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Weakly Bound Neutron-Rich Nuclei and Cosmic Phenomena

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The study of single particle and bulk properties of the neutron-rich nuclei constrains fundamental issues of Nuclear physics like limits of existence of the quantum many body system (atomic nucleus) and equation of state of neutron-rich matter etc [1-7]. This information has also important impact in understanding cosmic phenomena, like neutron star, nucleosynthesis, evolution of star etc…[1,6,7]. The state of art of Coulomb breakup of the neutron-rich nuclei has been used to explore those properties [1-9]. The unambiguous information on detailed components of the ground-state wave-function along with quantum numbers of the valence neutron of the nuclei obtained from the measurement of threshold strength along with the g-ray spectra following Coulomb breakup [1,3-5,9]. The shape of this threshold strength is a finger-print of the quantum numbers of the valence neutron. We investigated the ground-state properties of neutron-rich Na, Mg, Al nuclei around, island of inversion, N ˜20 using this method at GSI, Darmstadt. Very clear evidences have been observed for melting and merging of long cherished magic shell gaps at N = 20,28 [4,9]. The evanescent neutron-rich nuclei imprint their existence in stellar explosive scenarios (r-process etc.). The indirect measurements are the only possible access to the information which is a valuable input to the model for star evolution process [6]. Some valuable bulk properties of the neutron-rich nuclei like density dependent symmetry energy, neutron skins etc. [7] play a key role in understanding densest object in the universe, the neutron star. I shall discuss our experimental investigation to obtain those information.

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