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Proton deuteron fusion reaction in the energy range between 60 and 300 keV

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We have studied the nuclear reaction $d(p,\gamma)He-3$ in the proton energy range between 60 and 300 keV. This reaction is the second step of the primordial nucleosynthesis and our energies cover the range of energies after the Big-Bang. The reaction has previously not been studied very well in this energy range and the few existing cross section measurements do not agree with latest model predictions. At the moment, it looks like the main reason for the disagreement is in an unexpectedly strong angular distribution of the emitted gamma rays. During the same reaction studies we observed electrons emitted with an energy very similar to that of the gamma rays, i.e. about 5.6 MeV. The electrons could not be due to the usual internal conversion process, since the probability for their emission was about four orders of magnitude too large. We, therefore, interpret the unexpected result as the electrons being forced much closer to the nucleus by the electron screening effect which also increases the cross section at low energies.

Selected session

Nuclear Astrophysics

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