3:30 pm • Friday March 14, 2014 • 2241 Chamberlin Hall • Coffee at 4:30 pm

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Status and Prospects for Achieving Thermonuclear Ignition on the National Ignition Facility

Department of Physics Colloquium

WISCONSIN

Recent experiments on the National Ignition Facility (NIF) have achieved the conditions where the thermonuclear fuel is self-heated by the alpha particles produced by the fusion process. For the first time in fusion research, the self-heating process causes a significant increase of the plasma temperature (~ 20 - 25 %) and a large enhancement of the fusion yield, more than doubling the number of fusion reactions. Demonstrating ignition will require much higher fusion yields and dominant self-heating by the alphas. Current NIF experiments use the indirect drive approach where a cryogenic spherical shell filled with deuterium and tritium is imploded using an x-ray drive. While these results represent an important step forward in fusion research, the path to thermonuclear ignition is uncertain. Other concepts like direct drive and shock ignition provide additional options to achieve ignition on the NIF. While all the currently available ignition options are affected by major physics uncertainties, steady progress is being made on both the NIF and OMEGA laser facilities thus improving the prospects for the achievement of ignition on NIF.

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