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Stepping to burning plasmas and peaceful use of nuclear fusion

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The peaceful use of Nuclear Fusion energy has been a dream for more than a century. Six partners, now the ITER members China, the European Union, India, Japan, Korea, Russia and the United States, have joined their effort to build ITER, the largest device dedicated to achieving the first burning plasmas with magnetic confinement in a laboratory. Together with organization and engineering challenges, the physics endeavor is to achieve a plasma at temperatures exceeding 100 000 000 K, hotter than the sun temperatures, in conditions allowing the fusion energy released on the alpha particles to sustain 2/3 of the heating power. ITER is presently being built in Cadarache, France, hosted by the European Union. In the meanwhile, the research activity in national labs is dedicated to improving our understanding of the physics and ability to control plasma operation. An ambitious simulation program completes this experimental effort. Key issues are plasma stability, in particular Magneto-Hydro-Dynamics relaxation phenomena, plasma energy confinement, via plasma turbulent transport, and heat exhaust issues where physics meets technological constraints. The presentation will give an overview of what is nuclear fusion, how to achieve its peaceful use as well as ongoing physics research as addressed by numerical simulations.

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