Abstract Submitted
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Experimental techniques to investigate astrophysical key reactions at the extremes. WOLFGANG HAMMER, University of Notre Dame — In order to explore stellar evolution and nucleosynthesis the reaction rates of the relevant nuclear reactions must be determined at burning temperatures. This means investigating the reactions down to a pikobarn or subpikobarn level. To achieve this, all important experimental parameters have to be optimized, which are: high primary beam intensity, targets of high chemical and isotopic purity and high stability, high detection efficiency and resolution for the reaction products, appropriate means to reduce disturbing background of any kind, sufficient long measuring time. The key reaction $^{12}C(\alpha,\gamma)^{16}O$ was investigated using enriched solid targets, which could withstand beam powers of up to $10\,kW/cm^2$ and beam currents of up to $800\,\mu A$. The angular distributions of the γ's were measured using a close 4π Ge-detector array or the GANDI array of high efficient Ge-detectors on a turntable. The background was suppressed by active shielding. Thus the $E1$ and $E2$ S-factors could be determined in the energy range $E_{c.m.} = 890-2800\,keV$, enabling the extrapolation of the reaction rate with 25 % accuracy.
The astrophysical key neutron source $^{22}Ne(\alpha,n)^{25}Mg$ was investigated using the windowless recirculating gas target RHINOCEROS with gas purification in the main stream. The neutrons were detected by a 4π detector with an absolute efficiency of 50 %. The excitation function was determined down to the threshold with a sensitivity at the 10^{-11} b level. The uncertainty of the reaction rate was reduced considerably.

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