Nuclear Fusion Challenges and the Portuguese contribution

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The production of electricity from nuclear fusion has been a long-term challenge addressed by many research teams around the world. Recent records from inertial fusion and in magnetic confinement fusion experiments open great perspectives for a successful outcome in this quest. ITER construction is being accompanied by a vibrant fusion research program in many countries but, in particular in Europe, carried out by the consortium Eurofusion. The private investment in fusion is also growing considerably promising an ecosystem where innovation will accelerate the path towards fusion energy. In the EUROFusion roadmap, DEMO is foreseen as an intermediate step between ITER (under construction) and commercial power plants. Large tokamaks like ITER and the many different DEMO devices being designed will require to solve enormous engineering problems. This lecture will provide insights into the advancements and challenges surrounding nuclear fusion as the energy source of tomorrow. The lecture promises to delve into the world of nuclear fusion and the Portuguese contributions to this endeavor. This contribution will present some of the multiple engineering and physics challenges addressed while designing components for nuclear fusion devices. Using as example some of the Portuguese contribution, particular focus will be given to diagnostic development, control and data acquisition but also on experimental physics and understanding of the plasma.

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