i process and CEMP-s+r stars

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Amongst the Carbon Enriched Metal Poor Stars (CEMP), a subclass denoted CEMP-s+r remains a mystery. Previously modeled by a superposition of r and s process sources, now 1-zone calculations show that an intermediate neutron capture process, the i-process, might better reproduce elemental signatures found in some CEMP-s+r stars. In i-process conditions Eu can be produced and typical [La/Eu] ratios are between 0.0 and 0.4. The [Ba/La] ratio can take on a rather wide spread from 0.0 to 1.0, depending critically on the nuclear data of unstable species in the i-process path (such as ^{135}I). Another signature of i process is the large ratio of elements in the range Er to W compared to Os and Ir. We explore these 1-zone calculations with initial conditions reminiscent of convective-reactive H-ingestion events in super-AGB stars, where the conditions for the i-process could exist. Several CEMP-s+r stars, such as HE0338-3945 and CS31062-050 are reproduced exceptionally well with these 1-zone i-process calculations if we adopt the neutron exposure (length of simulations) as the fitting parameter. i-process condition can reproduce several other CEMP-s+r stars as well. The nuclear production site of the i-process involves a violent convective-reactive regime that we investigate with 3-D hydrodynamic simulations.