Comparison of s-Processing Occurring in a Low Mass AGB Star of Low Metallicity and the Results of s-Classical Analysis.

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We examine the results of s-Processing occurring in a low mass star of low metallicity during the pulsed He-instability in AGB phases by comparing them with the s-Classical analysis. Neutron exposures are provided by the C13(Alpha,N)016 reaction, according to the mechanism suggested by Iben and Renzini (1983) for the formation in the interpulse phase of a small zone rich of C13 and its subsequent ingestion in the next pulse.

As far as the s-Classical process is concerned, the analysis of several branchings of the s-Flow provides stringent constraints on neutron density, temperature, electron density and duration of the pulsed process. In particular, the neutron density has to be low enough [Nn = (1.0-0.5)E8 N/CM**3] and the temperature has to be sufficiently high [T = (2-3)E8 K].

These conditions apparently seem to exclude the C13-source as efficiently producing the main component of heavy s-Isotopes in a solar system composition. Indeed, the bulk neutron densities during C13 exhaustion are much higher, of the order of 5E9 N/CM**3, and the temperature at the bottom of the He-burning shell is too low: typically 1.5E8 K.

Nevertheless, the realistic neutron flow is not constant, as assumed in the s-Classical analysis, reaching a maximum of 5E9 N/CM**3 and then decreasing slowly until C13 is exhausted. At the beginning of neutron exposure, the n-Processing is far from an s-Processing, but the n-rich isotopes are frozen out when the average neutron density is decreasing. This density practically coincides with the s-Classical constraints. The main bulk temperature during neutron exposure is fairly low; nevertheless, a short phase of high temperature (of the order of 3E8 K) is met near the end of the pulse, when convection extends over its maximum extension. In these conditions, the abundant isotope NE22 undergoes small alpha-captures through the NE22(Alpha,N)MG25 reaction, thus releasing a small flux of neutrons. The high temperature branching points in the s-Flow are now open, and a consistent production of just the few "thermometers-isotope" is obtained.

We conclude that the C13-source in low mass AGB stars may fulfill all the constraints provided by the s-Classical analysis.

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