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Lighting the Way to Fusion Energy with Ultra-High Intensity Laser-Matter Interactions

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Advances in laser technology over the past few decades have lead to the reality of lasers with energies as high as megajoules (10^6 Joules) per pulse and pulse durations as short as a few femtoseconds (10^{-15} seconds). Large energy laser systems are capable of inertially compressing material to densities and temperatures found inside stars and extremely short duration pulses routinely yield peak laser powers in the hundreds of terawatts (10^{12} Watts). The combination of high energy and short pulses together produces focused laser intensities that accelerate electrons to ultra-relativistic velocities. Currently we sit on the threshold of being able to harness these types of lasers to produce realistic laser driven fusion energy sources. The concepts of laser fusion and the required complex intense-laser physics will be presented with examples of recent and proposed experiments that light the way to achieving such power plants.