

# THEORY AND COMPUTATION FOR MAGNETIC CONFINEMENT

Fusion energy is a promising technology: safe, based on abundant fuel, with no waste legacy and minimal land use. Due to the climate emergency, it has recently attracted much public attention and private funding. For efficient energy production, the right mixture of hydrogen isotopes must be heated to temperatures ten times larger than the temperature of the sun core. This is a grand technological and physics challenge in which we have made great progress. The most advanced concept for energy production is magnetic confinement fusion, an approach that utilizes large electromagnets to confine the hydrogen and powerful beams and radiofrequency emitters to heat it up. This talk will describe the principles behind magnetic confinement fusion and its two most illustrious representatives: the tokamak and the stellarator. The talk will emphasize the importance of theoretical and computational tools in the development of these concepts by describing how the community models energy losses in these systems then and uses these models to design better machines.

Professor Felix Parra Diaz is Head of the Theory Department and Professor of Astrophysical Science at Princeton University. He studied Aeronautical Engineering in the Escuela Tecnica Superior de Ingenieros Aeronauticos (ETSIA) of the Universidad Politecnica de Madrid (UPM) from 1999 to 2004. He continued his studies in the Massachusetts Institute of Technology (MIT), where his work started to focus on nuclear fusion by magnetic confinement. In 2009, he graduated from MIT with a PhD that earned him the Marshall N. Rosenbluth Outstanding Doctoral Thesis Award. After graduation, he moved to the University of Oxford as an EPSRC Post-doctoral Fellow in Theoretical Physics and a Junior Research Fellow at Christ Church college. He moved back to MIT in 2011, where he was an Assistant Professor in the Nuclear Science and Engineering Department from 2011 to 2013. While at MIT, Professor Parra Diaz received the US DoE Early Career Award. In 2013 Professor Parra Diaz moved back to Oxford, where he stayed until 2021. In 2016, he was awarded the BBVA Prize for the Best Theoretical Physicist by the Spanish Royal Physics Society. He joined the Princeton faculty and PPPL in September 2021.

**Dr. Felix Parra Diaz**  
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**FRIDAY, MAY 9**

**11:30 AM - 1:00 PM**

**Central King Building, Room 303**