Towards Inertial Fusion Energy (ToIFE) – Auxiliary Heating of Inertial Fusion Targets

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The role of heating arising from the propagation of orthogonal petawatt-laser-driven relativistic electron beams in dense plasma will be discussed[1]. The energy cascade mechanism begins first with the rapid growth at 45° to the two beams of electrostatic waves near the electron plasma frequency. These waves reach high amplitudes and break, which then results in the generation of a strongly driven turbulent Langmuir spectrum. Parametric decay of these waves, particularly via the modulational instability, then gives rise to a coupled turbulent ion acoustic spectrum. The resulting waves also give rise to ion heating through collisions via equilibration of both electrons and ions. In this talk, I will present the most recent analytic modelling, and particle-in-cell / Vlasov-Poisson simulation results from my team within Oxford Physics and the Central Laser Facility that explores the optimum parameter space for this process, focusing in particular on the requirements for auxiliary heating of the central hot spot. I will describe new methods for hole-boring through the coronal plasma surrounding the fuel using strongly relativistic laser beams that demonstrates the strong suppression of the hosing instability under these conditions[2]. The development of multi-kJ ultraviolet petawatt-class beams will be explored[3,4]. Finally, proof-of-concept experiments for the Orion and OMEGA EP facilities will be described.

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