Measurements and Analysis of Alpha-Induced Reactions of Importance for Nuclear Astrophysics

Abstract

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Reactions during stellar helium burning are of primary importance for understanding nucleosynthesis. A detailed understanding of the critical reaction chain 4He(2α, γ)12C(α, γ)16O(α, γ)20Ne is necessary both because it is the primary energy source and because it determines the ratio of 12C to 16O produced, which in turn significantly effects subsequent nucleosynthesis. Also during Helium burning, the reactions 22Ne(α, n)25Mg and 22Ne(α, γ)26Mg are crucial in determining the amount of neutrons available for the astrophysical s-process.

This thesis presents new experimental results concerning the 16O(α, γ)20Ne, 22Ne(α, n)25Mg, and 22Ne(α, γ)26Mg reaction rates. These results are then applied to the calculation of the associated stellar reaction rates in order to achieve better accuracy.