Assoc.Prof. Dipl.-Ing. Dr. Christopher Albert

CONTACT

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BORN

September 25, 1986 in Graz, Austria

SUMMARY

Physicist with more than 10 years of experience in theory and computation, physics-consistent machine learning, software development and leading international teams. The application of my work is mainly on fusion plasma physics. There my focus is on metrics for stellarator optimization and how they affect plasma transport and kinetic modeling of 3D perturbations in tokamaks. Former projects include R&D on acoustics in the automotive sector and developing noise and vibration measurement database systems and e-learning software. I enjoy finding connections between fields and working with students.

WORK EXPERIENCE

Graz University of Technology

Tenure Track Professorship (head of plasma physics group) since 2021, tenured 2025

University Assistant (research and teaching) 2014 - 2018

Teaching Assistant (part-time, development of e-learning software) 2008 - 2012

Max Planck Institute for Plasma Physics

Postdoctoral Researcher 2018 - 2021
Machine learning for reduced complexity models within a cross-disciplinary project team, structure-preserving methods in plasma simulation

Virtual Vehicle Research GmbH

Master's Thesis and Junior Researcher (part-time, vehicle acoustics) 2011 - 2014

Dr. Pfeiler GmbH Civil Engineering

Software Developer and Engineer (part-time, engineering acoustics) 2006 - 2014

TEACHING EXPERIENCE

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

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

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

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

23 Bachelor theses (theory, numerics, plasma, acoustics) since 2015

EDUCATION

Graz University of Technology

Habilitation - Theoretical and Computational Physics 2021 - 2024
Physics-consistent methods for particle orbits and fields in fusion plasmas

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

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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 early classification on Poincaré sections. Reconstruction of 3D equilibria and profiles and disruption prediction from diagnostics time-series.

Physics-consistent 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 multidisciplinary applications in acoustics and electrical engineering.

Publication record

- 42 peer-reviewed articles (15 first author, 10 last author)
- 20 scientific talks (9 invited) and several public outreach presentations
- One textbook, one monograph and one patent granted

Acquired funding of $>$ 2 Mio EUR (EUROfusion, Helmholtz, ÖAW, Schiedel)

Skills

Extensive knowledge in theoretical and computational physics, plasma physics, acoustics, numericals, data science and visualization. More than ten years of experience in pure and applied physics, developing scientific and application software, authoring scientific articles, proposals and reports, and university level teaching. Five years of experience in project and risk management, negotiation and leadership in international teams.

Leadership Training

- Project Management for Scientists (Max-Planck Institute for Plasma Physics, 2020)
- Rhetorics: Argumentation, Techniques, Moderation (TU Graz, 2022)
- Management Development Programme (TU Graz, 2023)

Codes

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

GORILLA: Geometric tracer for plasma transport. (https://github.com/itpplasma/GORILLA)

NEO-2: 3D drift-kinetic plasma transport. (https://github.com/itpplasma/NEO-2)

Activities

Delegate: International Tokamak Physics Activity Transport/Confinement (since 2024)

Partner: Dr. Pfeiler GmbH Engineering (since 2024)

Advisory board member: URANIA Steiermark science-to-public (since 2023)

Coordinator: Analysis and modeling in EUROfusion work packages (since 2022)

Graz, 29/04/2026

Elected head: Union of doctoral students at TU Graz (2015-2017)

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Selected publications

Albert CG, Graßler GS, Kasilov SV, Markl M, Schatzlmayr J. *Symplectic integration of guiding-center equations in canonical coordinates for general toroidal fields.* Plasma Physics and Controlled Fusion 67:115016, 2025.
doi:10.1088/1361-6587/ae10dd

Schatzlmayr J, Graßler G, Heyn MF, Kasilov SV, Albert CG, the ASDEX Upgrade Team, the EUROfusion Tokamak Exploitation Team. *Symplecticity of the GORILLA guiding-centre tracer and its implications for edge transport modelling.* Plasma Physics and Controlled Fusion 67:075014, 2025.
doi:10.1088/1361-6587/add0df

Albert CG, Heyn MF, Kapper G, Kasilov SV, Kernbichler W, Martitsch AF. *Evaluation of toroidal torque by non-resonant magnetic perturbations in tokamaks for resonant transport regimes using a Hamiltonian approach.* Physics of Plasmas 23:082515, 2016.
doi:10.1063/1.4961084

Markl M, Ulbl P, Albert CG, Angioni C, Buchholz R, Heyn MF, Kasilov SV, Kernbichler W, Suttrop W, Willensdorfer M, the ASDEX Upgrade Team. *Kinetic study of the bifurcation of resonant magnetic perturbations for edge localized mode suppression in ASDEX Upgrade.* Nuclear Fusion 63:126007, 2023.
doi:10.1088/1741-4326/acf20c

Lainer P, Markl M, Heyn MF, Kasilov SV, Schatzlmayr J, Albert CG, Suttrop W, the ASDEX Upgrade Team, the EUROfusion Tokamak Exploitation Team. *Hybrid kinetic-MHD model of RMP interaction with tokamak plasmas.* Preprint, 2024.
pure.mpg.de/item_3610045

Albert CG, Beidler CD, Kapper G, Kasilov SV, Kernbichler W. *On the convergence of bootstrap current to the Shaing–Callen limit in stellarators.* Journal of Plasma Physics 91:E77, 2025.
doi:10.1017/S0022377825000200