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A characteristic study of the most probable nucleus beyond the island of stability

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The possible occurrence of superheavy nuclei(SHN) in nature, neutron stars, pallasite meteorites validated the theoretical predictions about the occurrence of SHN in nature. Very recently, Zagrebaev et al. estimated the possibility of production of SHN in the astrophysical r process. Ohnishi and Okamoto has studied the nuclear structure properties of neutron magic numbers 184, 228 and 308 and proton magic number 114 and 164, and reported that the upper mass limit of the r-process depends strongly on the magic neutron numbers. In this work the expected next proton magic number Z=164 in the next island of hyperheavy nuclei is studied. BE/A through the Droplet model (Z=164 and N=180-390 suggests the maximum binding is from N=250-270 (>6.1MeV). But the positive εp and εn for N=184, suggests higher probability of existence of 348164. The multi-nucleon separation energies are obtained through BE formalism. The single particle levels and the level density and entropy are obtained through cranking and statistical models resply and the spin cut-off parameter, using our modified formula. The level density increases with temperature. At T>1MeV, it became infinite, which shows the nucleus reaching the plasma state. The survival of 184164 upto T=1MeV, suggests that the nuclei beyond the island of stability will lie along or near to N=Z line. Thus a high possibility of occurrence of hyperheavy nuclei in supernovae is predicted, since supernovae generally contain material with equal numbers of neutrons and protons.

Primary author: KUMAR, S. Santhosh (Department of Physics, Bharathidasan Govt. College for Women, Puducherry– 605 003, U. T. of Puducherry, INDIA)

Co-authors: Mr BABU, A. Victor (Research Department of Bharathiar University, Coimbatore – 606 060, TamilNadu, INDIA); Ms PREETHA, P (Research Department of Bharathiar University, Coimbatore – 606 060, TamilNadu, INDIA)

Presenter: KUMAR, S. Santhosh (Department of Physics, Bharathidasan Govt. College for Women, Puducherry– 605 003, U. T. of Puducherry, INDIA)

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