APR05-2005-000606

Abstract for an Invited Paper
for the APR05 Meeting of
the American Physical Society

Nuclear Diagnostics of the Cosmos

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It is by now well established that the bulk of the elements heavier than helium have been assembled in stars, and that supernovae have played a major role in this synthesis. Though there remain some interesting exceptions - the origin of the light p-process nuclei and a few other rare isotopes and the site for the r-process, to name but two - the abundances we see in the sun are, at least qualitatively, understood. Nucleosynthesis is thus increasingly used as a diagnostic for cosmic events and evolution. From the numerous possibilities, I will discuss four in some detail: nucleosynthetic diagnostics of a) the neutrino burst in core-collapse supernovae; b) the neutrino-powered wind from young neutron stars; c) the average rate of nucleosynthesis in the Galaxy as evidenced by the abundances of gamma-ray line emitters ^{26}Al and ^{60}Fe; and d) Population III stars, "hypernovae," and gamma-ray bursts. Uncertainties in nuclear physics will be discussed where appropriate.