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A Study of the $^{12}C + {}^{12}C$ Fusion Reactions at Astrophysically Relevant Energies J. ZICKEFOOSE, J. SCHWEITZER, T. SPILLANE, University of Connecticut, USA, D. SCHUERMANN, INFN Naples, Italy, Y. GUAN, Guangxi University, China, H.-W. BECKER, C. ROLFS, F. STRIEDER, Ruhr University Bochum, Germany, M. DE CESERE, N. DE CESERE, A. DI LEVA, F. TERRASI, Second University of Naples and INFN Naples, Italy, L. GIALANELLA, G. IMBRIANI, B. LIMATA, University of Naples and INFN Naples, Italy — The fusion reactions $^{12}C(^{12}C,\mathrm{p})^{23}Na$ and $^{12}C(^{12}C,\alpha)^{20}Ne$ are the relevant nuclear processes in the carbon burning phase of stellar evolution. The stellar mass required to ignite carbon depends on the fusion reaction rates at the Gamow energy. The measurement of carbon burning reaction rates near the Gamow energy has been limited by hydrogen contamination in the carbon targets. Thus current estimates of the reaction rates rely heavily on extrapolation from higher energies that does not include resonances. We extended the lower energy limit by a novel technique to strongly reduce the hydrogen background for both gamma ray and charged particle measurements. The current experiment intends to further extend the lower energy limit by utilizing ultra low hydrogen content targets. Experimental procedures, results, and the impact for reaction rates will be discussed.

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