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Upgrading the dppn45 post-processing nucleosynthesis code

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Decay rates have a significant effect on the abundance of branching point elements and short-lived nuclei. Thus, a correct description of the decay rates is essential for the accurate study of the s-process in AGB stars. The dppns45 post-processing nucleosynthesis code calculates the changes in the abundances of isotopes due to mixing and nuclear burning after the detailed stellar structure was calculated by a stellar structure evolution code. The nuclear reaction network of dppns45 is originally based on the reaclib formula (Thielemann et al., 1987). The JINA reaclib libraries have several advantages, however, they do not include temperature and density dependence of decay rates. To remedy this shortcoming, a new version of the code includes a routine that allows using tabulated values of decay rates instead of the reaclib fit. During this work, I expand the reaction network to account for the temperature and density dependence of the radioactive decay and electron captures. The tables were created based on the NEXTGEN (Xu et al., 2013) database, and new rates are currently being tested on a model with M = 3 solar masses and z = 0.014 metallicity. The purpose of the testing process is to determine whether the use of tabulated rates instead of reaclib fit causes a significant difference in the final surface abundances. According to the results so far, it can be assumed that the new version of the dppns45 code works, there are significant differences between the tabulated and the reaclib rates, especially for the 152Gd, whose surface abundance is greatly influenced by three (151Sm-›151Eu, 152Eu-›152Sm and 152Eu-›152Gd) new rates.

Session

Stellar nucleosynthesis

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