NIC XII - Satellite workshop on r-process nucleosynthesis

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β decays of isotones with N = 126 and nuclei nearby and r-process nucleosynthesis

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β decays of the isotones with N = 126 are studied by shell-model calculations taking into account both the Gamow-Teller (GT) and first-forbidden (FF) transitions [1]. Shell-model interaction of Ref. [2] is adopted and a quenching of g_A^{eff}/g_A =0.7 is used for both the GT and FF transitions except for 0^{-} case. The FF transitions [3] are found to be important to reduce the beta-decay half-lives, by nearly twice to several times, from those by the GT contributions only. The half-lives obtained here are short compared with the standard data of FRDM [4] except for Z = 71 usually employed in nucleosynthesis network calculations. They increase monotonically as Z increases showing no odd-even staggering found in FRDM's. They are, on the other hand, longer than those of CQRPA calculations [5].

Possible implications of the short half-lives of the waiting point nuclei on the r-process nucleosynthesis during the supernova explosions are discussed. A slight shift of the third peak of the element abundances in the r process toward a higher mass region is found.

The dependence of the \beta-decay half-lives and the r-process nucleosynthesis on the magnitudes of the quenching of g_A and g_V in FF transitions is studied. Large quenchings are found to be necessary for FF transitions in ^{206}Hg [6]. FF transitions in nuclei at and near the N=126 isotones such as 204Pt, 203Pt, 202Ir and 201Ir are also investigated. Calculated half-lives of these nuclei are compared with recent experimental data [7] and the quenching of g_A and g_V are discussed.

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