Spectroscopy of neutron-rich Tellurium Nuclei.

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Neutron rich nuclei around the double shell closure nucleus ^{132}Sn (Z=50 & N=82) has been of special interest both in experimental and theoretical aspects[1]. Though this region is located far from the valley of beta-stable nuclei, ^{132}Sn still exhibits strong magicity, where as disappearance of magic numbers and evolution of new magic numbers have been observed in other regions far from the valley of beta-stability. It is desirable to know if this persistence of the double shell closure is similar to the stable doubly shell closed nuclei. This needs systematic study of structure of nuclei around this nucleus.

Production of these nuclei is not possible using the conventional fusion-evaporation reactions. However, these nuclei can be populated with low yields in presence of several tens of nuclei using fission [2,3] and deep-inelastic reactions[4,5]. With the advent of new generation large detector arrays with high detection efficiency such as Gammasphere [6] and EUROBALL[7], it became possible to study neutron-rich fission fragment nuclei using heavy ion induced fusion-fission reaction[8]. Such experiments have established the feasibility of this technique. In the present study, an attempt was made to populate these nuclei in heavy ion fusion-fission reaction by exploiting the availability of the power of 24 Clover detector array INGA Spectrometer which provided an opportunity to probe these weakly populated neutron rich nuclei around doubly magic A=132 region.

In the present study, a beam of ^{7}Li ions of 55 MeV were used to bombard a natural Uranium target of 1mg/cm^{2} thickness. The energy of the Li-ions is above the barrier and total fusion-fission cross-section is about 1.2 barns. Two-fold gamma-coincidence events are recorded in list-mode.

A γ–γ matrix was created from the data and used to construct the level structure of the neutron-rich fission fragments. A good number of fission fragment nuclei were populated with measurable yields. Nuclei identified were in the range of Z=40-60 and A= 90-150.

Level structure has been updated for several isotopes of Cd-Sn-Te-Xe region. Several new transitions have been identified in these nuclei. In present report, level schemes have been updated for neutron-rich Tellurium nuclei with A=126-130.

Earlier known level schemes of these nuclei were established from the ^{130}Te(^{64}Ni,X) deep-inelastic transfer reactions[5,9,10]. In ^{126}Te nucleus, level scheme was know up to 14^{+} state at an excitation energy near 4.5 MeV [9]. Several new transitions decaying to 6^{+} and 4^{+} states have been identified. In ^{128}Te also, level scheme was known up to 14^{+} state at 4.3 MeV [9]. In the present work a new sequence is identified which is decaying to the 5^{-} state at 2.1 MeV. In ^{129}Te, only very limited level structure was known from beta-decay data of an isomeric state of ^{129}Sb. This nucleus was also directly populated in the deep-inelastic transfer reaction $^{130}Te(^{64}Ni,X)$[9,10] up to $23/2^+$ state at about 2 MeV. In the present work some more transitions have been identified and placed them in the level scheme. In ^{130}Te, level structure was known up to 15^- state at 4.4 MeV [5,9,11]. Now three new states were identified above 3 MeV and were decaying to 9^- and 11^- states via several new transitions. A couple of new states below 3 MeV were also identified which decay to the known levels. Newly identified transitions are shown as dashed lines in the partial level schemes presented in the Figure-1.

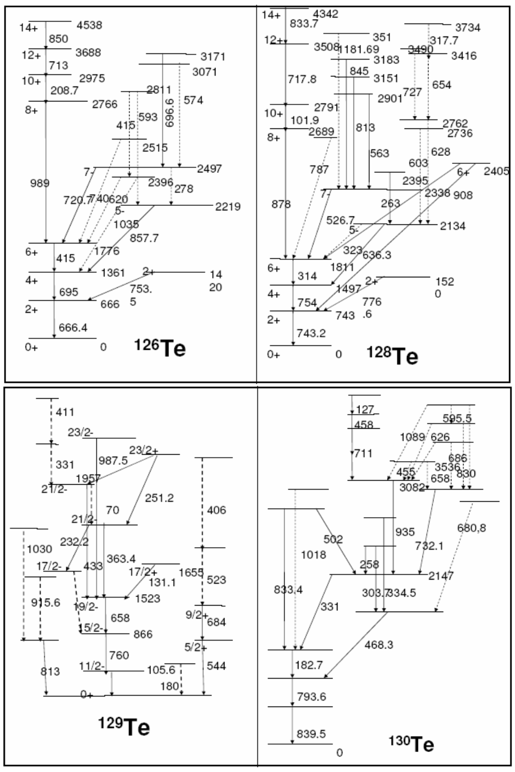

Fig.1: Partial level schemes of Tellurium nuclei. New transitions were shown as dashed lines.

Nuclei populated in this experiment with measurable yields have range of Z=40-60 and A= 90-150. However, strongly populated nuclei are neutron-rich isotopes of Cd-Sn-Te-Xe elements. Cross-sections for these nuclei are approximately about 1-5mb. Most of these nuclei have been studied earlier were produced via beta-decay, spontaneous fission, deep-inelastic transfer, induced fission and Coulomb excitation of accelerated radioactive fission fragment nuclei. These measurements have established level structures up to low to moderate spins. In the present study, level schemes of Tellurium nuclei, with A=126,128,129,130, have been revised by adding newly identified gamma transitions. Uncertainties, in assignment of spins and parities of several levels could not be removed in the present measurement due to the limitations in the experimental measurement, presence of large number of nuclei and poor statistics.

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