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Study of Ground-state configuration of neutron-rich Aluminium isotopes through Coulomb Breakup

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The region of the nuclear chart around neutron magic number, N~20 and proton number (Z), $10 \leq Z \leq 12$ is known as the *island of inversion*. The valance neutron(s) of these nuclei, even in their ground state, are most likely to be found in the upper *pf* orbitals instead of lower *sd* orbitals and thus show deformation from spherical shape. The nuclei like ^{34,35}Al (N=21,22) are lying at the boundary of this *island of inversion*. Little experimental information on ground state configuration of those isotopes are available in literature[1] regarding their intruder *pf-shell* contribution. Coulomb excitation is a direct probe for studying the ground state configuration of loosely bound nuclei [2]. Hence, an experiment was performed using the existing RIB facility at GSI, Dramstadt to study the properties of nuclei in and around the N=20 *island of inversion* through electromagnetic excitation. The exclusive set-up for kinematically complete measurement, the LAND-FRS(R3B) set-up, was used for that. Short-lived radioactive nuclei were produced by the fragmentation of pulsed ^{40}Ar beam (at 531 MeV/u). Secondary beam from FRS, containing various isotopes ^{34,35}Al was allowed to fall on various Pb target for electromagnetic excitation. The incoming beam was identified uniquely by energy loss and ToF measurements before the reaction target along with the known magnetic rigidities of FRS. Neutrons and γ-rays from the de-exciting projectile or projectile like fragments were detected by the LAND and the 4π-Crystal Ball spectrometer, respectively. Reaction fragments were tracked via the Silicon Strip Trackers and GFI detectors placed before and after the magnetic spectrometer (ALADIN), respectively. Finally, mass of the outgoing fragments were identified by reconstructing the magnetic rigidities inside ALADIN and velocity measurements of the reaction fragments. Measurement of four momentum of all decay products and utilization of invariant-mass method leads to the reconstruction of nuclear excitation energy. Comparison of the measured Coulomb breakup differential cross-sections with the theoretically calculated cross-sections provide the ground state configuration and shell inversion in these neutron-rich nuclei. Here, we shall report first time the ground state configuration of ^{34,35}Al, obtained from Coulomb breakup method.

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