Measurement of the plasma astrophysical S factor for the $^3He(d,p)^4He$ reaction in exploding molecular clusters

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4 P.M.

Rm 124 NSH

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The plasma astrophysical S factor for the $^3He(d, p)^4He$ fusion reaction was measured for the first time at temperatures of few keV, using the interaction of intense ultrafast laser pulses with molecular deuterium clusters mixed with ^3He atoms. D_2 or CD_4 molecular clusters were produced in the adiabatic expansion in vacuum of high pressure (52.5 bar) and low temperature gas, through a supersonic nozzle. The temperature of the gas was 86 K in the case of D_2 and 200-260 K in case of CD_4. Different proportions of D_2 and ^3He or CD_4 and ^3He were mixed in the gas jet target in order to allow the measurement of the cross-section for the $^3He(d, p)^4He$ reaction. The Texas Petawatt laser delivered 90–180 J per pulse with 150 fs duration to irradiate the clusters. The Coulomb explosion of deuterium molecular clusters provided energetic D ions capable of drive fusion reactions. The energy distribution of the deuterium ions was obtained from their time of flight measured with a Faraday cup. The yield of 14.7 MeV protons from the $^3He(d, p)^4He$ reaction was measured in order to extract the astrophysical *S* factor at low energies. Results of the experiment performed at Center for High Energy Density Science at The University of Texas at Austin will be presented [PRL, 111, 082502]. The possibility to use the same technique to investigate other reactions of astrophysical interest will be also discussed.

Refreshments served prior to the seminar in Rm 124.