APR08-2008-001162

Abstract for an Invited Paper
for the APR08 Meeting of
the American Physical Society

New Views of the r-Process

YONG-ZHONG QIAN, University of Minnesota

Nucleosynthesis via rapid neutron capture, the r-process, is responsible for approximately half of the solar abundances of the nuclei with mass numbers $A > 100$. Five decades after this process was proposed, two outstanding issues remain: (1) which astrophysical environments can provide the physical conditions required for the r-process? and (2) what is the detailed nuclear physics input that governs the yield pattern of nuclei from an r-process? Both issues are crucial for a full understanding of the r-process. This talk will mainly address the issue of the astrophysical sites. While there are no self-consistent models that can produce a robust r-process, observations of elemental abundances in old stars of the Galactic halo over the past decade have provided important guidance to the overall nucleosynthetic characteristics of astrophysical r-process sources. For example, these observations strongly suggest that the source for the heaviest r-process nuclei produces none or very little of the Fe group and lighter nuclei. On the theoretical front, several new mechanisms other than rapid (r) or slow (s) neutron capture were found to produce the nuclei with $60 < A < 100$ that were thought to be made dominantly by the r and s-processes. Major results from the stellar observations will be highlighted. Their implications for astrophysical models of the r-process will be discussed. Existing models and possible improvements will be reviewed based on the observational implications.