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 $^{86,87}\text{Sr}$ AT STELLAR TEMPERATURES

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

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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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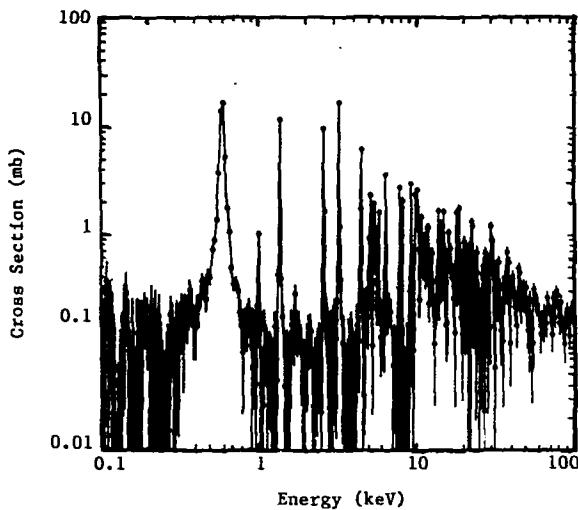


Fig.1

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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