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Status and prospects for the fast ignition inertial fusion concept

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In inertial confined fusion (ICF) research, fast ignition (FI) has the potential for higher gain, lower ignition threshold and less stringent implosion symmetry requirements than central hotspot ignition. There is a worldwide research effort which is approaching a critical stage where conclusions on the feasibility of FI should be obtained. The challenges are very broad spanning laser science and technology, plasma numerical modeling and design, innovation in experimental diagnostics and novel science of energy transport and heating by extremely high current densities of MeV electrons and protons. New short pulse high energy laser capabilities are being developed through innovations such as optical parametric chirped pulse amplification (OPCPA), large area multi layer dielectric (MLD) gratings, large segmented aperture diffraction grating pulse compressors and uni-phase operation and focusing of multiple short pulse beams. Numerical modeling is being pushed to new extremes combining treatment the intense short pulse laser plasma interaction by explicit particle in cell (PIC) methods, the transport of energy by electrons and protons by implicit hybrid PIC methods and conventional radiation hydrodynamic modeling of implosion and compression. New diagnostics of the short pulse interaction phenomena are being developed and intense effort is going into benchmarking new numerical models against experimental measurements. The critical next phase of fast ignition research will be integrated experiments and modeling using new facilities including Omega EP and NIF ARC in the USA and Firex I in Japan. The results will determine the requirements for full scale fast ignition which could then be demonstrated by for example short pulse modification of the NIF or with proposed new facilities such as the European Hiper project. The talk will give a broad of outline the status and prospects of FI touching on its full range of science and technology.