Achieving Net Gain Nuclear Fusion in Microcapsules by Coupling Sonoluminescence and Magnetic Compression

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Achieving net gain controlled nuclear fusion on Earth would lead to a revolution in energy and transportation technologies. This endeavor combined the techniques of sonoluminescence and magnetic compression, allowing the extreme ignition conditions required by the Lawson Criterion to be achieved at room temperature. First, a capsule is designed that can transmit both audio and magnetic energies. A spherical shell comprised of perforated iron is an efficacious and inexpensive choice. Second, the advantages of coupling sonoluminescence and magnetic compression were computed using Mathematica's numerical differential equation solver and integrator. Multiple nonlinear coupled ordinary differential equations were analyzed and plotted. The combined sono-magnetic wave imploded the capsule at speeds of over 95,000 m/s. The temperature inside the capsule rose rapidly to nearly 2keV, sufficient for D-T reactions to ignite. The fusion power function was approximated using a temperature-dependant Maxwellian distribution, and when integrated over the time-step, yielded a fusion energy of 302.43 J per capsule. Even when energy losses to Bremsstrahlung radiation and electron heat conduction are incorporated, and assuming 30% efficiency of electricity production, this output corresponded to a gain factor of 43, significantly more than any current form of fusion technology. In the final phase, a parallel-scalable nuclear reactor is designed that can generate heat and extract electricity from sono-magnetic reactions. More sophisticated Hydrocode simulations are being run to validate these initial findings. This project suggests that a sono-magnetic hybrid fusion approach can readily yield gain in a way that can be harnessed for clean energy generation.

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