

Fusion Research in Austria

Activities in 2024 and 2025

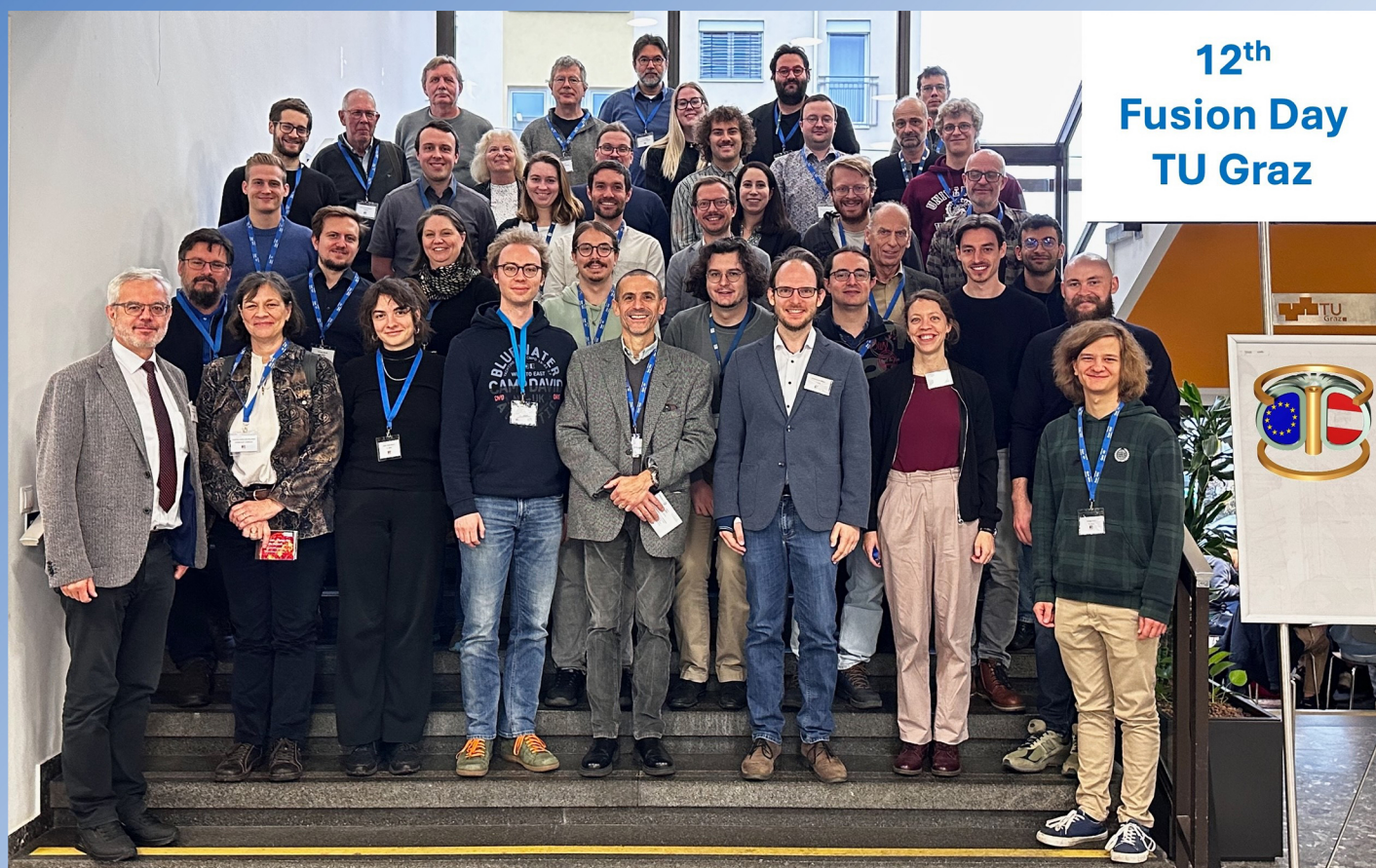


Photo on cover page:

12th Fusion Day at TU Graz, Graz, on 21.11.2025.

Courtesy Technische Universität Graz, Institut für Theoretische Physik – Computational Physics

Fusion Research in Austria

Activities in 2024 and 2025

Vienna

April 2026

Fusion Research in Austria - Activities in 2024 and 2025

Compiled and edited by Nadja Lampichler, Lätitia Unger and Monika Fischer

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CONTENTS

Introduction.....	2
I. On the road to fusion electricity	4
II. Fusion research in Austria	11
1. Overview	11
2. Research highlights	13
3. Selected PhD theses completed/near completion in 2024/2025	21
4. Public information and outreach	24
5. Publications	28
Management structure	33
Austrian representatives in fusion committees (2024-2025)	34
Glossary of scientific and technical terms.....	35
Contact information	36



We have now been part of the FP9 Horizon Europe programme for five years. It has already been extended until the end of 2027. Preparations for the next framework programme are about to start this year.

A lot has happened in the last two years in the field of nuclear fusion research: records have been announced and important milestones have been reached. At ITER, the fourth of nine sector modules has been successfully lowered into place. EUROfusion and ITER signed a new high-level cooperation agreement, Wendelstein and WEST set impressive

plasma records and partners launched a joint research plan for the BEST tokamak in China.

Moreover, Gianfranco Federici was elected as the new EUROfusion programme manager for a period of three years. His predecessor Ambrogio Fasoli stepped down from his function by the end of 2024. We summarised the most important developments in chapter I.

On Austrian level, we received two EUROfusion researcher grants. With this, we have already obtained three grants in this framework programme since 2021, which is more than ever before. In chapter II.2., you will find interviews with our grantees.

This brochure is intended to highlight the integration of Austrian fusion research into the European Fusion Research Programme and make successes visible. The largest part of Austrian fusion research is performed at university institutes, with approximately seventeen PhD students and their supervisors participating per year. Education and training of young researchers therefore continues to be an important objective of the Austrian Fusion Research Programme, which is well recognized by the number of PhD theses supported within the EUROfusion work package *Training and Education*. Selected theses completed in the period 2024/2025 or near completion are presented in chapter II.3.

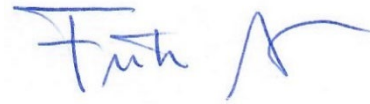
As Austria does not have its own fusion facilities, opportunities to contribute to experiments and modelling at ASDEX Upgrade, TCV Tokamak, MAST Upgrade and Wendelstein 7-X are vital for the successful participation of Austrian scientists in the fusion programme. I would therefore like to commend the efforts by the EUROfusion Programme Management Unit and task leaders to schedule and manage the experimental campaigns under the work packages *Tokamak Exploitation* and *Stellarator – W7X*.

The involvement of industry in the European Fusion Programme and the accessibility of business opportunities triggered by the construction of ITER are of vital importance for the ITER project. In this

respect, valuable support is provided by the Industrial Liaison Officer (ILO) at the Austrian Federal Economic Chamber who circulates information about calls and specialized meetings for industry to qualified companies.

Last, but not least I wish to thank all members of our Research Unit for their unbroken commitment and enthusiasm and the institutions listed below for their cooperation and support:

the Austrian Federal Ministry of Women, Science and Research
the President, Presiding Committee and staff of ÖAW,
the Austrian Commission for the Coordination of Fusion Research at ÖAW, and
the responsible officers of the European Fusion Programme.



Vienna, April 2026

(Friedrich Aumayr
Head of Research Unit, Fusion@ÖAW)

I. ON THE ROAD TO FUSION ELECTRICITY

ITER

On 19 and 20 June 2024, the ITER Organization and the Domestic Agencies submitted the updated ITER construction schedule (the New Baseline) to the ITER Council at its 34th meeting. The core elements of the new Baseline are an optimized sequence of assembly works, minimization of risks and licensing for nuclear operation. The research activities are scheduled to begin in 2034, with full magnetic energy to be achieved in 2036 and with the target of deuterium-tritium operation in 2039. Unlike the Baseline 2016, which targeted the first plasma at the end of 2025 in the form of a brief, low-energy test with essential components to be installed afterwards, the scientific operations in 2034 are planned to start with fully functional components such as the divertor, heat-shield and a replaceable first wall of tungsten instead of beryllium.

ITER is being built in international cooperation, with components delivered by the domestic agencies of all ITER partners (the People's Republic of China, the European Union, India, Japan, the Russian Federation, South Korea and the United States of America).

Many milestones have been achieved over the past two years, including the delivery of seven sectors of the vacuum vessel, test facilities for the cryopumps and coils, the receipt of all eight cryopumps, the completion of the central solenoid support structure and the delivery of all six modules (plus the spare module) of the central solenoid by the US Domestic Agency, as well as the stacking of already five of these modules. One of the most spectacular operations was certainly the transfer of the vacuum vessel sector modules into the tokamak pit. One sector module had already been installed in the pit in 2022, but had to be removed again 14 months later due to technical deficiencies. In April 2025, a second attempt was made and sector module #7 was installed. Due to lessons learned from the first installation and removal of such a heavy component in the tokamak pit, the assembly time of module #7 could be reduced considerably. Sector modules #6, #5 and #8 followed in June 2025, November 2025 and January 2026, respectively, so that there are currently four modules in the tokamak pit.

Significant progress has also been made in the repairs of the vacuum vessel sectors and thermal shields.

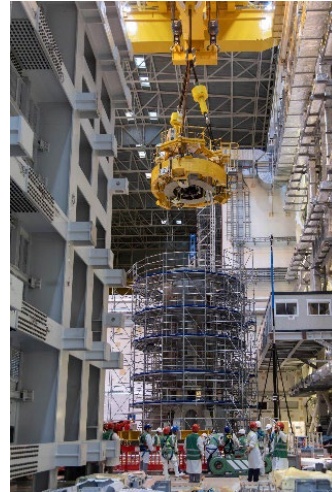
In 2023, ITER Director-General Pietro Barabaschi launched a project to create an [ITER Engineering Basis Handbook](#). The main purpose of this handbook is to secure the knowledge, experience and knowledge transfer gained from the ITER project. The handbook will consist of two parts. In January 2026, the first chapters of the first part have been published under the editorial lead of EUROfusion.

In October 2025, EUROfusion and ITER signed a new [high-level cooperation agreement](#) in order to strengthen academic and scientific collaboration. It establishes a framework for a more targeted contribution to ITER in the next two years.

In order to respond to the growing interest of the private sector in fusion energy and to take advantage of the complementarity in public and private initiatives, ITER organized the first "ITER Private Sector Fusion Workshop" in 2024. Due to the high level of interest and lively participation, this event is now being organized annually.



ITER Vacuum Vessel sector #8 is being lowered into the tokamak pit
Source: [ITER Organization](https://www.iter.org/)



Stacking of the 5th central solenoid module on top of four modules
Source: [ITER Organization](https://www.iter.org/)

The European Domestic Agency – Fusion for Energy (F4E)

F4E was established for a period of 35 years from 19 April 2007 and is responsible for Europe's contribution to the ITER project, which amounts to about half of the project's costs and translates into a wide range of business opportunities for industry and R&D institutions. Over the years, F4E has become the protagonist in building and maintaining the European supply chain for components required by ITER in the first place, but also with a view to future fusion power plants.

The prospect to harness fusion power in the near future and power plant design programs being developed in several areas of the world have recently inspired a growing number of start-ups to enter the market. At Round-Table meetings in 2024 and 2025, F4E provided a forum for discussion and exchange between research institutions, companies and policy makers.

Calls for tender, vacancies and up-to-date information on the progress of the ITER project are published on the F4E [website](https://www.f4e.eu/).



Keynote address by F4E Director Marc Lachaise at the Fusion for Energy Roundtable on 12 June 2025
Source: [F4E](https://www.f4e.eu/)

Information for Austrian industry

Harnessing fusion energy is an industrial effort to be backed up by targeted research. It is the task of the network of Industrial Liaison Officers (ILOs) to raise awareness among qualified companies and

advise them on ways to get involved in the ITER project. In cooperation with the ILOs, F4E organizes a series of information days and seminars to report on the roadmap of different procurement packages and facilitate partnerships between companies. In Austria the function of ILO is performed by the Austrian Chamber of Commerce which acts as a contact forum for Austrian companies qualified for participating in high-tech industrial projects.

EUROfusion

The scientific operation at ITER is expected to commence in the 2030s. To prepare for the experimental campaigns at ITER, EUROfusion manages campaigns at European tokamaks such as ASDEX Upgrade (Garching, Germany), TCV (Lausanne, Switzerland), MAST-U (Culham, UK) and WEST (Cadarache, France) and coordinates the advancement of the fusion research base. With a view to future fusion power plants, Wendelstein 7-X represents the largest device of the stellarator concept. Up-to-date information about recent results, news and vacancies within the European fusion research can be found at www.euro-fusion.org.



At the 49th General Assembly in December 2024, Gianfranco Federici was elected **EUROfusion Programme Manager** for a period of three years starting on 1 January 2025, after Ambrogio Fasoli had stepped down from this function at the end of 2024 due to his appointment as Provost and Vice-President of Academic Affairs of EPFL.

Ambrogio Fasoli and Gianfranco Federici at the 49th General Assembly in Barcelona.

Source: Joan Barcelo Moyano/[F4E](#)

The European Fusion Expert Group (FEG) [Opinion Paper](#) published by the European Commission at the beginning of 2025 envisions fusion as a sustainable energy source and provides recommendations to accelerate its commercialization. Looking ahead to the EU Multiannual Financial Framework 2028-2034, the FEG defines EUROfusion's future objectives as preparing for the support of ITER operation, strengthening collaboration with industry within the framework of public-private partnerships still to be established and building a skilled workforce comprising scientists, engineers and technicians.

In November 2025, EUROfusion and the Institute of Plasma Physics at the Chinese Academy of Sciences (ASIPP) launched the [first edition of a joint research plan for the BEST tokamak](#) (Burning Plasma Experimental Superconducting tokamak) in Hefei, China. Knowledge in the field of burning plasma physics can be gained quickly and a joint exploitation of experimental opportunities is possible. Milestones and updates will be presented on the EUROfusion website.

JET (UKAEA, Culham, United Kingdom)

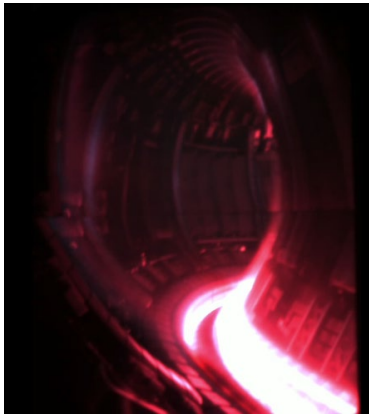
After more than 40 years, the Joint European Torus (JET), the heart of global fusion research at the UKAEA campus in Culham (UK) for many years, concluded operation with pulse number 105,842 on 18 December 2023. Before its shut-down, the final deuterium-tritium campaign yielded a new world record of fusion power. As announced at a [media event](#) in Culham on 8 February 2024, the researchers succeeded in consistently producing high fusion power with a pulse for 5.2 seconds on 3 October 2023. This generated **69 megajoules** of energy while using just 0.2 milligrams of fuel.

However, the original aim of the experiments in the DTE3 campaign was not to set a new record. One focus was to test various operating scenarios that could be used to structure and control the hot

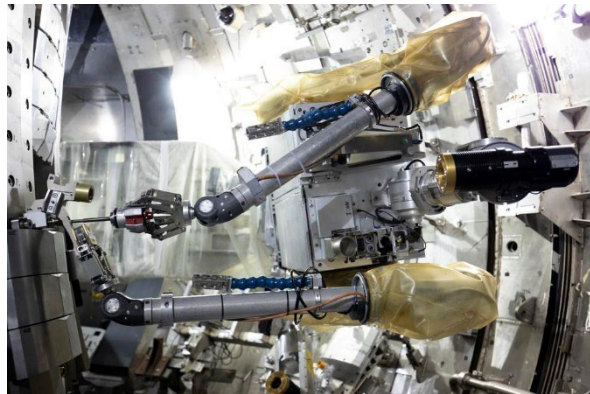
plasma. One of these scenarios, the so-called Quasi-Continuous Exhaust ([QCE Scenario](#)) is based on the findings of Austrian researchers in cooperation with researchers from IPP Garching.

Since its inception, JET has been instrumental in training and education of several generations of fusion scientists and engineers not only in Europe but also internationally. It has provided a hub for exchange of ideas, knowledge and expertise and has been a true heartbeat to a vast network of collaborative efforts on a global scale.

As JET transitioned to decommissioning and repurposing in early 2024, it will continue to provide valuable insights and experience to making future fusion machines more sustainable and attractive.



*Record fusion shot #99971 using DT fuel at the Joint European Torus (JET) at Culham, UK.
Source: [UKAEA](#)*



*MASCOT being used in UKAEA's dedicated In-Vessel Training Facility.
Source: [UKAEA](#)*

Progress in remote handling is one of the major spin-offs developed during the period of JET operation.

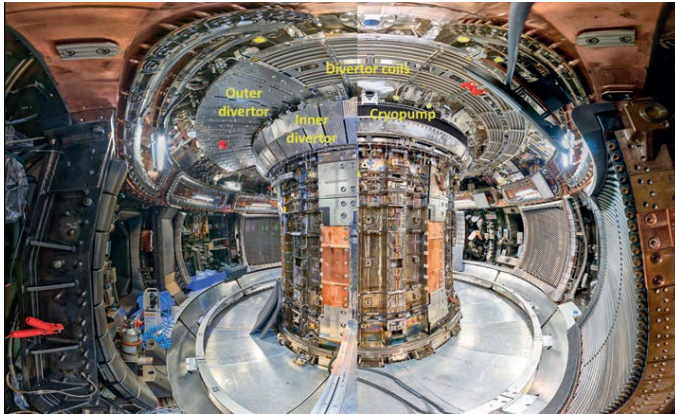
Experiments at medium-size tokamaks

(TE) managed by EUROfusion

With the tokamak exploitation programme, EUROfusion coordinates research on ASDEX Upgrade (AUG), TCV, MAST-U and WEST. This multi-machine approach is instrumental to progress in the field, as ITER and DEMO core/pedestal and scrape-off layer (SOL) are not achievable simultaneously in present day devices.

ASDEX Upgrade (IPP Garching, Germany)

The ASDEX Upgrade tokamak produced its first plasma on 21 March 1991. Therefore, the facility celebrated its 30th anniversary in 2021. In 2002, ASDEX Upgrade was opened for use by fusion laboratories from all over Europe. In 2014, joint exploitation started in the framework of the *Medium Size Tokamak Programme* (MST) of EUROfusion and continued in the framework of the *EUROfusion Tokamak Exploitation Programme* (TE) under Horizon Europe as of the beginning of 2021.



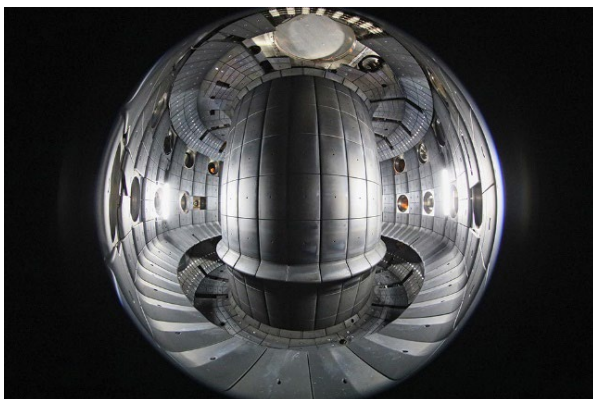
Main components of the upper divertor installed

Source: V. Rohde/[MPI for Plasma Physics](#)

After a two-year maintenance period, ASDEX Upgrade resumed operations in November 2024. This upgrade phase introduced significant changes to enhance operational flexibility, particularly in divertor configurations and exhaust handling. A key enhancement was the installation of a new upper divertor, enabling alternative magnetic configurations and improved plasma exhaust management. The components installed during this latest maintenance phase include a helium-extracting cryopump, inner and outer divertor modules and two concentric coils capable of producing a variety of alternative divertor geometries. A newly designed flat divertor was also added for bi-directional magnetic helicity, supporting novel operational regimes. The reassembly of ASDEX Upgrade was completed on time in autumn 2024, and the electrical connection of the new coils became operational in spring 2025. With the coils' activation, all preconditions for studies of alternative divertor configurations have been fulfilled.

TCV (Swiss Plasma Center, Lausanne, Switzerland)

The Tokamak à Configuration Variable (TCV) started operation at École Polytechnique Fédérale de Lausanne (EPFL) in 1992. In 2015/2016 the machine was upgraded to enforce its capabilities such as strong shaping and electron heating with ion heating, additional electron heating compatible with high densities and variable divertor geometry. The TCV programme aims at ITER support, explorations towards DEMO and fundamental research, with a focus on investigating advanced plasma configurations, enabling flexible experimentation with new control methods aimed at optimizing plasma stability and performance.

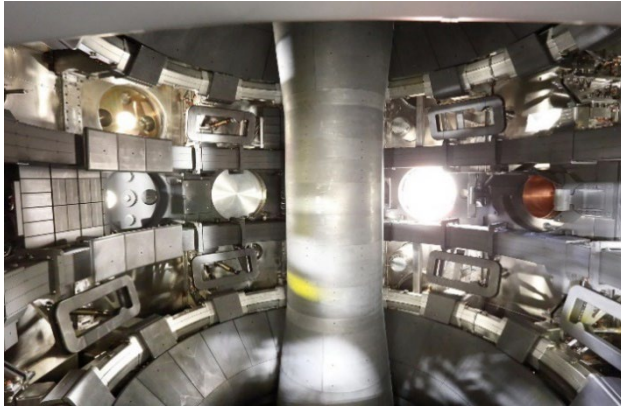


Interior of the TCV tokamak at EPFL

Source: A. Herzog/[EPFL](#)

MAST-U (CCFE, Culham, United Kingdom)

The Mega Ampere Spherical Tokamak (MAST) was in operation from 1999-2013. Afterwards it was shut down for a seven-year upgrade program. The upgraded MAST (MAST-U) produced its first plasma in October 2020 and resumed operation. MAST-U is a compact tokamak designed to investigate whether a smaller construction makes cheaper fusion power plants possible. Moreover, it is tackling one of fusion energy's biggest challenges: plasma exhaust. For this, the 'Super-X divertor' is being tested at MAST-U. This is an exhaust system designed to reduce heat and power loads from particles leaving the plasma, which will increase the lifetime of divertor components.



Interior of the MAST Upgrade Spherical Tokamak

Source: [UKAEA](#)

WEST (CEA, Cadarache, France)

The W Environment in Steady-state Tokamak (where W is the chemical symbol for tungsten) is the transformation of the Tore Supra tokamak which was commissioned in 1988. In March 2013, Tore Supra was upgraded to produce plasmas with similar properties to ITER. As part of the upgrade, the reactor, now renamed WEST, received new poloidal coils to achieve diverted operation, a new cooling system, and all-metal cladding.

In February 2023, after an eighteen-month shutdown, WEST was brought back into operation. During this time, it was outfitted with the same exhaust system as ITER.

On 12 February 2025 CEA reported that WEST was able to maintain a plasma for 1,337 seconds, which was an improvement of 25% compared to the record time the Chinese facility EAST had achieved a few weeks earlier.



WEST, the tokamak run by the CEA

Source: L. Godart/[CEA](#)

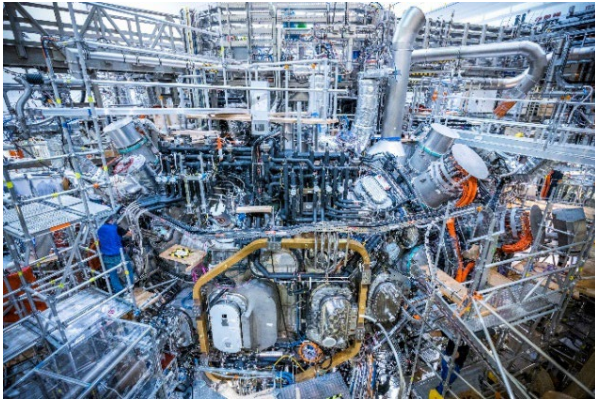
Wendelstein 7-X (IPP Greifswald, Germany)

Wendelstein 7-X is the world's largest stellarator type fusion device. After completion of the main assembly phase, the first plasma was achieved in December 2015. The facility was officially inaugurated on 3 February 2016 in the presence of the then German chancellor Angela Merkel.

After several phases of upgrading, reconstruction and maintenance shutdowns, a plasma with an energy turnover of 1.3 gigajoule was sustained over a period of 8 minutes in February 2023.

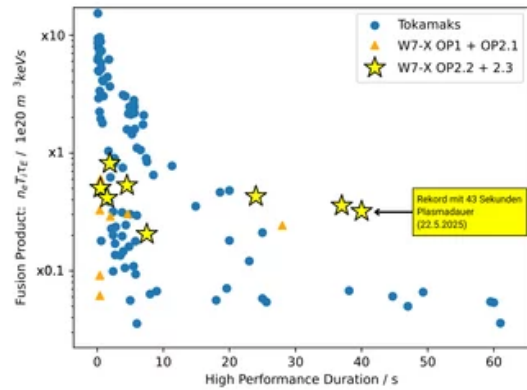
In May 2025 IPP reported that the world's largest stellarator facility had succeeded for the first time in generating high-energy helium-3 ions using ion cyclotron resonance heating. This technology constitutes a milestone for fusion research and has been developed as part of the TEC cluster by partners in Jülich and Brussels. It will not only foster the development of sustainable energy, but also provide new insights into processes on the sun.

Also in May 2025, a new world record was achieved for the triple product as part of the OP 2.3 experimental campaign. The triple product is a key parameter in fusion physics and describes the threshold at which a plasma generates more fusion power than the heating power invested. On the final day of measurements in the campaign, a new peak value for this key parameter was achieved over a plasma duration of 43 seconds. Furthermore, other milestones were reached as part of the campaign: the energy turnover was increased to 1.8 gigajoules, and in terms of the ratio of plasma pressure to magnetic pressure, W7-X achieved a value of 3% of the total volume for the first time.



Wendelstein 7-X in November 2021

Source: J. M. Hosan/[MPI for Plasma Physics](#)

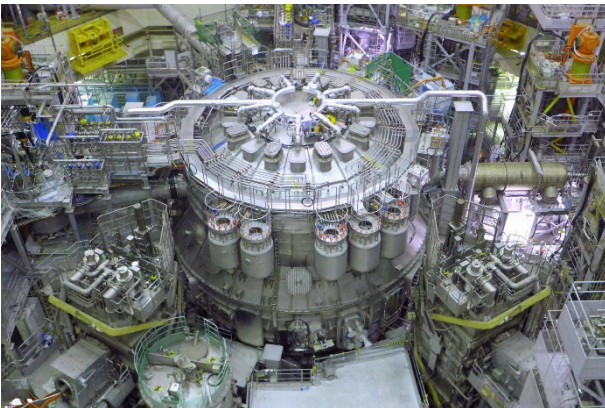


Triple product plotted against time

Source: [MPI for Plasma Physics](#)

JT-60SA

JT-60SA is a superconducting tokamak located at the National Institutes for Quantum Science and Technology (QST) in Naka, Japan. It is part of the Broader Approach Agreement, a scientific collaboration signed between the European Union and Japan to promote the advancement of know-how in fusion. The European contribution to the project is managed by Fusion for Energy (F4E). However, EUROfusion is also making a contribution in the form of hardware and personnel.



The tokamak JT-60SA

Source: [F4E/QST](#)

Phase 1 of the JT-60SA project, which was completed in 2023, involved the integrated commissioning and initial operation of the tokamak. In January 2024, a call for participation was launched. The purpose of the call was to analyse the initial experimental data from the first phase and prepare for further operational phases in 2026 and 2027. Currently, the teams are upgrading the device for more powerful operations from 2026.

II. FUSION RESEARCH IN AUSTRIA

Activities in 2024 and 2025

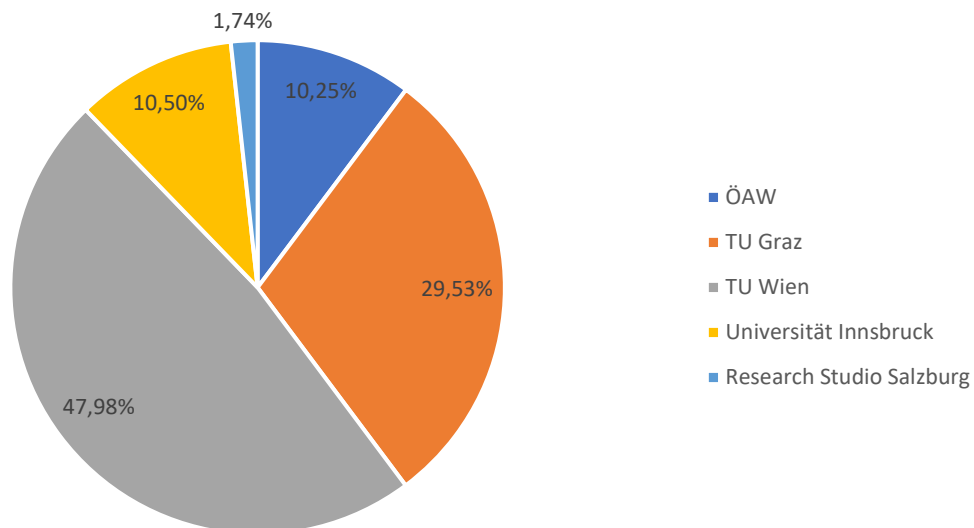
1. OVERVIEW

The Austrian Research Unit

The largest part of Austrian fusion research is performed at university institutes, with approximately 17 PhD students and 25 master students per year. Education and training of young researchers therefore continues to be the major focus of the Austrian Fusion Research Programme. Major activities/topics are measurements and experiments in medium-size tokamaks, plasma-wall interaction, modelling and simulation of plasma phenomena in tokamaks and stellarators, materials science, superconductors for fusion application and socio-economic studies on future energy scenarios.

Participation in EUROfusion

The Austrian Academy of Sciences (ÖAW) acts as national entry point and beneficiary of the EUROfusion Grant Agreement. Fusion research is performed at the Erich Schmid Institute of Materials Science at ÖAW and at four affiliated entities: Research Studio iSPACE in Salzburg, Technische Universität Graz, Technische Universität Wien and Universität Innsbruck. The share of ÖAW and its affiliated entities is shown below.



Austrian participation in EUROfusion:

Share of ÖAW and Affiliated Entities (based on expenditure in 2024 and 2025)

Source: Fusion@ÖAW

EUROfusion under Horizon Europe

Horizon Europe is the EU's key funding programme for research and innovation and the successor of the Horizon 2020 programme. The primary objectives of Horizon Europe are to strengthen research in the areas of climate change, the UN's Sustainable Development Goals and EU competitiveness. It was launched in 2021 and is scheduled to last until 2027.

EUROfusion has now been part of the Horizon Europe framework programme for five years. In the last two years, Austrian participation in the individual work packages has remained about the same as in the previous years.

The Training and Education work package (**TRED**) still represents the largest EUROfusion participation of Fusion@ÖAW. The following table shows the Austrian participation in the work packages in 2024 and 2025.

Participation in EUROfusion workpackages

Period: 2024/2025

<i>PART OF THE PROGRAMME</i>	<i>INSTITUTION</i>	<i>GROUPS INVOLVED</i>
ITER PHYSICS		
WP01 Tokamak Exploitation (WPTE)	TU Graz	C. Albert
WP03 Wendelstein 7-X (WPW-7X)	TU Graz	C. Albert
WP04 Theory, Simulation, Verification and Validation (WPAC)	TU Graz	C. Albert
WP05 Plasma Wall Interaction and Exhaust (WPPWIE)	TU Wien UIBK	F. Aumayr M. Probst
WP07 Enabling Research (WPENR)	TU Wien TU Wien	F. Aumayr H. Riedl-Tragenreif
POWER PLANT PHYSICS AND TECHNOLOGY		
WP08 Demo Design (WPDES)	TU Graz	C. Albert
WP10 Breeding Blanket (WPBB)	TU Wien	E. Jericha
WP18 Materials (WPMAT)	ÖAW-ESI	S. Wurster
WP21 Prospective Research and Development (WPPRD)	TU Wien TU Graz	M. Eisterer C. Albert
Socio-Economic Research on Fusion (SERF)		
WP22 Socio-Economic studies (WPSES)	Research Studios Austria FG	M. Biberacher
EDUCATION		
WP24 Training and Education (WPTRED)	TU Graz ÖAW-ESI TU Wien UIBK	17 PhD students 13 mentors

Abbreviations:

TU Graz = Graz University of Technology

TU Wien = Vienna University of Technology

UIBK = University of Innsbruck

ÖAW-ESI = Erich Schmid Institute of Materials Science at ÖAW

2. RESEARCH HIGHLIGHTS

WP01-TE: Tokamak Exploitation

Kinetic Plasma Response to resonant magnetic perturbations and the role of ion FLR effects

M. Markl, *TU Graz*

The ITER tokamak, currently under construction, represents a major step toward demonstrating the feasibility of fusion energy. To reach its target fusion gain $Q=10$, ITER will operate in the high-confinement (H-mode) regime. In this regime, an edge transport barrier forms that improves plasma confinement and increases the energy confinement time. However, H-mode operation is accompanied by periodic edge instabilities known as edge-localised modes (ELMs). These events eject particles and energy toward the plasma-facing components and may significantly reduce their lifetime. Therefore, ELMs must be mitigated or ideally suppressed.

A promising technique for ELM suppression is the application of resonant magnetic perturbations (RMPs) [1]. These perturbations modify transport at the plasma edge and can prevent the pedestal from exceeding the ELM stability threshold. While RMP-based ELM suppression has been demonstrated experimentally in several devices, the underlying physical mechanisms are not yet fully understood.

Our work focuses on the plasma response to RMPs, which is characterised by localised screening currents that oppose the penetration of the applied perturbation. In particular, we study the resonant response at a rational surface near the pedestal top. Experiments [2] indicate that mode penetration and the associated formation of a magnetic island at this location correlate with ELM suppression.

Although electrons provide the dominant contribution to the screening current, ions influence the response through their contribution to the electrostatic potential perturbation. To describe this effect, we recently developed an integral linear plasma response model based on kinetic theory in the large-aspect-ratio limit that consistently includes ion finite Larmor radius (FLR) effects [3].

Benchmarking against a previously used local model based on an FLR expansion shows that the expansion introduces artificial terms that distort the solution, particularly the electrostatic potential perturbation and thus also the electron shielding current. The integral formulation avoids these artefacts and provides a more reliable description of the plasma response.

Finally, we investigated the possible role of isotope effects, motivated by experiments in ASDEX Upgrade [4] showing that RMP-induced ELM suppression in deuterium plasmas can be lost when hydrogen is added. Since the ion Larmor radius depends on the ion mass, an isotope dependence might be expected. However, our model shows that the linear plasma response depends only weakly on ion mass. This suggests that the experimentally observed isotope effects originate from other mechanisms.

In summary, we developed an integral kinetic model for the linear plasma response to RMPs that accurately captures ion FLR effects and avoids artefacts of FLR expansion models. The results indicate that FLR physics does not provide a significant isotope dependence in the linear response, pointing to other mechanisms behind the experimentally observed isotope effects.

- [1] T. Evans et al. (2004). Suppression of large edge-localized modes in high-confinement DIII-D plasmas with a stochastic magnetic boundary. *Phys. Rev. Letters* 92.

<https://doi.org/10.1103/PhysRevLett.92.235003>

- [2] M. Willensdorfer et al. (2024). Observation of magnetic islands in tokamak plasmas during the suppression of edge-localized modes. *Nature Physics* 20. <https://doi.org/10.1038/s41567-024-02666-y>
- [3] M. Markl, *in preparation*, 2026.
- [4] N. Leuthold et al. (2024). Progress towards edge-localized mode suppression via magnetic perturbations in hydrogen plasmas. *Nucl. Fus.* 64(2). <https://doi.org/10.1088/1741-4326/ad1625>

WP05-PWIE: Plasma Wall Interaction and Exhaust

Understanding Deuterium Retention in Fusion-Relevant Re-Deposition Layers

M. Fellingner, F. Aumayr, TU Wien in collaboration with Uppsala University

Plasma-facing components in fusion reactors undergo continuous modification due to erosion, transport, and re-deposition processes. These dynamic surface changes can strongly influence the retention of fuel particles, which is not only relevant for fuel inventory and recycling but with respect to Tritium retention also for reactor safety considerations.

In this study [5], researchers from TU Wien in collaboration with Uppsala University investigated the impact of thin, re-deposited layers on deuterium retention in tungsten and EUROFER97 - two key materials in fusion wall designs. By designing a dedicated measurement procedure and utilizing a combination of ion beam analysis techniques, the team was able to quantify deuterium retention under controlled exposure conditions.

The findings reveal that re-deposited layers can lead to higher D retention levels compared to uncoated materials. For W coated EUROFER97, this effect was particularly pronounced, meaning that the sandwich structure showed significantly different outgassing characteristics compared to bare EUROFER97. These results underline the importance of considering dynamic surface modifications and the evolving microstructure of plasma-facing materials in retention models.

This work provides crucial experimental data for the validation of fuel retention simulations and supports the development of predictive tools to assess long-term fuel inventory build-up in future reactors such as DEMO.

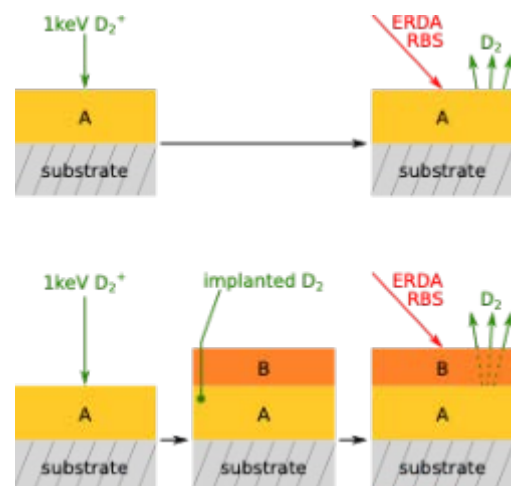


Fig. 1 Visualization of the measurement procedure containing individual steps: Implantation, coating and annealing. This series of measurement steps was conducted twice: for the case of A = W and B = EUROFER97 and for the inverted case of A = EUROFER97 and B = W.

- [5] M. Fellingner, E. Pitthan, D. Gautam, D. Primetzhofer, and F. Aumayr (2025). Influence of redeposited tungsten and EUROFER97 layers on deuterium retention in plasma-facing materials. *Nuclear Materials and Energy* 45. <https://doi.org/10.1016/j.nme.2025.101990>

WP18-MAT: Materials

Fatigue Crack Growth of Tungsten in Fusion Relevant Conditions

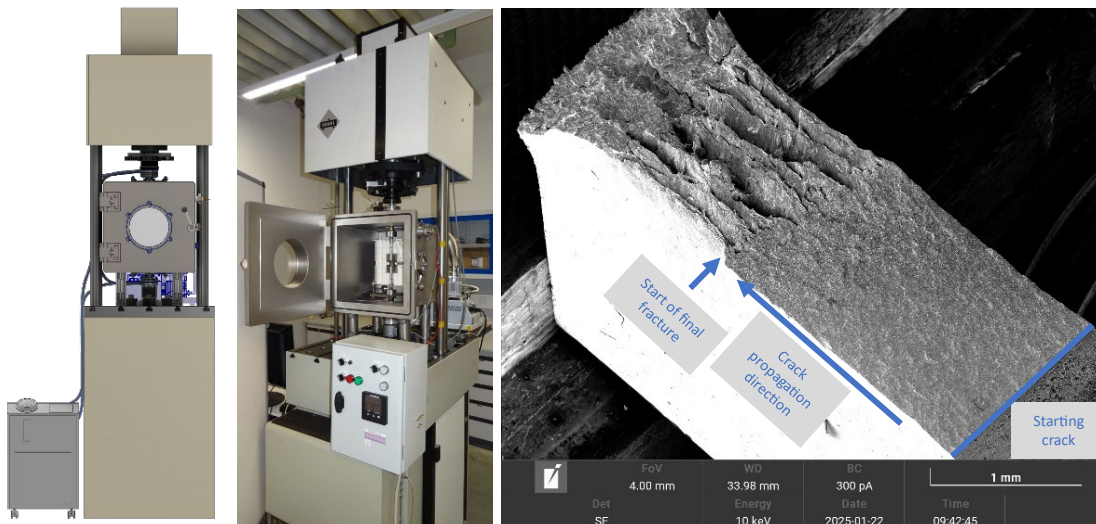
M. Pegritz, P. Reindl, S. Wurster, R. Pippan, A. Hohenwarter, M. J. Cordill

Erich Schmid Institute for Materials Science, Austrian Academy of Sciences

Tungsten plays an important role in fusion research because it can survive the harsh environment inside a fusion reactor. The materials facing the plasma must tolerate intense heat loads, neutron irradiation, and bombardment by energetic particles. Tungsten is especially well suited for these conditions due to its high melting point, high thermal conductivity, and strong resistance to sputtering and erosion. Its low tritium retention compared to other materials is another major advantage, as it reduces fuel losses and improves safety in reactors that rely on tritium. However, challenges still remain, such as the development of a thorough understanding of the fracture and fatigue behaviour, with this knowledge being vital for the design of any tungsten made component.

Focusing on crack propagation, scientific experiments have to be performed under the same conditions as the material will be used later. This means: testing in vacuum and at high temperatures – as high as you can get. When our focus shifted to this topic, remarkably, no data were yet available on the crack propagation behaviour of polycrystalline tungsten at elevated temperatures. The first step was to design and construct an experimental setup that is capable to realize the requested testing conditions, see left figure. Crack growth experiments on ITER-grade tungsten at temperatures up to 650°C show that the crack growth rate significantly depends on the orientation of the crack plane in respect to the semi-finished product of the rolled tungsten plate. Above 400°C it was found that the crack growth behaviour is comparable to that of ductile materials, such as steel; while for lower temperatures the crack growth behaviour under cyclic loading is governed by the response of the material to static loading. Investigating different orientations of the crack growth plane it was found that a substantial amount of grain boundaries lying parallel to the crack leads to accelerated crack growth. In other cases, when the crack plane is intersecting the grain boundaries, higher loads are applicable and the crack propagates slower as well.

Currently, we are upgrading the experimental setup to reach temperatures as high as 800°C to be closer to the reality of ITER.



Left: Experimental setup for measuring the fracture and fatigue properties of tungsten under fusion relevant conditions, i.e. in vacuum and at elevated temperatures up to 650°C. Right side: scanning electron micrograph of the fatigue and fracture surface of ITER grade tungsten, tested at 500°C. From the starting crack, the crack propagates by cyclically loading the specimen. Finally, at the end of the fatigue experiment, the sample fails in one single event.

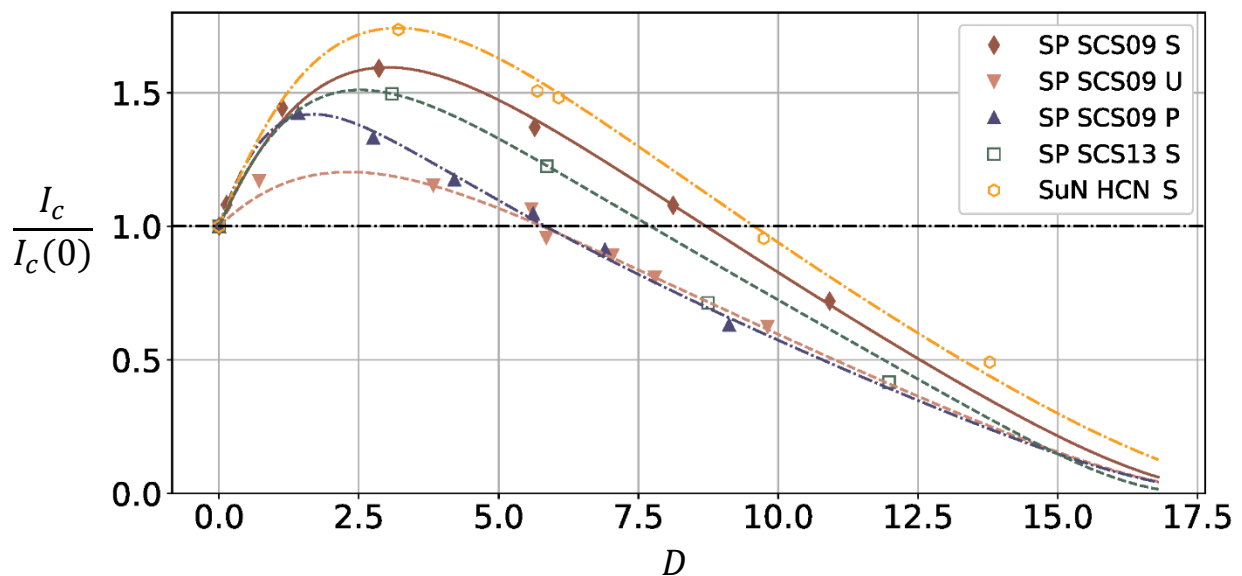
- [6] M. Pegritz, S. Wurster, A. Gschwentner, R. Pippan, A. Hohenwarter (2025). Fatigue crack growth of ITER-grade tungsten in the brittle to ductile transition regime. *International Journal of Fatigue* 200, 109080. <https://doi.org/10.1016/j.ijfatigue.2025.109080>
- [7] M. Pegritz, S. Wurster, R. Pippan, A. Hohenwarter. Fatigue crack growth of tungsten in the semi-ductile temperature range (submitted)

WP21-PRD: Prospective Research & Development

Degradation of superconductors due to impurity scattering: predicting the performance loss in fusion magnets

M. Eisterer, A. Bodenseher, R. Unterrainer et al., *TU Wien Atominstitut*

Superconducting magnets are essential for generating the strong magnetic fields required in a tokamak reactor. However, the neutrons produced during operation gradually damage these materials and alter their electrical performance. To ensure long-term reliability, it is crucial to understand how superconductors change under sustained radiation exposure. The research unit *Low Temperature Physics and Superconductivity* at the Atominstitut of TU Wien addresses this challenge through irradiation experiments in the TRIGA research reactor, where radiation conditions similar to those in a fusion device are reproduced. Based on these experiments, the team has developed a predictive model that describes how the maximum current a superconductor can carry changes as radiation damage accumulates. This knowledge provides an important foundation for the design and lifetime assessment of future fusion power plants [8].



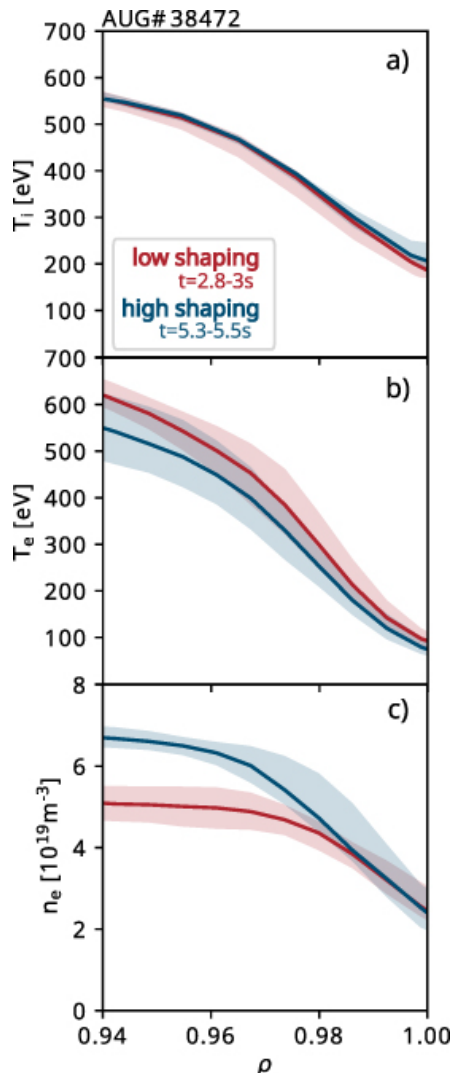
Change of the critical current I_c with radiation damage (D). The model (lines) describes the experimental data points of various superconductors irradiated with either neutrons or protons.

- [8] M. Eisterer, A. Bodenseher, R. Unterrainer (2025). Degradation of superconductors due to impurity scattering: predicting the performance loss in fusion magnets. *Supercond. Sci. Technol.* 38 (10). <https://doi.org/10.1088/1361-6668/ae1553>

Plasma shaping and β control for improved pedestal performance

L. Radovanović, E. Wolfrum, F. Aumayr et al., *TU Wien*

The edge pedestal in H-mode plasmas plays a central role in determining global confinement and performance in tokamaks. Its structure and stability depend on a subtle interplay of current profiles, pressure gradients, magnetic geometry and kinetic effects. In a recent study conducted at ASDEX Upgrade, Lidija Radovanović (TU Wien) and collaborators explored in detail how the global poloidal beta (β_{pol}) and plasma shape, specifically the upper triangularity, affect the pedestal's characteristics.



Reconstructed pedestal profiles at different shapes showing the ion temperature (a), electron temperature (b) and electron density (c) at low shaping in red, and high shaping in blue.

By employing precise NBI feedback control and tailored magnetic equilibria, the team systematically scanned β_{pol} and shaping parameters across a set of comparable discharges. Their analysis showed that higher β_{pol} predominantly increases the ion temperature pedestal height, while increased shaping significantly boosts the electron density pedestal height and width. Importantly, it was found that strong shaping lowers the power threshold required to access a given β_{pol} , thus indirectly enhancing pedestal stability and overall plasma performance [9].

A key strength of this work lies in its separate treatment of ion and electron pedestal profiles, which allowed the authors to disentangle the mechanisms governing each species' behavior. The study also reveals how changes in the radial electric field influence the position and steepness of the ion pedestal. Stability analysis further confirms that increased shaping favors access to the second MHD stability regime by modifying the magnetic shear and q-profile.

This comprehensive investigation provides valuable constraints for model validation and contributes to a better predictive understanding of pedestal dynamics. The findings are directly relevant for scenario development in future fusion devices such as ITER, where optimized shaping and beta control will be essential to achieving reliable high-performance operation.

- [9] L. Radovanović, E. Wolfrum, M. G. Dunne, G. F. Harrer, and F. Aumayr (2025). Impact of shape and global β on ASDEX Upgrade pedestal structure", *Nuclear Fusion* 65 (5).
<https://doi.org/10.1088/1741-4326/adce19>

Fast Magnetic Reconnection in Fusion Plasmas: The Role of Plasmoids

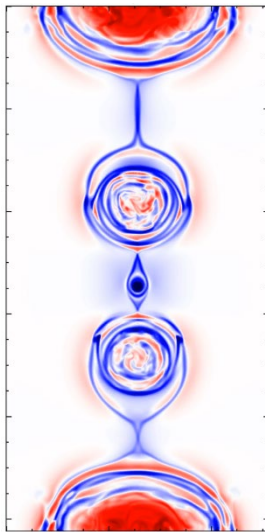
F. F. Locker, *University of Innsbruck*

Magnetic reconnection—the rapid rearrangement of magnetic field lines—is a key process affecting plasma stability in fusion devices such as tokamaks. It underlies the formation of magnetic islands, degrades confinement, and can trigger fast energy release. Yet in the hot, weakly collisional plasmas relevant to fusion, classical theories predict reconnection to be too slow, leaving an important gap between theory and observation.

Recent gyrofluid simulations provide new insight into how reconnection can proceed rapidly under fusion-relevant conditions. Using the newly developed GREENY code, researchers studied collisionless magnetic reconnection in strongly magnetised, low-beta plasmas representative of tokamaks. The simulations employ a Full-F gyrofluid model, which self-consistently evolves density and current and captures key effects such as electron inertia and ion finite Larmor radius (FLR) physics.

A central result is that, in this parameter regime, reconnection is often intermittent and explosive. Even when the initial tearing instability grows slowly, short bursts of rapid reconnection can occur, with rates comparable to those seen in kinetic simulations. This behavior is linked to the non-normal character of the governing equations, which allows strong transient amplification—an effect that is invisible to standard linear stability analysis.

The study also shows that plasmoids play a decisive role. In elongated current sheets, multiple



magnetic islands form spontaneously, creating several simultaneous reconnection sites and strongly enhancing the overall reconnection rate. Such plasmoid-mediated reconnection becomes increasingly important as system size and aspect ratio grow, a situation directly relevant to large fusion devices.

While ion FLR effects only weakly modify linear growth rates, they influence the structure and morphology of reconnection regions and magnetic islands, especially when ions carry a significant fraction of the current. Importantly, the results demonstrate that Full-F effects become essential once reconnection enters the strongly nonlinear regime, where simplified models lose accuracy.

These findings strengthen the theoretical foundation for fast, collisionless reconnection in fusion plasmas and highlight plasmoids as a key ingredient in magnetic island dynamics. Understanding and controlling such processes will be crucial for achieving robust confinement in future fusion reactors.

Picture: Plasmoid growth in 2D Full-F Gyrofluid Magnetic Reconnection

[10] F. F. Locker, M. Rinner, M. Held, A. Kendl. Plasmoid growth in 2D Full-F Gyrofluid Magnetic Reconnection (submitted, <https://doi.org/10.48550/arXiv.2603.06234>)

Research Topics of the Innsbruck Experimental Plasma Physics Group (IEPPG) 2024 - 2025

R. Schrittwieser, Codrina Ionita-Schrittwieser, *University of Innsbruck*

In the framework of the Education working package our group was concentrated on designing a New Probe Head (NPH) for Wendelstein 7-X, situated at the Max-Planck-Institute for Plasma Physics, Greifswald, Germany. This NPHW7-X is planned to contain two conventional Cold Langmuir Probes (CLP), and in addition one specially developed Electron Emissive Probe (EEP), strong and resilient enough to be employed also on the reciprocating probe manipulators of W 7-X. The principle of an EEP suitable also for large toroidal plasma experiments, such as W7-X, was developed by the IEPPG

several years ago, originally intend for the use in ASDEX-Upgrade and/or the TCV in Lausanne (EPFL) [B.S. Schneider et al. Plasma Phys. Contr. Fusion 61 (2019), 054004, C. Ionita et al. Materials 13 (2020), 4524]. Such an EEP would make it possible to measure the plasma potential and its fluctuations directly also in the large stellarator experiment of W7-X.

Fig. 1 shows a drawing of the latest state of the art of the planned NPH_{W7-X}.

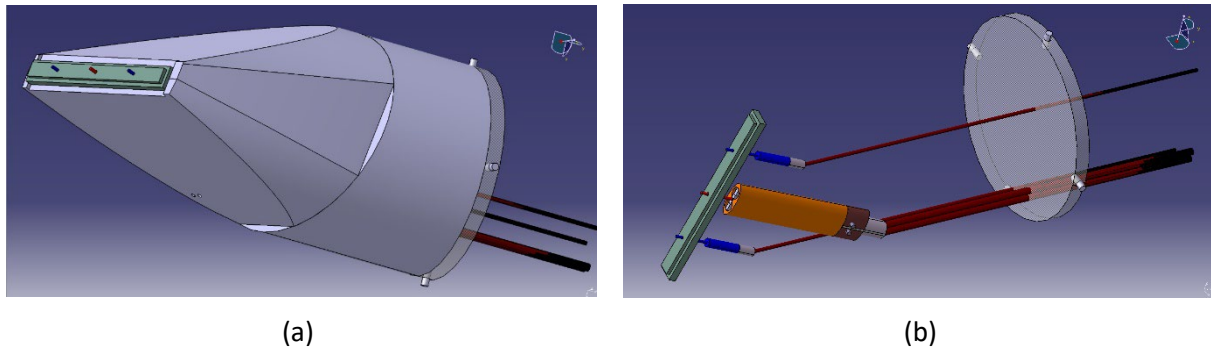


Fig. 1. (a) The probe with the external case hidden. On the LHS the three probes are visible: the blue probe pins are two CLPs, the red pin in between will be a EEP. (b) The probe with the external case hidden. On the LHS the three probes are visible: the blue probe pins are two CLPs, the red pin in between will be a EEP [11].

Around the NPHW7-X (Fig. 1(a)) there will still be one protecting layer of high-heat resistant material (not shown here). The red pin shows the EEP that will be heated – and therefore electron-emissive, as mentioned above [11].

The construction of this New Probe Head for W7-X is especially complex because of the very intricate and complex geometry of the plasma ring in the case of this stellarator. Fig. 1(b) shows the interior of NPHW7-X which shows the electric connections for the three probe pins. Because of this complicated geometry, the connections have to be tilted since there is an angle between the surface of the plasma ring and the direction in which the probe manipulator moves during the insertion of the probe head. In case of the CLPs (shown in blue) the tilted electric connections are very simple, while the red pin (i.e. the EEP) needs a special heating system, as described in [B.S. Schneider et al. Plasma Phys. Contr. Fusion 61 (2019)].

[11] F. Enescu, C. Ionita, R. Schrittwieser (20-25 July 2025). Robust Emissive Probes for Hot Plasmas. *Int. Conf. Phenomena in Ionized Gases, 36th Edition (XXXVI ICPIG), Aix-en-Provence, France* (Poster).

Two EUROfusion Researcher Grants for Austrian researchers

The EUROfusion Bernard Bigot Researcher Grant (ERG) programme was established to promote scientific excellence and foster the independent career development of outstanding post-doctoral researchers in the field of fusion energy. Every year, the EUROfusion consortium awards the researcher grants – named after the former Director General of the ITER Organization, Bernard Bigot – to talented young scientists from all over Europe. The selection process is highly competitive and involves an international evaluation and interview procedure. It is therefore very gratifying that an ERG has been awarded to scientists of the Austrian Fusion Research Unit two years in a row.

ERG for Markus Markl



Markus Markl from the Technical University of Graz was one of 16 scientists to receive the EUROfusion Bernard Bigot Researcher Grant 2025. As part of his ERG, Markl focuses on the topic “Integral Plasma Response Modeling: Isotope Effects and Access Windows of RMP ELM Suppression”.

Achieving high performance plasma regimes such as the H-mode (high confinement mode) is crucial for optimal performance in a tokamak. However, instabilities, so-called Edge Localized Modes (ELMs), can occur repeatedly. These occur at the plasma edge and can significantly affect the

lifetime of the wall materials due to transient heat and particle loads to plasma-facing components. Therefore, understanding and controlling these phenomena is crucial for optimizing tokamak performance and advancing fusion energy research. One experimentally verified method to suppress ELMs is to disturb the magnetic equilibrium field by small magnetic perturbations known as resonant magnetic perturbations (RMPs). However, since the plasma reacts to the perturbations with shielding currents, certain conditions must be met to effectively suppress the ELMs. In his work, Markus Markl theoretically and using computer simulations investigates how the plasma responds to these magnetic perturbations and what conditions are necessary to reliably suppress ELMs in future fusion reactors.

ERG for Lidija Radovanovic

In November 2025, it was announced that Lidija Radovanovic from the Technical University of Vienna was selected as one of only nine recipients of the EUROfusion Bernard Bigot Researcher Grant 2026. This is already the second time that a researcher from Fritz Aumayr’s group at the Institute of Applied Physics has been awarded the prestigious grant.

Radovanovic’s granted research project is entitled: “Modeling the Pedestal in the Quasi-Continuous Exhaust Regime: Towards Predictive Understanding Across Devices”. Similar to Markus Markl’s project, her project also addresses one of the key challenges for future fusion reactors: achieving high plasma performance while avoiding large, damaging edge-localised modes (ELMs). However, it focuses on a different aspect. In H-mode operation, a steep pressure gradient forms at the plasma edge, known as the pedestal. While a high pedestal is beneficial for confinement, it can also trigger ELMs, which pose a serious threat to plasma-facing components.



Her research focuses on ELM-free operational regimes, in particular the Quasi-Continuous Exhaust (QCE) regime. In this regime, particle and heat exhaust occur in a quasi-steady manner without large transient events. The goal of the project is to develop a predictive, physics-based model of the pedestal in such regimes, without relying on global peeling–ballooning stability limits. By combining experimental analysis, magnetohydrodynamic stability studies and gyrokinetic simulations, the project aims to disentangle the different transport mechanisms governing ion and electron pedestal structure. The results are expected to improve extrapolation to larger devices and contribute to the development of robust, ELM-free operating scenarios for ITER and future demonstration reactors such as DEMO.

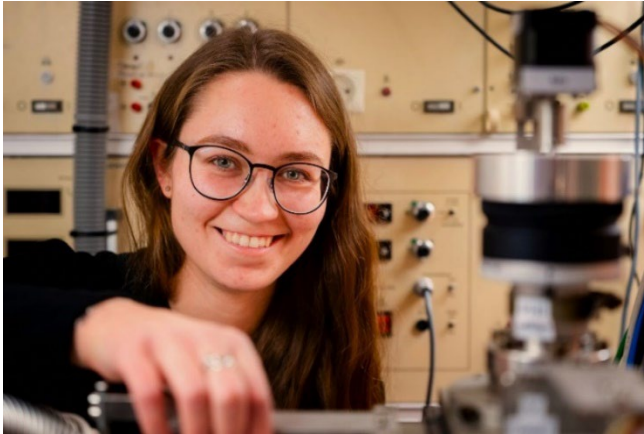
Pictures: private photos of L. Radovanovic and M. Markl

3. SELECTED PHD THESES COMPLETED/NEAR COMPLETION IN 2024/2025

Martina Fellingner, TU Wien (Institute of Applied Physics)

Investigation of erosion and implantation properties of fusion relevant materials: Laboratory studies and simulations

Supervisor: F. Aumayr



Martina Fellingner's PhD thesis focuses on plasma-wall interaction processes. She investigates how these affect the material of the inner wall of the reactor. Here, she focuses mainly on erosion, which is caused by a process called sputtering, and retention, which describes the trapping of particles in the wall. Different materials, surface structures and crystalline textures can have an influence on these phenomena.

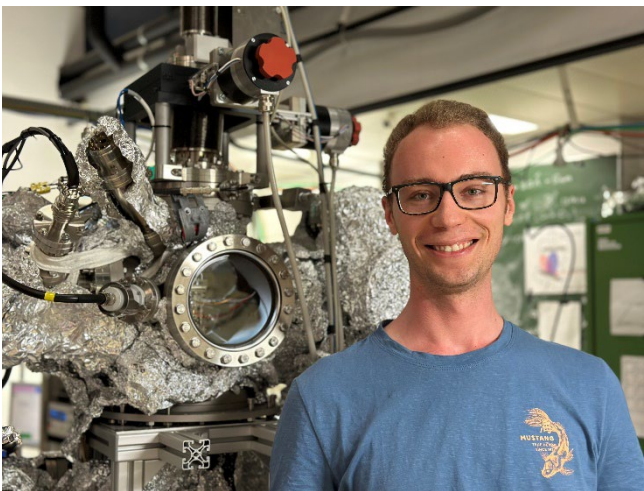
These processes help to predict reactor lifetime and enables optimized design

solutions for future machines. The goal is to find materials, for which erosion and retention are as low as possible. It can become challenging to quantify tiny values, which are often close to the detection limit. These challenges can be overcome by steadily optimizing the experimental setup and by designing dedicated measurement procedures that enable these quantifications.

Johannes Brötzner, TU Wien (Institute of Applied Physics)

Laboratory and numerical investigations of sputtering of fusion relevant materials

Supervisor: F. Aumayr



Johannes Brötzner focuses also like his colleague Marina Fellingner on plasma-wall interaction processes. He investigates different materials in order to see how fast they are sputtered and how this changes their surface in composition and structure and in turn how surface morphology can influence on the sputtering properties of a material. Minimising the sputtering of plasma facing components prolongs reactor lifetime and reduces cooling of the plasma by sputtered impurities. These experiments are accompanied with numerical simulations. The more complex the samples

get, the more time consuming these calculations become. In future, Johannes Brötzner wants to work in a sector that serves the public after his Phd. Whether this will be in the energy sector, in academia or even in fusion is still open.

Fabian Grander, University of Innsbruck (Institute for Ion Physics and Applied Physics)

Thermal Gyrofluid Turbulence in Full-F

Supervisor: A. Kendl



In his PhD thesis, Fabian Grander deals with full-f gyrofluid theory and tries to extend current models to include more physics (thermal effects). He performs direct numerical simulations of non-linear systems to learn more about turbulent transport and the physics behind it.

His research so far focuses on two parts. One is the mathematical modeling within full-f gyrofluid theory. The goal is to have a model that is complicated enough to include all the relevant physics while still being simple enough to be implemented in a simulation program. Another focus of his research is the interaction of turbulence and zonal flows in tokamaks.

Fabian and his group aim to better understand how turbulence works at the edge of the confined plasma. If theoretical understanding of physics can be improved, this will hopefully contribute to making fusion reactors more efficient in the future.

What became of...?

Georg Harrer, former PhD student and post-doc at TU Wien



Picture: www.euro-fusion.org

academic passion. He continues to contribute as a remote Research Professor to the STAR-Lite project.

During his time in the US Georg Harrer discovered his passion for teaching. Therefore, he applied for a part-time physics teacher position in Austria. Moreover, he founded the company harrer.tech aimed at contributing to the fusion industry. "Maybe I can solve the issue of limited fusion career paths in Austria via the private route."

He received the EUROfusion Researcher Grant in 2021. Georg secured one of ten two-year PostDoc positions and deepened his work on tokamaks. In August 2024, he headed towards the USA for co-leading the design of STAR_Lite, a university-scale stellarator at the Hampton University as a Tenure Track Assistant Professor. The reason for this undertaking, had been the scarcity of local long-term positions in fusion research. His role was to teach, set up the lab and lead the conceptual design of the stellarator.

He returned to Austria in summer 2025. Now he works as entrepreneur and teacher. Still, he follows his

Awards

[FuseNet Master Thesis Prize 2024](#) for Robert Babin

Fusion Days

After eight years, the Fusion Day 2024 finally took place again in Innsbruck. The following 12th Fusion Day was held at the TU Graz on 21 November 2025. The aim of this annual event is primarily the exchange and networking of scientists of the Austrian fusion research program.

The scientific meetings were opened at 9 am by Professor Friedrich Aumayr, Director of the Austrian Fusion Research Unit and Professor at TU Wien, who warmly welcomed all participants and introduced the guest speaker. In 2024, Prof. Karl Lackner from the Max Planck Institute for Plasma Physics in Garching (IPP) was invited to give a keynote speech. In his interesting presentation entitled “Start-ups - a broad range of alternatives!?”, he gave an overview and a realistic scientific assessment of the many start-ups working on nuclear fusion and the various approaches that are being used to achieve energy production. In 2025, we managed to secure the EUROfusion Programme Manager, Dr. Gianfranco Federici, as our keynote speaker. His presentation on “Towards a credible and attractive plan to deliver fusion (not just a promise)” was met with great interest by all participants. In addition, this year saw the introduction of a new thematic section in which contributions from new or potential new members of the Austrian fusion research program were presented. This was a good opportunity to learn more about their work.

The guest lectures were followed by several interesting 20-minute talks by students as well as project group leaders who presented recent research results of their groups.



12th Fusion Day in Innsbruck.

Source: Fritz Aumayr, Technische Universität Wien

4. PUBLIC INFORMATION AND OUTREACH

In recent years, there has been a trend for the topic of nuclear fusion to be increasingly present in the media. This trend can also be seen in the last two years and also applies to Austria.

Reasons for the continuing rise in public interest in the topic of nuclear fusion over the past two years can be attributed in part to records achieved (such as the record announced by JET in February 2024) and also to progress and setbacks in the ITER project. However, the growing interest of start-ups, often combined with very ambitious promises, and the numerous recent temperature records have also played a major role.

FuseNet Teacher Days

The European Fusion Teacher Day is an annual event organized by the FuseNet Association – The European Fusion Education Network (www.fusenet.eu). FuseNet is a platform for the coordination of European fusion education activities.

The FuseNet Teacher Day is aimed at secondary school teachers and normally consists of two parts: a local and a European session. In the local sessions experts from national labs and universities introduce the topic of nuclear fusion and talk about local fusion research. In the second part, new teaching materials are presented, along with a live stream from the largest fusion research facilities.

Since the first Teacher Day in 2020, the Fusion@ÖAW coordination office has been organizing a German-speaking session together with colleagues from the Karlsruhe Institute of Technology (KIT) and from the Max Planck Institute for Plasma Physics (IPP) in Garching. The only exception was 2024, when no local session was organized.

Scientists from Austria are regularly invited to give a talk at the Teacher Day, as was the case on 10 October 2025, at the sixth edition of this event. Johannes Brötzner, PhD student at the TU Wien, gave an introductory lecture on fusion research with a focus on the topic plasma wall interactions. This was followed by a presentation by Jan Coenen from the start-up company Gauss Fusion. Both talks were followed with great interest by the teachers, who also asked many engaging questions afterwards.

Around 350 people registered for the Teacher Day, including 78 from Austria and Germany. Of these, 40 participated in the local session.



Teacher Day in 2025

Source: FuseNet

EUROfusion Content Creation Tour

In March 2025, EUROfusion launched a content creation tour. As part of this tour, individual beneficiaries and their institutes are visited, interviews are conducted, and photos and videos are taken. The goal is to create a 2-3 minute introductory video for each EUROfusion member and to have photos that will be available in a media library.

The very first stop of the content creation tour was Austria. On 24-26 March 2025, Tamás Szabolcs, the Head of Communication at EUROfusion, visited Graz and Vienna, specifically the Institute of Theoretical Physics and Computational Physics at TU Graz and the Institute of Applied Physics at TU Wien.

The first photos of this visit have already been published on the EUROfusion LinkedIn page, along with the first [video](#) of a new series highlighting EUROfusion Members, young scientists, and engineers who are shaping the future of fusion energy.



The project groups at the Institute of Theoretical Physics and Computational Physics at TU Graz (left) and at the Institute of Applied Physics at TU Wien (right)

Source: Tamás Szabolcs, EUROfusion

Fusion@ÖAW Media coverage 2024/2025 (Selection)

Articles

[Fusionsreaktor JET vor Stilllegung mit neuem Energierekord](#) (02/2024), APA Science

[Fusionsreaktor JET verabschiedet sich mit Rekord](#) (02/2024), ÖAW Interview with Prof. Friedrich Aumayr

[Fusionsreaktor JET stellt zum Abschied einen Energie-Weltrekord auf](#) (02/2024), Futurezone

[Neuer Weltrekord bei Kernfusion](#) (02/24), ORF Science

[Schon wieder Rekord in der Kernfusion!](#) (02/2024), Die Presse

[Fusionsreaktor Jet tritt mit einem neuen Energierekord ab](#) (02/2024), der Standard

[Fusionsreaktor JET vor Stilllegung mit neuem Energierekord](#) (02/2024), Salzburger Nachrichten

[Europäisches Projekt erreicht Weltrekord bei Kernfusion](#) (02/2024), Salzburger Nachrichten

[Fusionsreaktor JET vor Stilllegung mit neuem Energierekord](#) (02/2024), Puls24

[Fusionsreaktor JET vor Stilllegung mit neuem Energierekord](#) (02/2024), Kleine Zeitung

[Größter Fusionsreaktor der Welt feiert Meilenstein](#) (07/2024), Futurezone

[Fusionsexperiment ITER: Der stärkste Magnet aller Zeiten wird fertig](#) (07/2024), Der Standard

[Weltgrößtes Fusionsexperiment Iter verzögert sich abermals](#) (07/2024), Der Standard

[ITER mit massiven Problemen: Platzt der Traum von Fusionsenergie?](#) (08/2024), Futurezone

[Kernfusion: Futuristisches Forschungsfeld mit Zukunft](#) (11/2024), TU Graz News, Interview with Markus Markl

[Baut China im Geheimen gerade einen der größten Kernfusionsreaktoren der Welt?](#) (02/2025), Der Standard

[Die Teile für den größten und stärksten Magneten der Welt sind fertig](#) (04/2025), Der Standard

[Austrian Fusion Ambassador reaching for STAR Lite](#) (10/2025), EUROfusion interview with Georg Harrer

Video/Radio interviews

Youtube video [“I Spy Science – Was ist eigentlich Kernfusion?”](#) from TU Graz with Markus Markl (8.5.2025)

Youtube short [“Was ist eigentlich Kernfusion?”](#) from TU Graz with Markus Markl (8.5.2025)

Interview with Christopher Albert about plasma physics in the podcasts [“Bridge the Gap”](#) (14.7.2025)

Public Talks and presentations

Talk by Prof. Friedrich Aumayr at the Rotary Club Neulengbach-Wienerwald: “Energie aus Kernfusion” (19.2.2024)

Participation of Prof. Friedrich Aumayr in the event [„Energiewende: Kernfusion – Hoffnung für die Energiewende?”](#) organized by the Austrian National Bank (OeNB) (20.3.2024)

Talk by Prof. Friedrich Aumayr at the Rotary Club St. Pölten: “Aktuelle Fortschritte in der Fusionsforschung” (29.4.2024)

Talks by Fabian Grander ("Chaos, Klima und Fusionsplasma") and Codrina Ionita-Schrittwieser ("Plasma ist überall!") at the Pint of Science (15.5.2024)

Talk about Nuclear Fusion by Prof. Friedrich Aumayr at Rotaract Wien (10.6.2024)

Participation of Fabian Grander at the BFI Tirol Science Slam: "Chaos, Klima und Kernfusion" (8.10.2024)

VHS talk by Lidija Radovanovic on nuclear fusion at the Planetarium Vienna (6.11.2024)

Talk by Prof. Friedrich Aumayr at Soroptimist International Österreichische Union: „Die Sonne auf der Erde: Der aktuelle Stand der Fusionsforschung“ (9.5.2025)

Talk by Fabian Grander at the Pint of Science: „Die geheime Formel, die das Universum erklärt (und die Plasmaphysik)“ (21.5.2025)

Talk by Johannes Brötzner at the FuseNet European Fusion Teacher Day 2025: „Plasma-Wand-Wechselwirkungen in der Kernfusionsforschung“ (10.10.2025)



Fabian Grander (3rd from the right) at the Science Slam 2024
 Source: BFI



Friedrich Aumayr at an event organized by the OeNB
 Source: OeNB



Markus Markl in "I Spy Science – Was ist eigentlich Kernfusion?"
 Source: TU Graz

5. PUBLICATIONS

Erich-Schmid-Institut für Materialwissenschaft at ÖAW

Articles in scientific journals

2025

M. Pegritz, P. Payer, A. Lassnig, S. Wurster, M.J. Cordill, A. Hohenwarter (2025). Synchronous biaxial straining of foils and thin films with in-situ capabilities. *Instruments*, 9(4). <https://doi.org/10.3390/instruments9040031>

M. Pegritz, S. Wurster, A. Gschwentner, R. Pippan, A. Hohenwarter (2025). Fatigue crack growth of ITER-grade tungsten in the brittle to ductile transition regime. *International Journal of Fatigue*, 200. <https://doi.org/10.1016/j.ijfatigue.2025.109080>

R. Pippan, M. Pegritz, L. Walch, O. Renk, S. Wurster, A. Hohenwarter (2025). Residual Stress Fields of Precracks and Impact on Fracture Mechanics Properties. *Fatigue and Fracture of Engineering Materials and Structures*, 48(11). <https://doi.org/10.1111/ffe.70069>

Technische Universität Graz / Institut für Theoretische Physik – Computational Physics

Articles in scientific journals

2024

C. Albert, D. Grekov, Yu. Volkova, Yu. Turkin (2024). Modelling of ICRH slow wave propagation and absorption in Wendelstein 7-X stellarator. *Nuclear Fusion*, 64(10). <https://doi.org/10.1088/1741-4326/ad6e05>

2025

C. Albert, C. Beidler, G. Kapper, S. Kasilov, W. Kernbichler (2025). On the convergence of bootstrap current to the Shaing-Callen limit in stellarators. *Journal of Plasma Physics*, 91(3). <https://doi.org/10.1017/S0022377825000200>

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Technische Universität Wien / Atominstitut

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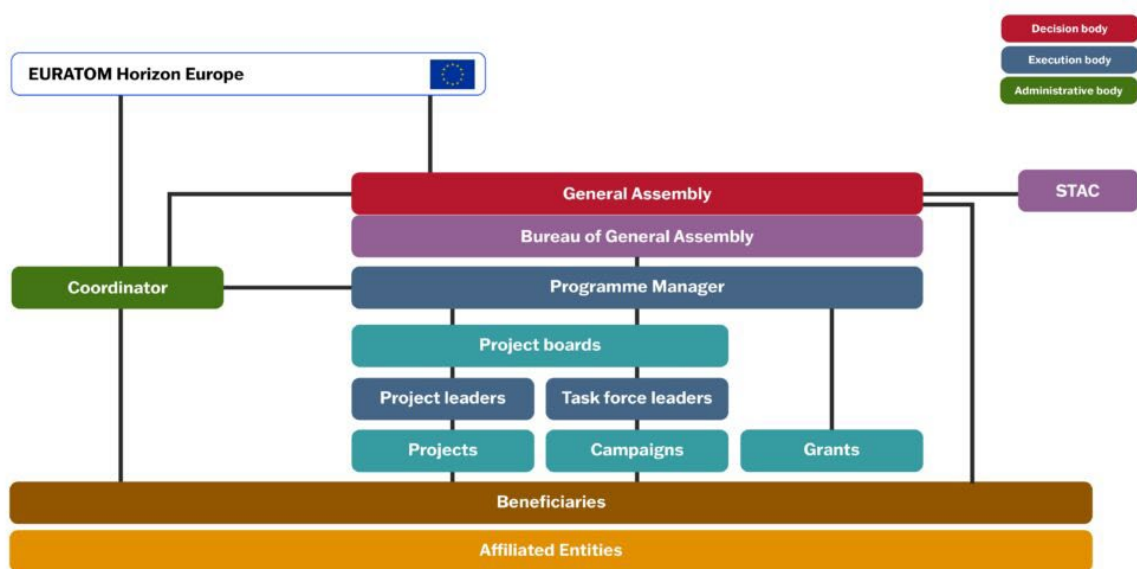
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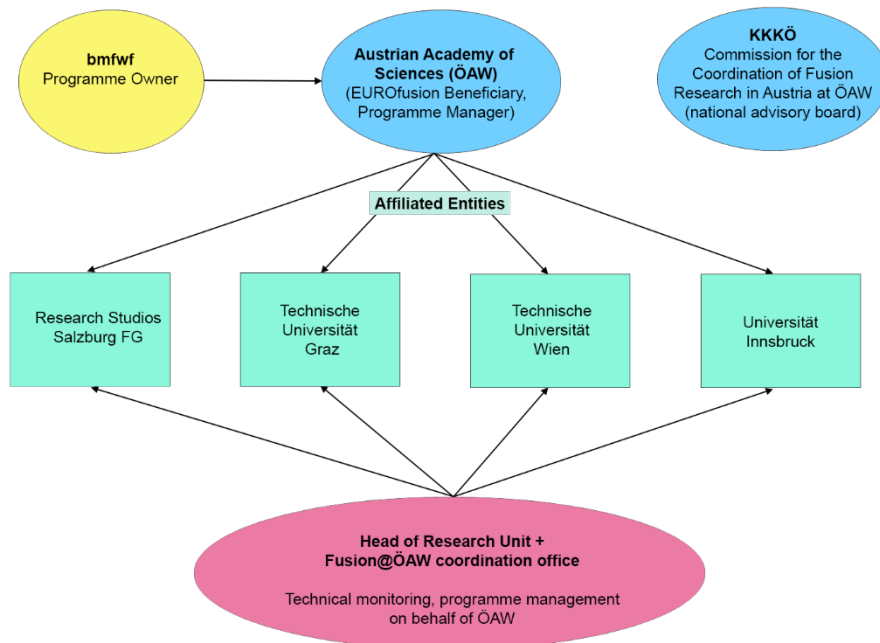
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MANAGEMENT STRUCTURE EUROFUSION ORGANIGRAM



AUSTRIAN PARTICIPATION (Fusion@ÖAW)



AUSTRIAN REPRESENTATIVES IN FUSION COMMITTEES (2024-2025)

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Univ.Prof.Dr. Friedrich Aumayr (expert)	Institute of Applied Physics / Technische Universität Wien

EUROfusion General Assembly

Univ.Prof.Dr. Friedrich Aumayr	Institute of Applied Physics / Technische Universität Wien
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FuseCom (EUROfusion Communicators' network)

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Nadja Lampichler, Bakk., BA, MSc.	Austrian Academy of Sciences

Fusion for Energy (F4E) Governing Board

Dr. Stefan Hanslik	Federal Ministry of Women, Science and Research
Univ.Prof.Dr. Friedrich Aumayr	Institute of Applied Physics / Technische Universität Wien

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Industrial Liaison Officer

Mag. Christian Miller	Advantage Austria Paris
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Kommission für die Koordination der Kernfusionsforschung in Österreich (KKKÖ)

Chair:	Univ.Prof.Dr. Anton Rebhan (ÖAW)
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GLOSSARY OF SCIENTIFIC AND TECHNICAL TERMSⁱ

Bootstrap current

Theory predicted in 1970 that a toroidal electric current will flow in a tokamak which is fueled by energy and particle sources that replace diffusive losses. This diffusion driven bootstrap current, which is proportional to β and flows even in the absence of an applied voltage, could be used to provide the confining magnetic field: hence the concept of a bootstrap tokamak, which has no toroidal voltage. A bootstrap current consistent with theory was observed many years later on JET and TFTR; it now plays a role in design of experiments and power plants (especially advanced tokamaks).

Collisionality

A measure of how frequently collisions occur in a tokamak plasma. A collisionality of unity corresponds to a trapped particle performing a single banana orbit before being scattered.

Confinement regime

In a magnetic field charged particles (ions and electrons) are forced to follow circular and helical orbits around the field lines. The low-confinement regime of tokamak plasmas with purely Ohmic or weak auxiliary heating is not viable for future fusion power plants. The latter will have to operate in so-called H-mode, i.e. in high-confinement regime with energy confinement in the presence of strong heating.

ELMs

Edge localized modes - instabilities which occur in short periodic bursts during the H-mode in divertor tokamaks. They cause sudden outbursts of the plasma thus expelling particles and depositing large heat flux onto the vessel wall. The plasma loses severe amounts of energy. In high-power fusion devices such as ITER or DEMO, powerful ELMs will cause erosion at the vessel wall. Finding methods to mitigate or suppress ELMs is therefore an important topic in present-day fusion research.

Guiding center orbit

The motion of an electrically charged particle such as an electron or ion in a plasma in a magnetic field can be treated as the superposition of a relatively fast circular motion around a point called the guiding center and a relatively slow drift of this point. The drift speeds may differ for various species depending on their charge states, masses or temperatures, possibly resulting in electric currents or chemical separation.

Pedestal

H-mode's high confinement stems from a sharp increase in the pressure at the edge of the plasma, known as the **edge transport barrier** or **pedestal**.

Zonal flows

Turbulence arising from the enormous difference in temperature between the core and edge of the plasma in a torus shaped tokamaks or stellarators may lead to substantial particle loss and reduced fusion power generation. Like in the giant gas planets Saturn and Jupiter, this temperature gradient also gives rise to global flows around the small torus circumference. The flows can be detected by sampling the electric potential, which shows pronounced bands, each extending on a complete flux surface. The flows exert a damping effect on the turbulence, which is favourable for the plasma confinement and reduces the technical effort necessary to keep the plasma burning.

ⁱ Sources: <https://www.euro-fusion.org/>
<https://www.ipp.mpg.de/1765980/glossar>

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Photos on back cover:

1-4: Photos taken as part of the EUROfusion Content Creation Tour in March 2025 (credit: Tamás Szabolics/EUROfusion).

5: 11th Fusion Day at the University of Innsbruck on 8 November 2024.

