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R. W. Bauer, G. J. Mathews,
J. A. Becker, and R. E. Howe
Lawrence Livermore National Laboratory
Livermore, California 94550

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250

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NEUTRON CAPTURE CROSS SECTIONS FOR $^{86,87}\text{Sr}$ AT STELLAR TEMPERATURES

R. W. Bauer, G. J. Mathews, J. A. Becker, and R. E. Howe

Lawrence Livermore National Laboratory, University of California
Livermore, CA 94550 USA

The neutron capture cross sections for $^{86,87}\text{Sr}$ have been measured from 100 eV to 1 MeV by the neutron-time-of-flight technique at the Livermore electron linear accelerator. The capture events were recorded by detecting the prompt gamma-ray cascade with two C_6D_6 scintillators, and were normalized to standard gold cross sections.¹ A ^6Li -glass scintillator was used to monitor the neutron flux. The background was determined experimentally utilizing the "black resonance" technique. We applied a weighting technique² to our data such that the resultant efficiency of the capture gamma-ray detectors is independent of the gamma-ray spectrum. Corrections were also applied for neutron multiple scattering and self-shielding, and for gamma-ray attenuation. Fig. 1 gives an example of our cross section results for ^{86}Sr . The Maxwellian average neutron capture cross sections have been calculated for stellar temperatures ranging from $kT = 10$ to 100 keV. Capture rates for representative temperatures for ^{86}Sr and ^{87}Sr are summarized in Table I.

Combining our results with those reported previously^{3,4,5} we recommend a Maxwellian-averaged capture cross section at $kT = 30$ keV of 74 ± 3 mb for ^{86}Sr , and 102 ± 4 mb for ^{87}Sr . The capture cross sections of these two pure shielded s-process nuclei are of importance for stellar nucleosynthesis of nuclei in the mass region near the $N = 50$ closed shell. Specifically, they are important in the study of the s-process branching through ^{85}Kr as a monitor of the neutron capture time scale, and also in the investigation of the ^{87}Rb - ^{87}Sr chronometric pair as an independent measure of the age of the galaxy. Our preliminary analysis yields a neutron capture time scale of ≈ 15 years, and a time scale for galactic nucleosynthesis which is consistent with other chronometric determinations.

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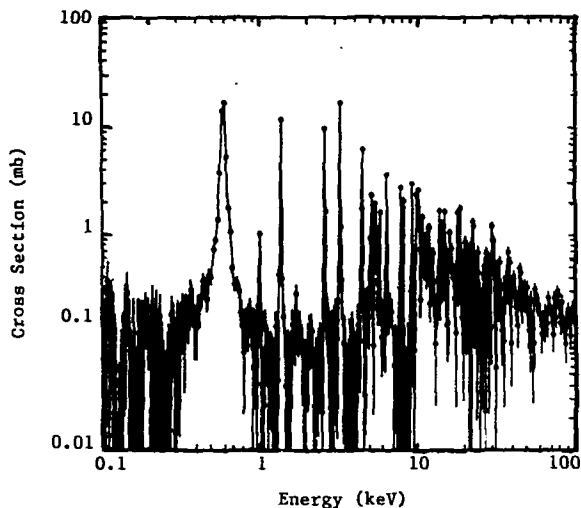


Fig.1

Measured capture cross sections of ^{86}Sr , displaying strong resonances at 0.588, 1.370, 2.592, 3.247, and 4.496 keV, and an approximate $1/v$ decrease above 20 keV.

Table I

Maxwellian-averaged capture cross sections of the measured isotopes as a function of the thermal energy kT

measured isotope	Calculated Maxwellian-averaged capture cross section (mb) at		
	10 keV	30 keV	100 keV
^{86}Sr	130 ± 6	74 ± 4	40 ± 2
^{87}Sr	198 ± 8	102 ± 5	43 ± 3

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