GALACTIC BA ENRICHMENT FROM TP-AGB STARS

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The production of the bulk of barium has long been ascribed to the *main* component of the *s*-process, whose astrophysical site has been envisaged in the convective He shell of Thermally Pulsing Asymptotic Giant Branch (TP-AGB) stars of low mass (1–3 $M_\odot$; see Käppeler et al. 1990). The main neutron source is the $^{13}C(\alpha, n)^{16}O$ reaction, operating at the thermal energy of $kT = 12\,\mathrm{keV}$. We have calculated neutron captures in such environment with an updated nuclear physics, adopting the neutron capture cross sections of Beer, Voß, & Winters (1992) together with their temperature-dependence. Stellar models producing a mean neutron exposure of $\tau_0 \simeq 0.30\,\mathrm{mb}^{-1}$ are able to reproduce the solar distribution of the *s*-abundances satisfactorly, but the Ba isotopes show some overproduction. Such a strong indication suggests a revision of the Ba cross sections (see Gallino, Raiteri, & Busso 1992). Once that a suitable choice of $\sigma_{n,\gamma}$(Ba) is made, it is found that a *r*-contribution to solar Ba of the order of 10% can be expected.

We also investigated the production of Ba in stellar models of different neutron exposures, corresponding to stars of various metallicities. A constant amount of the ^{13}C neutron source was assumed. The results of our calculations are shown in Table I: the overabundances of the Ba isotopes are given with respect to the initial (solar-scaled) ones. From these numbers the Ba yields from TP-AGB stars can be derived; by inserting them into a detailed model for the chemical evolution of the Galaxy (Matteucci & François 1989), we can predict the behaviour of barium as a function of metallicity. The results, that must be compared with the observation of [Ba/Fe] vs. [Fe/H], will be presented in a forthcoming paper.

TABLE I

[Fe/H]	-1.3	-0.82	-0.51	-0.35	-0.22	-0.12	-0.05	0.0
^{134}Ba	6.75e3	3.98e3	1.72e3	9.15e2	4.88e2	2.73e2	1.60e2	1.14e2
^{135}Ba	1.73e3	9.91e2	4.04e2	2.07e2	1.07e2	5.86e1	3.35e1	2.36e1
^{136}Ba	7.29e3	4.19e3	1.74e3	8.96e2	4.65e2	2.54e2	1.45e2	1.02e2
^{137}Ba	6.24e3	2.51e3	9.28e2	4.59e2	2.31e2	1.24e2	7.01e1	4.91e1
^{138}Ba	1.25e4	5.30e3	1.80e3	8.21e2	3.83e2	1.92e2	1.02e2	6.90e1
$\tau_0(\mathrm{mb}^{-1})$	1.19	0.47	0.29	0.23	0.19	0.17	0.15	0.14

References

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