplectic integration schemes of several orders for systems with non-canonical formulation. Combined analytical and numerical methods to improve efficiency in multi-disciplinary applications in acoustics and electrical engineering.

Publication record

- 18 peer-reviewed articles (10 as first author)
- 12 scientific talks (7 invited) and two public outreach presentations
- One textbook, one monograph and one patent granted

Acquired external funding for ~ 7 person-years (Helmholtz, EUROfusion)

SKILLS

Extensive knowledge in theoretical physics, plasma physics, acoustics, numerical simulation, data science and visualization. Several years' experience in university level teaching, sound and vibration measurement, construction physics and software development. Basics in economics, courses and initial experience in project and risk management, experience in authoring of proposals and reports as well as negotiation and leadership.

Programming:
★★★★☆ Python, Fortran, Matlab
★★★☆☆ Julia, C/C++, Java, C#

Languages:
★★★★★ German (mother tongue)
★★★★☆ English (8 years, Cambridge Certificate in Advanced English)
★★★☆☆ French (4 years, summer schools, academic year in Geneva)
★☆☆☆☆ Russian, Japanese (private study)

CODES

SIMPLE: Symplectic methods for particle losses. (https://github.com/itpplasma/SIMPLE)

proFit: Probabilistic reduced order model fitting (https://github.com/redmod-team/profit)

fffi: Fortran foreign function interface for Python (https://github.com/pyccel/fffi)

ACTIVITIES

Elected head of the union of doctoral students at TU Graz (2015-2017)

Fellow of the interdisciplinary student network PRO SCIENTIA (2015-2017)

Scholarship of the Austrian Ministry for Transport, Innovation and Technology to attend the Technology Symposium of the European Forum Alpbach (2015)

Scholarships of merit of the faculty of Mathematics, Physics, and Geodesy (2007, 2008)

GRAZ,
15/11/2021

12th place in the Austrian Mathematical Olympiad (2005) and successful participation in numerous international competitions