

Summary of WEGA Operation at IPP Greifswald

After more than 12 years at the Max Planck Institute for Plasma Physics (IPP), Greifswald, Germany, the operation of the WEGA stellarator was ended in November 2013 in order to free up resources in the institute for the upcoming flagship experiment, the stellarator Wendelstein 7-X (W7-X) that has just finished its first operation phase, OP 1.1.

WEGA, originally the **W**endelstein **E**xperiment in **G**renoble for the **A**pplication of RF heating, was built for the study of RF heating methods as a joint undertaking between the CEA in Grenoble (France), ERM in Brussels (Belgium), and IPP Garching (Germany) [1].

The machine, which was initially operated from 1974 to 1981 in Grenoble, is an early member of IPP's Wendelstein stellarator family. After a stay at the IPF Stuttgart from 1982 to 1999 the experiment was relocated in 2000 to IPP Greifswald, with the aim of bridging the time gap until the beginning of W7-X operation. After about one year of reassembly and preparation of the infrastructure plasma operation started in July 2001.

At IPP Greifswald the acronym WEGA was reinterpreted as **W**endelstein **E**xperiment in **G**reifswald für die **A**usbildung (for education) because the major goal was the training and education of young scientists. The machine was also used for the application of new diagnostics for testing of the control and data acquisition system developed for W7-X, and for basic research in plasma physics.

WEGA is based on a unique concept: the machine, with a major radius $R = 0.72$ m, can either be operated as a tokamak or, by equipping the plasma vessel with additional helical coils, as a classical stellarator. The machine was used nearly exclusively as a tokamak in Grenoble but as a stellarator only in Greifswald.

The magnetic configuration space of the stellarator configuration is very flexible. The magnetic field system consists of a set of 40 toroidal field coils required for both the tokamak and the stellarator version. The poloidal field for the

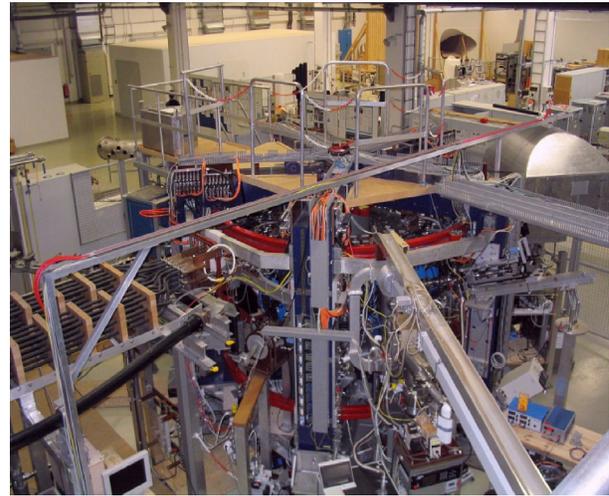


Fig.1. WEGA stellarator at IPP Greifswald.

stellarator configuration is generated by 4 coils consisting of 14 filaments each, winding helically around the torus with $l = 2$ and five-fold toroidal symmetry. The rotational transform ι (for WEGA as a stellarator) is determined by

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WEGA operated as a stellarator in Greifswald to train new plasma scientists and to develop diagnostics and operating scenarios for Wendelstein 7-X (W7-X).
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W7-X program and plasma evaluation workshop

A workshop was held in Greifswald at the end of May to discuss initial W7-X results and plans for the next operational phase. 4

Report on the 15th Coordinated Working Group Meeting

Activities at the 15th CWGM, held in Greifswald from 21–23 March, 2016, are discussed. 4

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the current ratio in the helical and toroidal field coils, $\iota \propto (I_h/I_{tf})^2$, and can be varied over $0 < \iota < 1$. Depending on the rotational transform, a maximum average plasma radius of about $a = 11$ cm is achievable, corresponding to an aspect ratio $R/a \sim 7$ and a plasma volume $V = 0.16$ m³. For radial positioning control of the plasma, two pairs of vertical field coils in a Helmholtz configuration were available. In addition, a 5-arm iron transformer with a flux change of 0.4 Vs could be used for current drive experiments. At low magnetic fields of about $B_0 = 70$ mT, steady-state plasma operation for about one hour with the water-cooled magnetic field coil system was demonstrated, and quasi-stationary operation at $B_0 = 0.5$ T with a pulse length of about 20 s and a subsequent cooling phase of about 5 min could be achieved.

A set of standard diagnostics such as a magnetic flux surface diagnostic, an 80-GHz single channel interferometer, different Langmuir probes and probe arrays, bolometers, video cameras, spectrometers in the visible and UV range, mass spectrometer, calorimeter, high-frequency (HF) probes, soft X-ray detector, electron cyclotron emission (ECE), Rogowski coils, and a diamagnetic loop was routinely used for the determination of the basic plasma parameters such as plasma density, electron temperature, stray microwave radiation levels, and for surveillance of the plasma vessel [2, 3, 4, 5, 6].

Furthermore, in cooperation with the W7-X team and external colleagues, additional diagnostics such as a coherent imaging system, a heavy ion beam probe, a supersonic helium beam, X-ray silicon drift detectors, and neutral pressure gauges have also been implemented and tested.

Plasma Heating Scenarios

Plasma heating was realized by two high-frequency heating systems operating at 2.45 GHz (26 kW, cw) and 28 GHz (10 kW, cw). In addition, the transformer could be deployed simultaneously for reaching otherwise non-accessible plasma regimes due to synergetic effects. Different advanced heating scenarios were experimentally established and theoretically analyzed.

The first harmonic O-mode heating (O1) with 2.45 GHz waves at a resonant magnetic field of 87 mT limits the electron density to a cutoff value of $n_{\text{cut},2.45} < 7.45 \times 10^{16}$ m⁻³. However, electron densities of $n_e > 20 \cdot n_{\text{cut},2.45}$ could be achieved for $\omega/\omega_{ce} < 0.7$ with a heating power of several kW. The coupling mechanism was explained by finite Budden tunneling through the evanescent layer, which is amplified by multiple reflections. The dependence of the absorbed power on the magnetic flux density was treated with a resonator model, being in good agreement with experiments emphasizing the excitation of whistler waves as the most probable candidate.

An entirely new heating concept was investigated during the simultaneous use of both HF heating systems. At a magnetic field of 0.5 T, the 28 GHz extraordinary polarized (X2) waves first generated a target plasma with densities up to the cutoff value of $n_{\text{cut},28} < 0.4 \times 10^{19}$ m⁻³ and a bulk temperature of the order 10 eV. Seed electrons with an energy above 50 keV started to interact effectively with the near field of the 2.45 GHz heating antenna similar to the process of Landau damping [7]. For this reason, the heating scenario was called stochastic Landau acceleration (SLA). Electrons up to energies of MeV verifiable by their X-ray, gamma ray and synchrotron emission could be detected [7]. Furthermore, the confinement of electrons with energies higher than 200 keV depends strongly on their momentum in relation to the magnetic field vector leading to a toroidal net current of up to a few hundreds of Amperes, verified by extensive particle tracing simulations.

Both microwave systems, 2.45 GHz and 28 GHz, were also used in a single operation to excite electron Bernstein waves via a two-step conversion process (OXB) within the plasma edge from an ordinary wave (O-wave) into an extraordinary wave (X-wave) and finally into a Bernstein wave. Such electrostatic Bernstein waves (EBW) have no upper density limit and are able to carry the heating power into the highly overdense plasma center. The OX conversion process, which takes place around the O-mode cutoff layer within the density gradient area of the plasma, was measured for the 2.45 GHz waves with the aid of HF probes [8]. Furthermore, the antennas of both heating systems were optimized to achieve a maximum OX conversion efficiency, which was measured for the 28 GHz case as being in good agreement with 2D finite-difference time-domain full wave calculations. On the other hand, the small wavelength of the electron Bernstein waves is of the order of the electron Larmor radius, allowing the modeling of their propagation by means of a 3D ray tracing code [9]. For both frequencies the code predicts a dependence on the magnetic field strength and the formation of a high parallel wave number $N_{\parallel} \gg 1$ allowing current drive mainly carried by a suprathermal electron component. The resultant Doppler downshifted absorption and the accompanying current drive efficiency could be proven in the experiment by a decrease of the magnetic flux density, whose absolute values were in very good agreement with the code predictions [10].

A further aspect also related to the operation of W7-X was the investigation of the X2 startup utilizing the 28 GHz microwave source. The experiments were continued at Heliotron J and LHD and led to a better understanding of the start-up behavior's dependence on the gas species, neutral gas pressure, rotational transform, and input power [11].

Plasma-Wall Interactions

One issue in OP1.1 of W7-X was the conditioning of first wall components saturated by hydrogen after e.g., plasma collapse. In contrast to predecessor stellarator experiments, the superconducting coils will be deenergized only overnight, so that the confining magnetic field does not allow the use of glow discharges for intermediate wall conditioning. For this reason, 28 GHz electron cyclotron resonant heating (ECRH) was tested in a conditioning campaign and directly compared with a 9 MHz, 3 kW ion cyclotron resonance heating (ICRH) wall conditioning system at WEGA [12]. Optimized sequences of short ECRH discharges were developed and additionally combined with off-axis heating and magnetic field sweeps. In comparison to ICRH, a cleaning efficiency of up to 50% could be obtained, leading to the decision to go without an exclusive ICRH cleaning system in OP1.1. The basic cleaning of the W7-X vacuum vessel by cleaning agents was followed by a 3-day baking of the plasma vessel and the ports at 150°C. The later application of glow discharges was limited because of unprotected copper surfaces in this first commissioning phase. However, ECRH was successfully used for the basic conditioning in the first 3 days of plasma operation as well as for reconditioning of saturated walls after extensive hydrogen operation.

Prototype Implementation of the W7-X Control and Data Acquisition System

The W7-X prototype CoDaC implementation at WEGA included an integrated test of control, data acquisition, and processing, as well as the implementation of diagnostics in an environment similar to the later W7-X operation [13]. Key aspects were the control of the experiment operation via segment programs, real-time control, and a continuously operating data acquisition system with many channels at high speed. Further topics were the validation of the W7-X safety concepts and the experimental test of the application software for planning, control, and observation of the experimental program.

The project was divided into two sequences. During the first, the existing control system was replaced by the implementation of the W7-X control and data acquisition concepts for the central control and also for the technical components and first diagnostics. In the second phase, the safety system and the segment control system were added to support a technically and physically oriented experimental program. Since 2011 the new CoDaC system has been nearly exclusively used for plasma operations, including sophisticated experiments such as event detection in plasma parameters and the subsequent change in microwave heating power. In addition, further W7-X prototype diagnostics such as a neutral pressure gauge, a sensitive integrator for the magnetic diagnostics, and a

multichannel Langmuir probe array have been implemented and tested.

Summary

After more than 12 years and 47,613 discharges the operation of the WEGA stellarator at the IPP Greifswald was ended in November 2013. WEGA has been intensively used for the education of young scientists. In total, 6 PhD theses and more than 15 diploma, bachelor, and master theses were finished. A few tens of students gained a first insight into the field of magnetically confined plasma physics during internships. But WEGA was also intensively used in preparation for W7-X operation in the fields of the development and testing of new diagnostics, the application of new plasma heating scenarios, and plasma wall cleaning discharges utilizing the HF heating system and as a test bed for CoDaC's control and data acquisition system.

Outlook

Despite its age of 40 years, the shutdown at IPP Greifswald was not the end of the machine. WEGA has found a new home! In 2014 the experiment was disassembled, and the whole machine including the power supplies, a few diagnostics, and further equipment were transferred to the University of Illinois at Urbana-Champaign (USA). Here, at the Center for Plasma-Material Interaction (CPMI), WEGA is being rebuilt now as the Hybrid Illinois Device for Research and Application (HIDRA) and will be used for studying the interaction of hot plasma with plasma-facing components (PFCs).

CPMI is one of the leading laboratories in studying plasma-material interactions and the effects of liquid lithium on fusion plasmas, as well as developing the technology required to use liquid metals in a fusion device. HIDRA now provides CPMI with a quantum leap in its capabilities. With its own toroidal device to study liquid metals and plasma-material interactions, CPMI can now more efficiently study different PFC concepts and technologies before their deployment on larger machines around the world.

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W7-X program and plasma evaluation workshop

The first W7-X program and evaluation workshop took place at the end of May 2016. Many colleagues from near and far came to Greifswald, Germany, spending an interesting four days at the Krupp-Kolleg in a stimulating atmosphere. From the approximately 130 participants, about 40 were from collaboration partners around the world, including scientists from various European labs, from the United States, and from Japan.

During the four days spanning 23–26 May, many interesting presentations were given and lively discussions paved the way for starting the scientific and organizational preparations for the next operational campaign.

The first day of the workshop was devoted to the results of the first experimental campaign (OP 1.1), giving a comprehensive overview of the status of the data analysis, already indicating many interesting plasma properties.

The second day focused on the scientific objectives of the next campaign (OP 1.2) for which the installation of an inertially cooled divertor just started. The partners from the United States, from Japan, and from the EUROfusion Consortium presented their views and ideas to further extend the collaboration topics.

On the third day, presentations and discussions concentrated on all the issues associated with the device: control, data acquisition, data access, and data analysis. Of course, these are topics which have many aspects and concern the complete chain from taking first data to providing a full scientific analysis. Also remote participation was discussed, which is of particular importance for all those not always working on site.

Finally, the last day dealt with all questions around the organization of experiments, ranging from the developing

experimental proposal to conducting the experiment and starting the data evaluation.

All in all, many lively and very constructive discussions provided a large collection of interesting and important ideas and proposals aiming at smooth conduct of future experiments. The many comments and ideas now definitely form a good basis for the preparation of OP 1.2.

The organizers would like to thank all those who helped preparing the workshop and who participated and devoted four days to the future success of Wendelstein 7-X.

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Report on the 15th Coordinated Working Group Meeting

The 15th Coordinated Working Group Meeting was held in Greifswald 21–23 March 2016. The organizers are grateful to the host institution, the Max-Planck-Institut für Plasmaphysik (Greifswald, Germany), EUROfusion, and NINS/NIFS for support. The meeting was conducted under auspices of the IEA Energy Technology Network (IEA Technology Collaboration Programme for Cooperation in Development of the Stellarator-Heliotron Concept). For the first time, a group of coordinators (Ascasibar, Gates, Yokoyama, and Dinklage) prepared the meeting, identified topics for international cooperations, and took over the responsibility to track the agreed actions. Figure 1 shows the on-site workshop participants.

Given that the first experimental campaigns of W7-X ended only 2 weeks prior to the meeting, a session about first findings on W7-X attracted large attention from the roughly 20 external participants on site. Session attendees from the host institute and many remote participants (Japan, US, Ukraine, EC) added up to about 50 colleagues attending the meeting in total.

W7-X and comparative plasma start-up studies

First findings from W7-X confirmed low error fields, in agreement with magnetic surface measurement experiments. Trim coils were used to confirm good magnetic fields and to assess the coils as a tool for edge studies. Even in the first weeks of operation, a substantial number of sophisticated instruments were employed to investigate plasmas with both helium and hydrogen fill gases. Edge cooling was successfully demonstrated with nitrogen

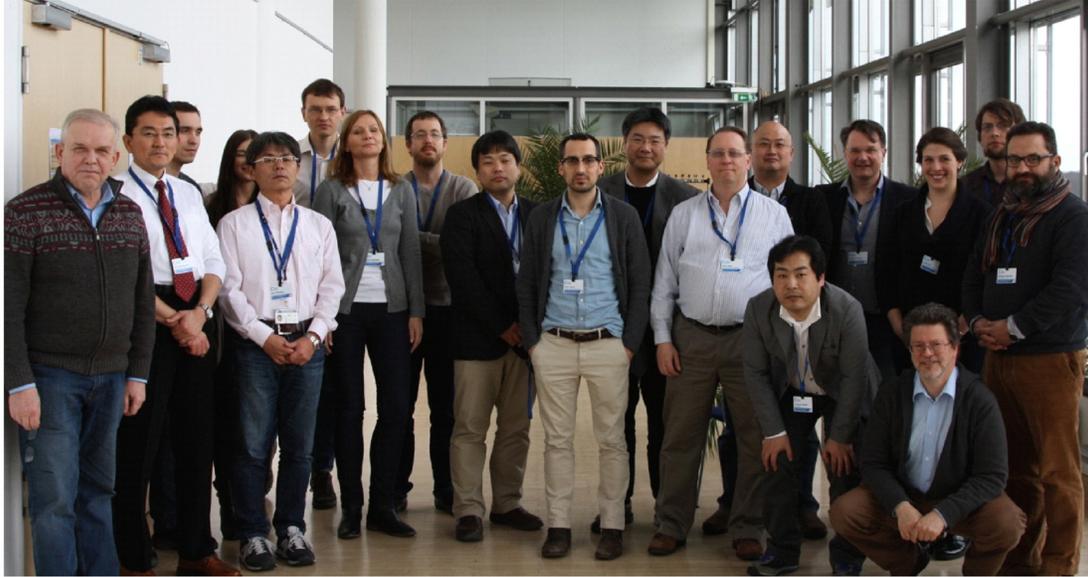


Fig. 1. On-site participants at the workshop.

puffs. Unexpected phenomena such as rotating filaments in the plasma edge are under investigation. Heating with X2 mode was proven to work reliably both on- and off-axis. Electron cyclotron (EC) current drive was demonstrated as a proof-of-principle. Even first O2 mode heating could be demonstrated. The global particle balance in comparison to HSX and W-7X employing filterscope measurements was discussed and compared to modeling. The role of magnetic islands and rotational transform on particle confinement was discussed.

First experiences for wall conditioning in W7-X, both with glow discharge and electron cyclotron resonance heating were reported. The major impurities in the device as determined from residual gas mass spectrometry, are water and carbon mono- and dioxides. Shot-to-shot behavior of the ratio of outgassing level indicates improvements over the campaign. The wall conditioning scenarios for the next campaign of W7-X were proposed and discussed.

Features of RF plasma production were studied in detail at the Uragan-3M device. Low-frequency oscillations are detected and analyzed at this machine in a low plasma density regime. A simple method to control the edge island zone was suggested for the Uragan-2M machine. Self-consistent RF wall conditioning discharge modeling for W7-X is in progress. A new antenna for plasma production and heating in the Alfvén resonance regime is being modeled for the H-1 heliac.

A 0-D model simulation could reproduce the experimental observation of neutral beam injection (NBI) plasma startup in Heliotron J. The important process is a positive feedback among production of fast hydrogen ions, electron

heating, and ionization/dissociation of the main gas puff. One prediction of the model was that plasma startup using perpendicular NBI could be possible in W7-X if a sufficiently dense seed plasma is used as a target.

Impurity transport

Recent measurements of different impurity lines in the VUV range showed the ability to obtain estimates of impurity confinement time in the first plasmas of W7-X. The relationship of impurity density asymmetries (i.e., angular variations of the moments of the impurity distribution function) with radial transport was discussed. A method was proposed to assess the presence of impurity density asymmetries from 0-D signals by identifying radiation oscillations following sudden changes in plasma parameters. This has been consistently observed after pellet injection in TJ-II and successfully modeled with a fluid code. Recent extensions of neoclassical theory for high-Z species are being tested in several codes (EUTERPE, SFINCS) and could allow a critical assessment of the nature of impurity transport in stellarators by direct comparison with flux-capable diagnostics.

A TESPEL system was installed on the pellet injection line of the TJ-II stellarator in 2015, with several successful injections showing a clearly separated evaporation of the polyethylene shell followed by the release of the tracer material.

The following coordinated actions were agreed to:

- ⇒ Prepare a comparison of discharges with Fe flakes for an LHD ICH plasma and a W7-X ECH plasma. This might give a hint about plasma sustainment.

- ⇒ Assess the presence of radiation oscillations in the range of the $E \times B$ rotation frequency after sudden events such as pellet injections, central T_e crashes, ELMs, etc., as a signature of density asymmetries.
- ⇒ Initiate a validation activity for the computation of electrostatic potential variations on flux surfaces with EUTERPE/SFINCS/FORTEC-3D.

3-D equilibria

The first 3-D equilibrium reconstruction of W7-X has been performed using the V3FIT/PARVMEC code. From diamagnetic loop signals, V3FIT can reconstruct a finite beta equilibrium. This result was made possible through the development of new tools for the W7-X experiment. These tools, access magnetic diagnostic data from the W7-X CoDaC data archive system and generate input files for VMEC and V3FIT. Using this, researchers have a turn-key solution to provide the equilibrium state, allowing better understanding of W7-X results.

Results of the investigation of error fields at W7-X using the flux surface measurement technique available at W7-X and the trim coils were reported. The focus was on the investigation of the ($n = 1, m = 2$)-error field in a configuration especially designed to provide the $\iota = 1/2$ resonance in a region accessible with the flux surface measurement technique. The special design of the configuration having an increased (still small) shear allowed a successful comparison of measurements and calculations to derive first estimates of the error field component and its phase at low field strength.

HINT calculations were made for configurations of W7-X that had been especially designed via an iterative process of equilibrium calculations and neoclassical transport simulations (DKES and NTSS) with small bootstrap current (a few kilo-amperes) for high-performance, high-density experimental scenarios. The HINT study explored the divertor compatibility of the low- ι and the high- ι configuration, taking into account the pressure and the current density profiles of the self-consistent core-plasma equilibrium and transport analysis. The main results is that for the high- ι configuration, increasing beta increases the stochasticity of the field around the boundary island.

Fueling and particle transport

An overview of energy and particle transport in tokamaks and helical devices bridged the different magnetic confinement concepts. Emphasis was placed on the possibility that some of the features experimentally observed in tokamaks (pedestal in the H-mode, stiffness of temperature profiles, and inward particle pinch in the core) could become more relevant in large optimized helical devices. The following coordinated actions were agreed to:

- ⇒ Improve the documentation of the benefit of H-mode

to confinement. Restart a topical group that studies the role of magnetic topology and radial electric fields in access to H-mode.

A joint paper with contributions from LHD and TJ-II on the effect of transient density profile shaping on transport is being prepared to document fueling effects through inward transport after injection of a pellet. Similar observations at LHD and TJ-II were reported. A new observation on LHD is a change in fluctuations when the density gradient becomes positive, and thus the ratio of the logarithmic temperature and density gradients, η , becomes negative. A discussion of analytical and quasilinear numerical TEM calculations about the impact of η on turbulence in W7-X showed that the relative orientation of density and temperature gradients (e.g., positive density gradient combined with negative temperature gradient) may have a relevant impact on the level of turbulence.

These findings were complemented by investigations of fueling in reactor-grade plasmas, in particular by means of pellet injection. Pellet penetration should be shallow in a burning plasma, according to ablation models, which predict that it is improved by high-field-side injection.

Strategic cooperation and diagnostics cooperation

Plasma-wall interaction (PWI) studies for 3-D devices were discussed again to bring in experience from tokamaks. This topic is newly proposed. Examples of PWI study in tokamaks, which could impact the experiment plan for OP1.2. in W7-X, were presented. PWI studies in LHD focused on material migration.

- ⇒ It was agreed that PWI studies need to develop simulation codes for 3-D systems that include the wall and that can predict what happens.

Recently, 3-D edge modeling, especially with EMC3-EIRENE, became a topic of ITPA SOL/Div, and we can cooperate with the activity. On the other hand, it was noted that edge plasma simulation codes are still under development. For example, detachment plasma and drift are difficult to treat at this stage. A follow-up meeting will be organized as a satellite meeting to the forthcoming IAEA FEC.

Activities at the ITPA Transport & Confinement topical group meeting, which was held 16–18 March 2016, were reported. The progress of studies in tokamaks (ITER H-mode database, low-Z impurities transport, I-mode, L-H transition, and 3-D) and stellarators (3-D) were briefly introduced. In the 3-D session, the L-H transition mechanism in stellarators was discussed.

Studies of the iota window to L-H transition in low-shear stellarators were introduced. It was emphasized that

understanding the iota window is a critical issue for exploring the L-H transition in low-shear stellarators, especially for W7-X.

A summary of the first US stellarator workshop, *First US Stellarator*, which was held 16–17 February 2016, was introduced. Areas of consensus in the workshop were:

- ⇒ A tool to optimize divertors is needed.
- ⇒ Turbulence optimization is new and exciting.
- ⇒ Coil simplification is new and exciting.
- ⇒ Comparisons between experiments and extended MHD are important.

Progress in International Stellarator/Heliotron Database (ISHDB) activities was reported. ISHDB was acknowledged by EUROfusion and supported to be brought to a common EUROfusion infrastructure. Expansion of ISHDB with new data sets and physics topics is possible and desirable.

Overlapping interests emerged from presentations on diagnostics (neutron diagnostics and pulse-height analysis). It was agreed to pursue this field of common activities to leverage expertise in the stellarator community.

Alfvén Eigenmodes

In order to externally control and/or stabilize energetic particle (EP)-driven MHD instabilities which could induce a redistribution and/or loss of energetic ions (including alpha particles in a fusion reactor), we attempted to apply ECH/electron cyclotron current drive (ECCD) to three stellarators: LHD, Heliotron J and TJ-II, in which several kinds of Alfvén eigenmodes (AEs) have been observed. Global AEs (GAEs) were successfully mitigated by increasing ECH power or EC-driven plasma current in Heliotron J. Both stabilization and destabilization of toroidal AEs (TAEs) were observed during additional ECH in LHD. In the case of GAE stabilization by ECCD in Heliotron J, a continuum damping rate, which is a main damping mechanism of this case, will increase because of the formation of magnetic shear induced by ECCD. On the other hand, effects of ECH on AEs are under investigation in both Heliotron J and LHD. In TJ-II, the mode behavior of the observed AEs changes from continuous to burst when ECH/ECCD is applied. A candidate driver for the changing mode behavior is the changing trapped electron fraction, which may have influence on fast ion drag. When a refractive index N_{\parallel} is changed to induce EC-driven plasma current, changes in mode behavior (e.g., chirping frequency and amplitude) are observed.

Modes with a frequency strongly dependent on the plasma current are observed in TJ-II and Uragan-3M. An explanation was put forward about the nature of some low- to moderate-frequency MHD modes observed in TJ-II plasmas that cannot be identified if closed and nested flux sur-

faces are assumed. The interaction of shear Alfvén waves with static magnetic island chains opens new gaps in the continuum spectrum, which enables the existence of weakly damped Alfvénic modes, magnetic island-induced AEs (MIAEs). In addition, the coupling of island rotation modes with Alfvén waves has been identified for the first time in TJ-II. Fluctuations of 1–500 kHz were investigated in the Uragan-3M torsatron. High-frequency fluctuations in the range of 20–500 kHz are observed in low-density plasmas only. The observed frequency depends on plasma current rather than square root of electron density.

The next step for intermachine comparisons is to investigate modes in a normalized parameter space (e.g., stability condition vs resonance condition).

Turbulence Optimization

Past and recent advances on turbulence optimization [ion temperature gradient (ITG), trapped electron mode (TEM)] in stellarator configurations were addressed. A simple proxy function, including “bad curvature” and the surface compression due to 3-D shaping, is able to control ITG turbulence. Starting from the W7-X-high-mirror configuration, we found a new quasisomnigenous configuration, termed MPX, with lower turbulent transport. At the same time, the effective helical ripple (acting as a proxy for neoclassical transport in the core) was also reduced. A realizable experimental setting was proposed, in order to test the theoretical finding that elongation is a critical geometrical factor for the control of ITG (and perhaps other types of) turbulence. In particular, it was suggested that a high-iota W7-X configuration (with large elongation) should be identified with stronger turbulence than a low-iota configuration. For TEM, a proxy has also been found that separates the region of trapped particles from those with strong bad curvature. The University of Wisconsin was provided with the configuration information.

- ⇒ A report on the electron temperature gradient type of turbulence for W7-X, compared directly to ITG, will be prepared in order to assess the relative merit of electron and ion scales.
- ⇒ Attempts will be made to combine the aforementioned approaches; that is, we will try to create new turbulence-optimized configurations for TEM, while also providing coil-current information for configurations with low ITG transport.

Beyond a brief follow-up meeting within the IAEA FEC, it was agreed to continue the Coordinated Working Group Meetings in Spring 2017 at PPPL in Princeton.

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