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Video

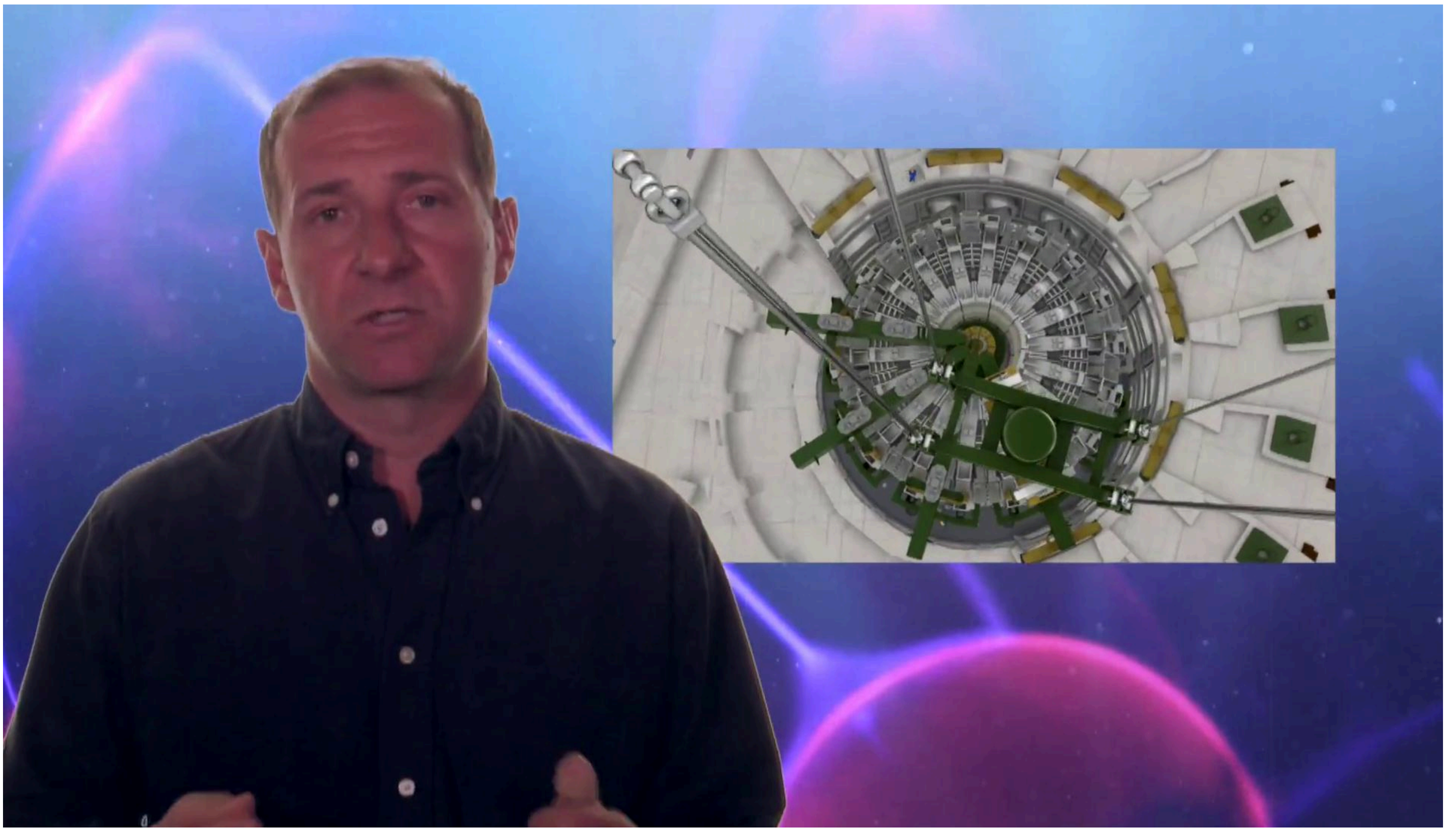
EPFL

In this last lecture of the course we aim at providing a complete overview of the basic issues we're facing to doing fusion on Earth and on the possible solutions we are progressively implementing to achieve the burning plasma regime and to construct a reactor. As most parts of this course, this lecture, which lasts two weeks, and is taught together by myself and by Dr. [inaudible], an expert of Tokamak physics, will be a mix of formal mathematical derivation and more qualitative presentations. We will focus on the magnetic confinement approach and illustrate the different magnetic confinement schemes that are considered for reactors, but we will concentrate on the most promising scheme so far: the Tokamak. We discuss its main elements, the macroscopic plasma equilibrium in it, and its operational limits. With a brief flashback to some of the basic properties of plasmas, we will study the transport of particles and heat across the confining magnetic fields. We will find that in Tokamaks, turbulence dominates other collisional effects and illustrate how we can partially defeat it to obtain advantageous high-confinement regimes.

Notes

Summary

0m 00s



Having clarified how we keep the plasma stable in a Tokamak magnetic cage, we will examine how we can heat it to thermonuclear temperatures using neutron beams and waves. The very different frequency ranges related to the dynamics of electrons and ions imply not only diverse physical mechanisms for the heating but also different technologies, which we will briefly touch upon. Finally, we will illustrate a so-called *burning plasma regime* in which the plasma will produce significant amounts of fusion power, and we will illustrate the road map to fusion energy. We go from the present experimental device to ITER, currently under construction, which will demonstrate the scientific and technological feasibility of fusion and demo the step following ITER, which aims at proving that the commercial deployment of fusion is possible.

Notes

Summary

1m 08s