Final technical report for DE-SC0022561 Support for the 2022 US-EU Joint Transport Taskforce Workshop

DOE Program Office: Fusion Energy Sciences, SC-24
Technical Contact: Dr. Michael Halfmoon

Date prepared: 7/3/2023

Principle investigator:
C. Holland
Research Scientist
Center for Energy Research, University of California, San Diego
(tel) 858-455-4017
chholland@ucsd.edu

Abstract
This closeout report documents outcomes from the 2022 US-EU Joint Transport Task Force workshop, which was partially supported by this award. This workshop was held April 5-9, 2022 at the Hyatt Regency Sonoma Wine Country in Santa Rosa, California, and was co-located with the 2022 Sherwood Fusion Theory Conference. There were 127 registrants at this meeting (38 of whom were students, and 27 of whom were from foreign institutions), drawn in roughly equal measure from national laboratories, universities, and private industry. The meeting was primarily in-person, with talks streamed online to support remote viewing and Q&A session participation.

I. Background

The long-term goal of the Transport Task Force (TTF) is to "*characterize local fluctuations and transport in toroidal plasmas, understand the basic mechanisms responsible for transport, and, ultimately, control these transport processes*" [1]. It was formed in 1988 "*in response to calls for greater emphasis on studies of plasma confinement and transport by a number of magnetic fusion program review panels and influential members of the program community*" [2], with sponsorship of the US DOE Office of Fusion Energy. As detailed on the TTF homepage (https://ttf.mit.edu/background)

> *The desire for a more physics-based understanding of transport and more precise predictive confinement models in the late 1980s led to calls for increased emphasis on transport studies. Namely, during the winter of 1987 and spring of 1988, the Ignition Physics Study Group (led by J. Sheffield, ORNL), Compact Ignition Tokamak (physics group led by R. Parker, MIT), and International Tokamak Experimental Reactor (physics group led by D. Post, PPPL) future device design studies, and the Office of Fusion Energy (OFE) of the US Department of Energy all highlighted the need for greater understanding of plasma transport. Also the Coolfont Magnetic Fusion Advisory Committee (MFAC) Summer Study Panel called for a "National Confinement and Transport Task Force" to "improve predictive capability for tokamak confinement". In response, in October 1988, J. Callen of the University of Wisconsin, formed a Transport Task Force under the auspices of the OFE. At about the same time, the newly installed director of the Office of Energy Research (OFE's parent organization at DOE) decided that studies of transport should be the number one priority within the magnetic fusion program and began to substantially redirect program resources to reflect this prioritization. As a result of all these events, much greater emphasis was placed on studies of plasma turbulence and transport within the magnetic fusion program and a Transport Initiative was established by OFE.*

The first TTF workshop was held in 1989 in Austin, Texas. Seven working groups of about ten individuals each prepared papers reviewing the then-current status of transport understanding in each area and presenting recommendations for future research directions. These initial topics were transport theory [3], alternate confinement theory [4], fluctuation measurements [5], local transport studies [6], modeling [7], global confinement scaling studies [8], and the physics of enhanced confinement modes [9]. The focus of the TTF working groups has evolved along with advances in experiment, theory, and simulation. In addition to core thermal transport, there are now long-standing working groups in the TTF focusing on topics such as energetic particle transport, boundary physics, and 3D field effects.

II. Summary of 2022 meeting

In 2019, a joint US-EU TTF workshop was held at the AT&T convention center on the campus of UT-Austin. Due to the COVID-19 pandemic, the 2020 US TTF workshop was postponed until 2021, when it was held as a purely virtual meeting. In 2022, TTF was again held as a mostly in-person join US-EU workshop, with additional support for remote participation in discussions and poster presentations. There were 127 registered attendees at this meeting (38 of whom were students, and 27 of whom were from foreign institutions), drawn in roughly equal measure from national laboratories, universities, and

private industry. In addition, the 2022 Sherwood Fusion Theory meeting (April 4-6, 2022) was co-located with the 2022 US-EU TTF workshop, enabling some small cost reductions and greater attendance at both meetings. Logistical support was provided by event staff from UC San Diego and General Atomics.

The 2022 US-EU TTF workshop featured plenary and working group sessions featuring invited talks on core and near-edge turbulence and transport (T&T), pedestal T&T, and scrape-off layer T&T. Additional working group sessions dedicated to energetic particle T&T were held, and the meeting began with a joint Sherwood-TTF plenary session featuring a range of talks relevant to both conferences, such as a preview of results from the JET D-T campaign delivered by Jeronimo Garica. Plenary sessions featured invited talks which were ~25 minutes each, while working group sessions featured shorter ~12 minute contributed oral presentations; both included dedicated discussion time as well. In addition to the talks, both in-person and virtual poster sessions were held; all speakers were invited to present poster versions of their work. Recordings of oral presentations and copies of posters are (conditional on author approval) available via the conference website https://sites.google.com/ucsd.edu/ttf-2022. As with the 2019 workshop, the 2022 workshop adopted the APS meeting code of conduct (https://www.aps.org/meetings/policies/code-conduct.cfm) as a condition of participation. To the best of the PI's knowledge no concerns or violations were reported.

III. References

[1] https://ttf.mit.edu/background

[2] J. Callen, Phys. Fluids B **2** 2869 (1990)

[3] J. D. Callen, Phys. Fluids B **4** 2142 (1992)

[4] Allen H. Boozer, David E. Baldwin, C. Wendell Horton, Réne R. Dominguez, Alan H. Glasser, John A. Krommes, G. H. Neilson, Ker-Chung Shaing, Walter L. Sadowski, and Harold Weitzner, Phys. Fluids B **2** 2870 (1992)

[5] A. J. Wootton, B. A. Carreras, H. Matsumoto, K. McGuire, W. A. Peebles, Ch. P. Ritz, P. W. Terry, and S. J. Zweben, Phys. Fluids B **2** 2879 (1990)

[6] K. H. Burrell, K. W. Gentle, N. C. Luhmann, E. S. Marmar, M. Murakami, K. F. Schoenberg, W. M. Tang, and M. C. Zarnstorff, Phys. Fluids B **2** 2904 (1992)

[7] W. A. Houlberg, D. W. Ross, G. Bateman, S. C. Cowley, P. C. Efthimion, W. W. Pfeiffer, G. D. Porter, D. E. Shumaker, L. E. Sugiyama, and J. C. Wiley, Phys. Fluids B **2** 2913 (1992)

[8] S. M. Kaye, C. W. Barnes, M. G. Bell, J. C. DeBoo, M. Greenwald, K. Riedel, D. Sigmar, N. Uckan, and R. Waltz, Phys. Fluids B **2** 2926 (1990)

[9] R. D. Stambaugh, S. M. Wolfe, R. J. Hawryluk, J. H. Harris, H. Biglari, S. C. Prager, R. J. Goldston, R. J. Fonck, T. Ohkawa, B. G. Logan, and E. Oktay, Phys. Fluids B **2** 2941 (1990)