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# Direct measurement of the carbon-carbon fusion cross section at stellar energies

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The carbon-carbon fusion reaction serves as a crucial reaction for stellar evolution and explosive events, significantly influencing the evolution of massive stars and the explosion of superburst in the Universe. Despite decades of research, there remains considerable uncertainty in the cross section, particularly at stellar energies below E_{C.M.}=3MeV. The extrapolation techniques cannot provide a clear picture of the reaction within the Gamow window. We measured the cross section of ^{12}C(^{12}C,a_{0})^{20}Ne in the energy range of E_{C.M.}=2.3 MeV to 3.6 MeV using an intense carbon beam with intensity up to 100 particle microamperes, provided by the LEAF accelerator in Lanzhou, and a novel detection system comprising a time projection chamber (TPC) and a silicon detector array. Our direct measurement results yield new values for the reaction cross section, indicating that further improvements are needed in the THM indirect method. A new reaction rate is recommended based on our experimental result.

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