

THE EXPLOSIVE r -PROCESS

(Abstract)

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Previous r -process calculations were done using constant temperature and neutron density. However, the r -process presumably occurs under dynamic conditions in supernovae. In this work, more realistic, dynamic r -process calculations with time varying temperature and density are presented. It is shown that these dynamical calculations eliminate the previous need for arbitrary smoothing of the calculated abundances in order to fit the observed r -process abundances. It is also shown that for certain conditions it is possible to make all three observed r -process abundance peaks in the same dynamical event. Previous non-dynamical calculations were always forced to have more than one event in order to fit the observed peaks. It is felt that these dynamic calculations are able to remove many of the major uncertainties regarding the r -process. In determining the r -process conditions, one may also be determining the conditions at the mass cut separating the ejected supernova material from the neutron star remnant. In order to determine these conditions, a detailed examination of the nuclear reaction network which builds 'seed' nuclei from neutrons, protons and alphas is being carried out, as is a careful examination of the β -rates appropriate to the r -process region.