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Burning Plasma Proposals

R. Bickerton, Oxford

Abstract

There is a desperate need for new Tokamak apparatus in which to investigate the physics of a plasma in which alpha-particle heating plays the dominant role in sustaining the plasma. Proposals have been on the table for years but nothing has yet been approved. In this note five such proposals plus JET are analysed using three different scaling laws for the energy confinement time. These are the Goldston [1984] law, the ITER-98 one used to design ITER-FEAT and finally one based on Gyro-Bohm physics. The results are remarkably similar. Only ITER, ITER-FEAT and ET4 ignite while Ignitor satisfies the burning plasma requirement, $F > 0.5$ where F is the ratio between the alpha power and the total power loss from the plasma. FIRE, a Princeton proposal does not reach $F = 0.5$ on any of the three scaling laws. Ignitor does. We conclude that Ignitor should be built without delay on the JET site taking advantage of the existing power supplies, and tritium-handling system. Ignitor is a mature design with prototypes of key components already made and tested in Italy. We could then have physics results on a burning plasma within five years. Decades have been lost due to indecision. This must stop.