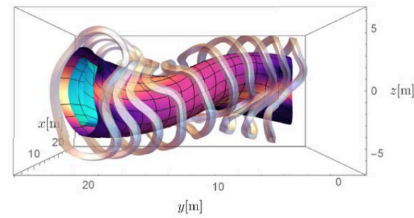
ipam institute for pure & applied mathematics

Workshop III: Fusion Device Design and Engineering



May 4-8, 2026

Scientific Overview

The ultimate goal of fusion research is to provide the scientific and technological basis for the development of fusion power plants. In the past, both aspects have often been addressed separately and sequentially, but over time, it has become increasingly clear that they are intimately coupled. This led to the goal of fully integrated designs, where plasma physics, materials science, and fusion technology are dealt with in the context of an integrated design.

A good example is the development of MFE designs based on the stellarator principle. While state-of-the-art devices like Wendelstein 7-X have been optimized primarily in terms of plasma performance, the next generation of such machines should ideally also include various reactor-relevant aspects (like magnet buildability or the magnet-magnet and magnet-plasma spacing) right from the start. This, in turn, requires fast, but accurate ways to quantitatively model many features of plasma physics, materials science, and fusion technology.

In this context, there exists a fundamental tension between efficiency and reliability of a given (sub-)model. While the integration into optimization loops calls for fast low-fidelity models, the need to provide robust predictions (even in experimentally unexplored regimes) hangs on the availability and use of high-fidelity models. Multi-fidelity methods provide a unique way of combining models of different fidelity, so that an optimal balance between accuracy and cost is achieved. In many cases, speed-ups of several orders of magnitude are to be expected, which amounts to being a true gamer changer, allowing for studies which would be impossible otherwise. This workshop will explore the utilization of multi-fidelity methods to enable fusion device design and engineering, and discuss the mathematical challenges in characterizing the uncertainty induced by incorporating lower-fidelity models into complex plasma physics systems.

This workshop will include a poster session; a request for posters will be sent to registered participants in advance of the workshop.

Long Program Schedule

This workshop is part of the long program Multi-Fidelity Methods for Fusion Energy (MFE2026).

- Multi-Fidelity Methods for Fusion Energy Tutorials : March 10-13, 2026
- Workshop I: Multi-Fidelity Methods for Fusion Plasma Physics : March 23-26, 2026
- Workshop II: Learning Models from Data for Multi-Fidelity Fusion Plasma Physics : April 13-17, 2026
- Workshop III: Fusion Device Design and Engineering : May 4-8, 2026
- Workshop IV: Multi-Fidelity Methods to Enable Robust Optimization and Real-Time Control of Fusion Processes : May 18-22, 2026

Participation

Additional information about this workshop including links to register and to apply for funding, can be found on the webpage listed below. Encouraging the careers of women and minority mathematicians and scientists is an important component of IPAM's mission, and we welcome their applications.

Organizers

Federico Felici (Google DeepMind)
Lise-Marie Imbert-Gerard (University of Arizona)
Orso Meneghini (General Atomics)
Elizabeth Paul (Columbia University)

Invited Speakers

Antoine Cerfon (Type One Energy)
Michael Churchill (Princeton Plasma Physics Lab)
Cami Collins (Oak Ridge National Laboratory)
James Cook (UK Atomic Energy Authority)
Jon Hillesheim (Commonwealth Fusion Systems)
Takeo Hoshi (National Institute for Fusion)
Archis Joglekar (Ergodic)
Alan Kaptanoglu (New York University)
Egemen Kolemen (Princeton Plasma Physics Lab)
Thomas Kruger (Thea Energy)
Matthew Landreman (University of Maryland)
Brendan Lyons (General Atomics)
Yong-Su Na (Seoul National University)
Mackenzie Nelson (Lawrence Livermore National Laboratory)
Anouk Nicolopoulos-Salle (Renaissance Fusion)
Benjamin Peherstorfer (Courant Institute of Mathematical Sciences)
Pablo Rodriguez-Fernandez (Massachusetts Institute of Technology)
Tonatiuh Sanchez Vizuet (University of Arizona)
Syunichi Shiraiwa (Princeton University)
Georg Stadler (New York University)

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For more information, visit the program web page:

www.ipam.ucla.edu/MFEWS3