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Fusion measurements of 12C+12C at energies of astrophysical interest

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The cross section of the $^{12}C+^{12}C$ fusion reaction at low energies is of paramount importance for models of stellar nucleosynthesis in different astrophysical scenarios, such as Type Ia supernovae and X-ray superbursts, in which this reaction is a primary route for the production of heavier elements. In a series of experiments performed at Argonne National Laboratory using Gammasphere and an array of silicon detectors, measurements of the fusion cross section of $^{12}C+^{12}C$ were successfully carried out in the center-of-mass energy range of 3-5 MeV using the γ and charged-particle coincidence technique. These were the first background-free fusion cross section measurements for $^{12}C+^{12}C$ at low energies. Our results are consistent with previous measurements in the high-energy region; however, our lowest energy measurement indicates a fusion cross section slightly lower than those obtained with other techniques. Results will be presented and the physical implications of extrapolations of the fusion hindrance model and other theoretical calculations will be discussed.

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