A Path to Inertial Confinement Fusion: Magnetic Flux Compression

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Inertial confinement controlled thermonuclear fusion (ICF) is an active area of research pursued mainly with high-energy laser facilities, such as NIF at the Lawrence Livermore National Laboratory or comparable lasers under construction in France, China and Russia. The overarching goal of ICF is developing a new source of safe, sustainable, carbon and emissions-free electricity, but this achievement, if feasible at all, is still decades away. A more immediate goal is demonstrating ignition, i. e., producing more fusion energy from a plasma target than initially deposited into it. Attractive new opportunities for the ICF ignition are based on using ultrahigh magnetic fields of ~100 MG and above to suppress thermal conductivity and confine the alpha particles in hot, dense fusion plasma. This approach, named Magnetized Liner Inertial Fusion, or MagLIF, has been actively studied in recent years at DOE labs, primarily at Sandia National Laboratories. The results have been encouraging enough to consider MagLIF a credible option for the ICF ignition in the next decade. I will talk about the efforts to generate ultrahigh magnetic fields and to use them for achieving controlled thermonuclear fusion, starting from the dark times of cold war, when some of the main ideas had been originated, to the spectacular progress of the recent years and the prospects for the near future.