Abstract Submitted
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Increased Precision in Gamow Window Calculations for Thermonuclear Reaction Rates J. TOKIWA, R.L. KOZUB, TTU, M.S. SMITH, ORNL, K.Y. CHAE, UT-K, E.J. LINGERFELT, ORNL/UT-K — The simulations of many astrophysical events require the input of thermonuclear reaction rates. These rate calculations involve a numerical integration over the Gamow window for each reaction. Standard codes to calculate rates, such as the tools at nucastrodata.org, utilize a Gaussian approximation[1] to estimate the relative energy range (Gamow window) over which the calculation is performed numerically. This analytic method fails for low Z particles such as d(d,p)t and d$(d,n)^3$He reactions at low temperatures, which are important for Big Bang Nucleosynthesis (BBN). A new FORTRAN code was written and tested that numerically determines the lower energy limit whose contribution to the integration over the Gamow Window is less than 1.0% at a given temperature. The code also determines the Gamow peak energy numerically, instead of using the formula for a constant S-factor. These developments will extend the rate calculation capabilities at nucastrodata.org to include BBN and enhance upcoming features at bigbangonline.org. This research is supported by the U. S. Department of Energy.

[1]See, e.g., C. E. Rolfs and W. S. Rodney, "Cauldrons in the Cosmos," The University of Chicago Press, Chicago (1988), p. 158.

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