American Nuclear Society
Fusion Energy Division
December 2016 Newsletter

Letter from the FED Chair, Arnold Lumsdaine, Oak Ridge National Laboratory, Oak Ridge, TN.

This has been a remarkable year for the Fusion Energy Division (FED). Many goals that we have been working on for years came to fruition. It is my privilege in my first "Letter from the FED Chair" to pass on all of this good news to you. But first, I would be remiss if I didn't express my deepest gratitude and appreciation for Susana Reyes, who capably chaired the division for the past two years, and had the primary responsibility for carrying these initiatives past the finish line.

Now, to the good news. For many years, the Fusion Energy Division has had a goal of permanently funding a scholarship. At the ANS annual meeting in June, the ANS Board approved the funding of the Kenneth R. Schultz Fusion Energy Scholarship, which will grant $2500 annually to an undergraduate student. You can see details on the division's Awards web page (http://fed.ans.org/awards/). Our first awardee is Nirbhav Chopra of the University of Illinois at Urbana-Champaign. We had the honor of having Ken Schultz present at the ANS Winter meeting in Las Vegas to personally hand the award to Nirbhav at the President's Special Session. Given how long we have been working on creating this scholarship, and given that it will continue for years to come, this was a historic moment in the history of the Fusion Energy Division. Special thanks to Leigh Winfrey at the University of Florida, who chairs the division scholarship subcommittee.

Another division goal that has received much effort for the last several years has been developing a position statement on fusion energy to reflect the view of the ANS, and to be a basis for public policy discussions to decision makers and society at large. You can find the statement at the ANS "Public Information" web page: (http://cdn.ans.org/pi/ps/docs/ps12.pdf).

The primary technical meeting of the division is the Topical Meeting on the Technology of Fusion Energy (TOFE), and we held the 22nd meeting in Philadelphia, PA from August 21-25, 2016. Some highlights of the meeting were the keynote address by ANS President Andy Klein, and plenary talks on "ITER Project Overview" by Ned Sauthoff (Director, US ITER Project Office) and "DOE's Role in Fusion Innovation and Commercialization" by Adam Cohen (Deputy Under Secretary for Science and Energy). Thanks to the general chairs, Adam Cohen, Susana Reyes, and Arnie Kellman, and especially to the Organizing Chair, Keith Rule (who carried many other responsibilities for the meeting) for all of their efforts in putting together an engaging technical program and an excellent meeting. At the conference banquet, we were able to honor Professor Mohamed Sawan with the FED Outstanding Achievement Award for his lifelong lasting contributions to fusion technology through research and education in the areas of fusion neutronics and fusion reactor safety and designs. We also gave the outstanding student paper award to Mahmoud Lofty of UCLA for his paper, "Study on the Thermally Induced Stress and Relaxation of Ceramic Breeder Pebble Beds." Thanks go to Nermin Uckan who is chairing our honors and awards committee, and to Lauren Garrison who chaired of the student award subcommittee. We ended the conference banquet by announcing the location of the 23rd TOFE meeting, which will be embedded in the 2018 ANS Winter

meeting in Orlando, FL from November 11-15. Leigh Winfrey (University of Florida) will serve as the General Chair and John Gilligan (North Carolina State University) will be the Program Chair. Please mark your calendars!

The 2016 ANS Winter Meeting was held from November 6-10, 2016 with the theme "Nuclear Science & Technology: Imperatives for a Sustainable World." As mentioned above, FED made a "splash" at the meeting by announcing the inaugural recipient of the Kenneth R. Schultz scholarship, with Dr. Schultz himself present to give the award (see photo below). FED also participated in the President's Special Session, which was centered on the "Nuclear Grand Challenges" that ANS President Andy Klein has put forward as an initiative to highlight the key technologies that need to be addressed in the next 15 years. There were 12 division members at the table (including two students) and we had a lively and productive dialog. We are still taking ideas for these grand challenges. If you would like to submit an idea, you can do so by either submitting to the ANS Nuclear Grand Challenges website (http://www.ans.org/challenges/), by logging into the discussion thread of the Fusion Energy Division in ANS Collaborate (http://collaborate.ans.org/home - use your ANS username and password to login), or just send it to me in an E-mail (lumsdainea@ornl.gov). We will also plan on having brainstorming sessions by teleconference – one in December and one in January. I will send out exact dates and instructions by E-mail to members of the Fusion Energy Division.

On behalf of the Executive Committee of the Fusion Energy Division, I wish you all a happy holiday season.

Fusion Award Recipients,

Laila El-Guebaly, Fusion Technology Institute, University of Wisconsin-Madison, Madison, WI.

Fusion awards have been established to formally recognize outstanding contributions to fusion development made by members of the fusion community. The following awards (listed in alphabetical order) were available to the newsletter editor at the time of publishing this newsletter. We encourage all members of the fusion community to submit information on future honorees to the editor (laila.elguebaly@wisc.edu) to be included in future issues. The ANS-FED officers and executive committee members congratulate the honored recipients of the 2016 fusion awards on this well-deserved recognition and our kudos to all of them.

ANS-FED Outstanding Achievement Award

This award is for recognition of a continued history of exemplary individual achievement requiring professional excellence and leadership of a high caliber in the fusion science, and engineering area. The 2016 Outstanding Achievement Award was presented to Prof. **Mohamed Sawan** (University of Wisconsin-Madison) at the 22nd ANS Topical Meeting on the Technology of Fusion Energy (TOFE), in Philadelphia, PA, August 22-25, 2016. Prof. **Sawan** is cited "for his lifelong lasting contributions to fusion technology through research and education in the areas of fusion neutronics and fusion reactor safety and design."

ANS-FED TOFE Student Award

The Outstanding Student Paper award was presented at the 22nd TOFE to **Mahmoud Lotfy** (University of California, Los Angeles) for his paper "**Study on the Thermally-Induced Stress and Relaxation of Ceramic Breeder Pebble Beds,"** Mahmoud Lotfy, Alice Ying, Mohamed Abdou, Yi-Hyun Park, and Seungyon Chob

Honorable mentions:

- "Reducing the Peak-to-Average-Power-Ratio in Fusion Blankets," Marco Riva, Christian Di Sanzo, Mohamed Abdou, Mahmoud Youssef. (University of California at Los Angeles)
- "Computational Investigation of the Thermal-Hydraulic Performance for Twisted Tape Enabled High Heat Flux Components," E. Clark, A. Lumsdaine, K. Ekici, A. Ruggles (University of Tennessee, Knoxville, Knoxville).

APS Rosenbluth Award

The American Physical Society (APS) Rosenbluth awards recognize scientists who have performed original thesis work of outstanding scientific quality and achievement in the area of plasma physics. Dr. **Michael Rosenberg** (University of Rochester Laboratory for Laser Energetics) has been chosen to receive the Rosenbluth Award for Outstanding Doctoral Thesis. The award cites his work for the "first experimental demonstration of the importance of kinetic and multi-ion effects on fusion rates in a wide class of inertial confinement fusion implosions, and for use of proton diagnostics to unveil new features of magnetic reconnection in laser-generated plasmas."

FPA Awards

The Fusion Power Associates (FPA) Board of Directors has selected the recipients of its 2016 Distinguished Career, Leadership, and Excellence in Fusion Engineering Awards. The awards will be presented at the FPA 37th Annual Meeting and Symposium on Fusion Power: An International Venture, December 13-14, 2016 in Washington, DC.

- The 2016 Distinguished Career Award will be presented to Prof. **Mohamed Abdou** (University of California, Los Angeles). Prof. **Abdou** is recognized for "his leadership and scientific contributions provided over many decades on the important issues associated with nuclear technologies for future fusion power plants and especially for the breadth of many scientific contributions in such areas as neutronics, tritium behavior, and fusion fuel cycles and for the leadership provided to the world effort on the design of tritium breeding blankets and to numerous fusion power plant studies."
- The 2016 Leadership Awards will be presented to Drs. **Joe Kilkenny** (General Atomics and LLNL) and **Steven Zinkle** (University of Tennessee and ORNL). Dr. **Kilkenny** is cited for "the leadership provided for inertial confinement fusion for nearly four decades, including pioneering work on hydrodynamic instabilities, opacity, thermal and suprathermal electron transport, and advanced diagnostics at major laser facilities" and noting especially "the leadership provided more recently of the National Diagnostics Program, whose goal is to develop instruments that may revolutionize inertial confinement fusion and high energy density plasma research." Dr. **Zinkle** is cited for "the leadership provided over many years on the important issues associated with materials for future fusion power plants" and noting especially "many scientific contributions to the physical metallurgy of structural materials, the effects of neutron irradiation on materials, and participation in, and leadership of, many fusion community workshops and program reviews."
- The 2016 Excellence in Fusion Engineering Awards will be presented to Drs. **Stefan Gerhardt** (Princeton Plasma Physics Laboratory) and **Michael Van Zeeland** (General Atomics). **Gerhardt** is cited "for many scientific contributions, including recent work on plasma disruptions, which will provide major benefit to ITER and other major fusion experiments, and the leadership provided to the successful completion and operation of the NSTX-U experiment at PPPL." Dr. **Van Zeeland** is cited "for many scientific contributions, including work on energetic particle physics, toroidal Alfven eigenmodes, and the development of advanced diagnostics for a variety of fusion experiments" and "especially noting the leadership provided to the development of the ITER tangential interferometer/polarimeter."

IEEE Award

The Institute of Electrical and Electronics Engineers (IEEE) has named Dr. **Wayne Meier** (Lawrence Livermore National Laboratory) the recipient of the IEEE NPSS 2016 Fusion Technology Award in recognition of his outstanding record of accomplishment and leadership in advancing the science, technology and integrated assessment of Inertial Fusion Energy power plants. His award will be presented during the 2017 Symposium on Fusion Engineering (SOFE), to be held in Shanghai, China, June 4-8, 2017.

News from Fusion Science and Technology (FS&T) Journal, Nermin A. Uckan, FS&T Editor, Oak Ridge National Laboratory, Oak Ridge, TN.

During the period of October 1, 2015 to September 30, 2016, FS&T received a total of 327 manuscripts. Papers rejected/withdrawn from pre-selection of the conferences and special issues are not included in paper counts and regional breakdowns in the ANS/FS&T database.

Of the 327 manuscripts, 155 were from North America, 59 from Europe (including Russia), 97 from Asia, and 16 from Others, with the following breakdown: 124 have been accepted, 52 have been rejected/withdrawn, and 151 are under review/revision.

The following dedicated issues were published during the period 10/1/15 to 9/30/16:

- Selected papers from TOFE2014 (Parts I & II) – FS&T Sept. & Oct. 2015
- NIF-NIC Special Issue – FS&T Jan./Feb. 2016
- 1st IAEA-TM on Fusion Data Processing, Validation, Analysis – FS&T Apr. 2016
- Target Fabrication 2015 special issue – FS&T Aug./Sept. 2016.

The following special/dedicated issues are scheduled/planned for 2017 and beyond

- Selected papers from APS-DPP Mini Conf. on Measuring & Modeling of Plasma Material Interactions – scheduled FS&T Jan. 2017
- Selected papers from Tritium 2016 [Parts I & II] – planned FS&T Apr. & May 2017
- Selected papers from TOFE2016 [Parts I & II] – planned FS&T Sept. & Oct. 2017
- Target Fabrication 2017 special issue - planned FS&T (early 2018).

As noted before, ANS start assigning DOI numbers to articles starting with the January 2014 issue. However, there is no timetable yet for historical/back issue DOI assignments. Don't forget to check recent postings at ANS 'first-look,' where you will find posting of 'preprint' copies ahead of print issue: see http://www.ans.org/pubs/journals/fst/firstlook/. These pre-publication articles are peer reviewed, copyedited, and proofread and can be cited using DOI.

The electronic access to FS&T is available from 1981-to-current. Tables of contents and abstracts of papers can be accessed at http://www.ans.org/pubs/journals/fst/. Individual and library subscribers can access the full text articles at http://epubs.ans.org/.

Please send your comments on FS&T contents and coverage as well as suggestions for potential future topical areas that are timely and of interest to fst@ans.org. Expect to see changes with ANS scientific publications in 2017 and beyond.

ONGOING FUSION RESEARCH

Status of DONES Facility: the EU Approach to a Fusion Neutron Source

, A. Ibarra, National Fusion Lab, CIEMAT, Madrid, Spain.

The need for a neutron source for the qualification of materials and materials systems to be used in future fusion reactors has been recognized in the EU fusion program since many years. This has been further confirmed in the EU Roadmap to the Realization of Fusion Energy developed in 2012 [1].

The main mission for such a material testing facility is to reduce the risks to the DEMO Fusion Power Reactor (that follows ITER) and future commercial reactors by reducing the uncertainties affecting the materials behavior under relevant irradiation conditions and facilitating the licensing process. Specific requirements for this neutron source were updated in detail in the framework of the MAG Report [2]. These requirements can be summarized as follows: the neutron source should be able to produce DT fusion-like neutrons with enough intensity to allow accelerated (as compared to DEMO) testing, up to a level above the expected operational lifetime, and with an irradiation volume large enough to allow the characterization of the macroscopic properties of the materials of interest.

Starting from these requirements, different needs have been identified for the short term (primarily related to the DEMO design presently undertaken as part of the Fusion Roadmap [3]) and for the longer term (related to the fusion power plant). The obtained results are summarized in Table I describing the impact on the risk mitigation strategy. Generally speaking, irradiation volume higher than 300 cm^3 is required for each material grade of interest.

An ad-hoc panel evaluated in 2014 the different alternative options and concluded that the best approach is the use of an IFMIF-like facility. A proper balance between short-term and long-term needs favors a stepped approach in which, with a smaller investment, the first step can be focused on the DEMO irradiation needs. The design of this facility should be based on and take benefit of the obtained results from the IFMIF/EVEDA project, presently being developed in the framework of the EU-Japan Bilateral Agreement for the Broader Approach to Fusion. This strategy gives rise to the IFMIF-DONES (DEMO-Oriented Neutron Source) facility [5]. Consequently, IFMIF-DONES will be based on the IFMIF Facility design, simplified to reduce cost and focused on fulfilling the DEMO needs as identified in [4].

IFMIF/EVEDA Results Advancing the IFMIF Engineering Design

In the framework of the IFMIF/EVEDA project, an Intermediate Engineering Design of IFMIF (IIEDR) for a generic site was developed. The IFMIF plant includes two 125 mA deuteron beams, which after being accelerated up to 40 MeV (10 MW) and shaped to have a nominal cross section of 200 mm x 50 mm, impinge on a liquid lithium curtain 25 mm thick cross-flowing at about 15 m/s in from of them. The IFMIF systems needed to fulfill a common goal have been grouped in the so-called Facilities:

1) Accelerator Facility
2) Lithium Target Facility
3) Test Facility
4) Post-Irradiation and Examination (PIE) Facility
5) Conventional Facility.

The Engineering Design has been developed in three specific stages (Facility/System identification and design requirements, system definition, Design Integration) describing a comprehensive and fully integrated engineering design of the IFMIF plant for a generic site. The IIEDR also addresses reliability, availability, and maintainability analysis, gives an evolution of the preliminary safety assessment by performing the preliminary safety analysis of the Facility and also provided consolidated cost estimation [6].

Table 1- DEMO and Power Plant requirements for the fusion-like neutron source [4]

		Maximum risk reduction
DEMO-I Phase I[1]	Expected maximum dose Minimum dose rate Irradiation temperature range Irradiation volume/material grade	< 20 dpa (Fe) 10 dpa/fpy 250-550 ºC > 300 cm^3
DEMO-I Phase II	Expected maximum dose Minimum dose rate Irradiation temperature range Irradiation volume/material grade	< 50 dpa(Fe) 10 dpa/fpy 250-550 ºC > 300 cm^3
Power Plant	Expected maximum dose Minimum dose rate Irradiation temperature range Irradiation volume/material grade	> 100 dpa(Fe equiv.) 20 dpa/fpy 250-1200 ºC* > 300 cm^3 * High temperatures are relevant to the case of using advance materials (SiC/SiC composites or W as structural materials)

IFMIF-DONES Status

Based on the previously mentioned IFMIF Engineering Design, a Preliminary Conceptual Design for IFMIF-DONES has been recently developed (see figure 1). This design is based on the following aspects:

- Only one full energy (40 MeV) accelerator –maintaining the angular incidence-, as a consequence only a 5 MW beam will be produced;
- Implement, if possible, a beam shape flexibility able to manage beam shapes from

[1] It is currently envisaged that DEMO will utilize a "starter" blanket configuration using moderate-performance materials (which will not affect regulatory approval) and then switch to blankets with a more advanced-performance material after a limited accumulated $MW \cdot year/m^2$. A similar philosophy might be applied to the divertor.

10 x 5 cm^2 to 20 x 5 cm^2;

- Full size IFMIF Test Cell but only half cooling needed due to the lower power to be handled;
- Full size IFMIF Li loop and same flow characteristics: smaller temperature increase in the Li, only half cooling required, around half purification system needed;
- Only High Flux Test Module (HFTM) and shielding modules to be irradiated, as a consequence no need of Tritium online measurements and strong simplification of the Test Cell containing the irradiation modules;
- Minimum manipulation of irradiated materials (modules, target, …) in the plant: in order to achieve this target, the irradiated HFTM is transferred in a cask, after a minimum dismantling, to an external facility;
- Waste management reduced to the minimum;
- Reuse of some IFMIF/EVEDA prototype components could be considered; and
- Upgrade to full IFMIF should be feasible.

In the next few years, further design and R&D work of the IFMIF-DONES Plant will take place in the framework of a of the EUROfusion Consortium, in direct collaboration with Fusion for Energy. The main objective of these activities is to consolidate the design and the underlying technology basis to be ready for IFMIF-DONES construction as early as 2020, pending availability of sufficient funding (at the end of the IFMIF/EVEDA activities).

In parallel, and within the framework of the negotiation of a new EU-JA Bilateral Agreement for the Broader Approach to Fusion, the siting of this facility in Europe or in Japan is being discussed. For Europe, three candidates site are currently under consideration: Poland, Kroatia, and Spain.

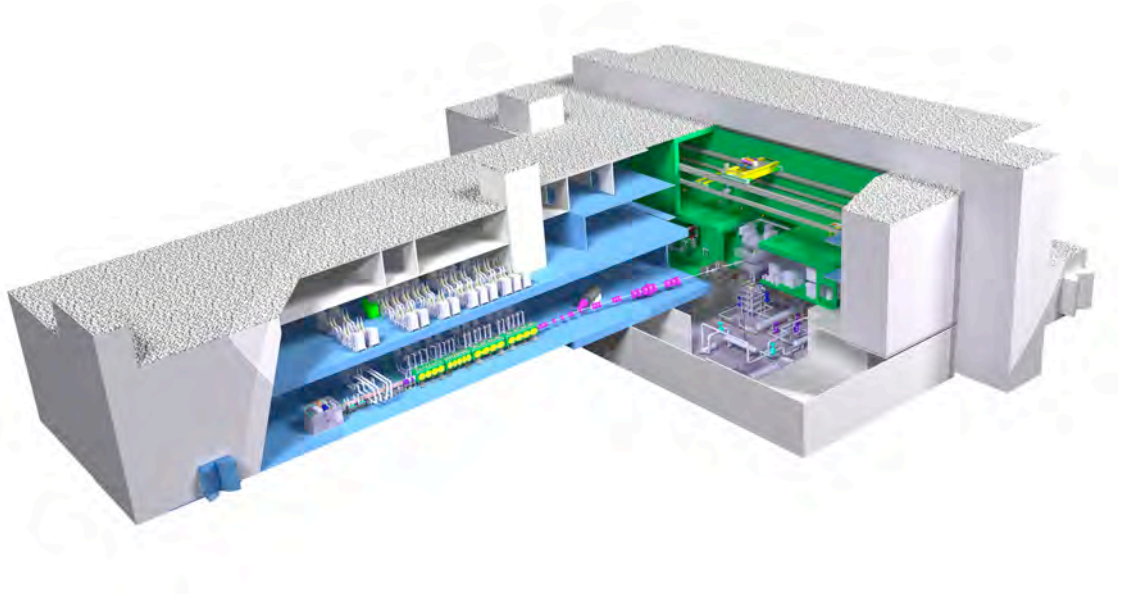

Figure 1. IFMIF-DONES CAD preliminary conceptual design.

References:
[1] Romanelli et al., "Fusion Electricity: A roadmap to the realisation of fusion energy," EFDA Report, https://www.euro-fusion.org/wpcms/wp-content/uploads/2013/01/JG12.356-web.pdf (2012).
[2] D. Stork et al., "Materials R&D for a timely DEMO: Key findings and recommendations of the EU Roadmap Materials Assessment Group," Fus. Eng. Des. **89**, 1586-1594 (2014).
[3] G. Federici et al., "Overview of EU DEMO design and R&D activities," Fus. Eng. Des. **89,** 882 (2014).
[4] D. Stork et al., "Assessment of the EU R&D Programme on DEMO Structural, Plasma
Facing and High Heat flux Materials," CCEFu57-7.1, European Commission (2012).
[5] A. Ibarra, R. Heidinger, P. Barabaschi, F. Mota, A. Mosnier, P. Cara, F. S. Nitti, "A stepped approach from IFMIF/EVEDA toward IFMIF," Fus. Science and Tech., **66,** 252-259 (2014).
[6] J. Knaster et al., "The accomplishment of the engineering design activities of IFMIF/EVEDA: The European-Japanese project towards a Li(d,xn) fusion relevant neutron source", Nucl. Fus. **55,** 086003 (2015).

INTERNATIONAL ACTIVITIES

US ITER Report, Ned Sauthoff, US ITER Project Office, Oak Ridge National Laboratory, Oak Ridge, TN.

Confidence in the work of both the international ITER Project and the seven Domestic Agencies (DA) increased due to demonstrated accomplishment both at the ITER Site and in the Members. All Council-level 2016 milestones for the project were achieved. The Council also noted effective project decision-making based on "deep understanding and prompt mitigation of risks, and rigorous adherence to standards of quality, safety and schedule commitments." Director General Bigot continued implementation of the Executive Project Board to enable prompt decision-making, and utilized the Reserve Fund to enable rapid execution of changes in the interest of the project as a whole; he also established integrated project teams in areas needing more effective coordination of ITER Organization (IO) and DA activities.

At the ITER Site, the Main Cranes were installed in the Assembly Hall; each of the two cranes has a capacity of 750 tons, with a 1500-ton combined capability needed for the largest lifts. Designs for 6 levels of the Tokamak Complex have been approved. Concrete has been poured for the B-2 and B-1 Levels and for the Biological Shield; numerous buildings, cold basins and cooling towers have been started. An industrial joint venture called Momentum was awarded the Construction Management Agent contract to coordinate the assembly and installation of the Tokamak and associated plant systems; this is viewed as an important step. In an action aimed at schedule recovery, the Director General transferred responsibility for two vacuum vessel sectors from the EU to the IO, and contacted through the Korea Domestic Agency to have them fabricated there.

In the Domestic Agencies, progress is being made in many areas. Vacuum vessel segments, ports and in-wall shields are in fabrication in Europe, Korea and India. Toroidal field coil windings and cases are well underway in Europe and Japan. Poloidal Field Coil fabrication is underway in Russia, China and Europe. The cryostat base segments have been fabricated in India and shipped to the ITER site for welded assembly in the Cryostat Building. Cryoplant and cryodistribution systems are underway in Europe and India. Power supply work is very advanced in several Domestic Agencies.

In the United States, the Steady-State Electric Network and Toroidal Field Conductor scopes are nearly complete and delivered; vacuum flanges are ready to ship to the ITER Site. The CS-module fabrication facility is nearly commissioned at General Atomic; the Mock-Up Coil is through most of the stations, and winding of the first CS coil is complete. A US baseline review was held November 14-17, 2016, aiming at approval of a project baseline for the First Plasma scope of (a) design of all US ITER hardware, and (b) fabrication of the US hardware needed for First Plasma and for installation in the associated assembly sequence. The Department of Energy is scheduled to consider approving associated critical decisions in December 2016.

The ITER Central Team and the seven Domestic Agencies continued to work on development of a resource-loaded schedule for First Plasma and Start of Deuterium-Tritium Operation. Addressing priorities and resource constraints of the Members, the schedule was restructured to have First Plasma in 2025 and a series of operational "stages" leading to start of nuclear fusion-power operations (DT) in 2035; the "staged approach" was also seen as minimizing risk since it allows progressive installation and commissioning.

At its November 2016 meeting, the ITER Council reviewed the proposed cost and schedule and approved them "ad referendum", meaning that the Members will conduct governmental processes aimed at acquiring approval and commitment of the cost and schedule.

RECENTLY PUBLISHED FUSION BOOKS

George Neilson, **Magnetic Fusion Energy: From Experiments to Power Plants**
https://www.amazon.com/Magnetic-Fusion-Energy-Experiments-Publishing/dp/0081003153/ref=sr_1_1?s=books&ie=UTF8&qid=1478735021&sr=1-1&keywords=Magnetic+Fusion+Energy

CALENDAR OF UPCOMING CONFERENCES ON FUSION TECHNOLOGY

2017:

16th International Conference on Plasma-Facing Materials and Components for Fusion Applications
May 16-19, 2017, Neuss/Düsseldorf, Germany
http://www.fz-juelich.de/conferences/PFMC2017/EN/Home/home_node.html

27th IEEE Symposium on Fusion Engineering (SOFE)
June 4-8, 2017, Shanghai, China
https://sofe2017.princeton.edu

18th International Conference on Emerging Nuclear Energy Systems (ICENES)
April 24-27, 2017, Hefei, Anhui, China
http://icenes2017.org/dct/page/1

ANS Annual Meeting
June 11-15, 2017, San Francisco, California, USA
http://www.ans.org/

5th International Symposium on Liquid metals (previously: Lithium) Applications for Fusion (ISLA)
September 2017, Moscow, Russia

10th International Conference on Inertial Fusion Sciences and Applications (IFSA)
September 11-15, 2017, Saint Malo, France
http://web.luli.polytechnique.fr/ifsa2017/

13th International Symposium on Fusion Nuclear Technology (ISFNT)
September 25 – 29, 2017, Kyoto, Japan
http://www.isfnt-13.org

59th American Physical Society - Division of Plasma Physics (APS-DPP) meeting
October 23-27, 2017, Milwaukee, WI, USA
http://www.aps.org/meetings/meeting.cfm?name=DPP17

ANS Winter Meeting
October 29-November 2, 2017, Washington, DC, USA
http://www.ans.org/

18th International Conference on Fusion Reactor Materials (ICFRM)
November 5 – 10, 2017, Aomori, Japan
www.icfrm-18.com

2018:

ANS Annual meeting
June 17-21, 2018, Philadelphia, PA, USA
http://www.ans.org/

30th Symposium on Fusion Technology (SOFT)
September 17-21, 2018, Sicily, Italy

27th IAEA Fusion Energy Conference (FEC)
October 2018, India

60th American Physical Society - Division of Plasma Physics (APS-DPP) meeting
November 5-9, 2018, Portland, OR, USA
http://www.apsdpp.org/meetings/upcoming_meetings.php

ANS 23rd Topical Meeting on the Technology of Fusion Energy (TOFE)
November 11 -15, 2018, Orlando, Florida, USA
winfrey@mse.ufl.edu

ANS Winter meeting
November 11 -15, 2018, Orlando, Florida, USA
http://www.ans.org/