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Helium Burning Reaction Rate Uncertainties and Consequences for Supernovae[1] C. TUR, NSCL/MSU, A. HEGER, LANL/UCSC, S.M. AUSTIN, NSCL/MSU, and JINA — The triple alpha and $^{12}C(\alpha,\gamma)^{16}O$ reaction rates determine the carbon to oxygen ratio at the completion of core helium burning in stars, which, in turn, influences the later stellar burning stages. We explored the dependence of massive star evolution and nucleosynthesis yields on the experimental uncertainties in the triple alpha rate (10 to 12%) and the $^{12}C(\alpha,\gamma)^{16}O$ rate (25 to 35%) using full stellar models followed to core collapse and including supernova explosion. The production factors of medium-weight elements obtained by using the Lodders (2003) solar abundances for the initial star composition, rather than the abundances of Anders & Grevesse (1989), provide a less stringent constraint on the $^{12}C(\alpha,\gamma)^{16}O$ rate. Variations within the current uncertainties in both reaction rates, however, induce significant changes in the central carbon abundance at core carbon ignition and in the mass of the supernova remnant. An experiment is being carried out by an NSCL/WMU collaboration to improve the accuracy of the triple alpha reaction rate.

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