Observation of 8^+ and 10^+ multiplets in ^{124}Te

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Introduction

The spectroscopic study of Tellurium isotopes, with N $\geq$ 70, has been a subject of interest, because these isotopes lie in between of spherical Sn− and well deformed Xe−isotopes. Also, the availability of $\nu h_{11/2}$ and $\pi g_{7/2}$ orbitals, near Fermi level, leads to a complex structural behaviour of heavier Te−isotopes [1]. As the well established vibrational behaviour ($\frac{E_4}{E_2} \sim 2$) of lighter Te−isotopes, predicted the same behaviour for its heavier isotopes, but, in recent Coulomb excitation experiment on $^{120-124}$Te [2], author predicted the asymmetric behaviour for these nuclei. One of the major challenge in studying heavier Te−isotopes, is the unavailability of suitable target-projectile combination for fusion evaporation reaction. Experimental information for these heavier isotopes are available mainly via transfer reactions [1, 3, 4], β-decays studies [1],coulomb excitation [2] and fission spectroscopy [5, 6]. In past few decades these nuclei have been tested in the framework of LSSM [7], IBA−I & II [3], particle-core coupling model[8] , general collective models [9]. But due to lack of experimental information, these theoretical models still have a debating aspects on their validity. So it is important to study and provide experimental information for neutron rich Te−isotopes.

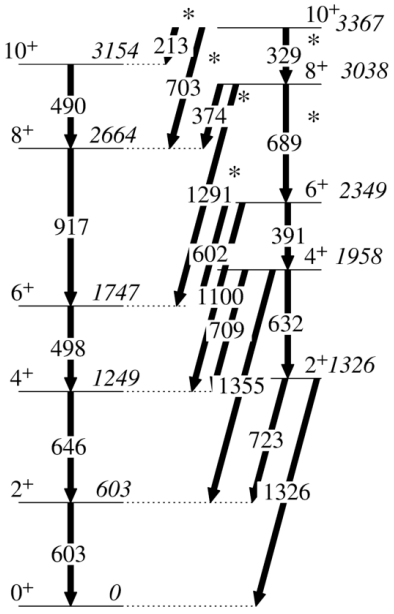

FIG. 1: Partial level scheme of ^{124}Te, established from present work

In the present work, an experimental investigation was carried out to study excited states of ^{124}Te via heavy ion fusion evaporation reaction. The major advantage of present heavy ion fusion evaporation reaction is availability

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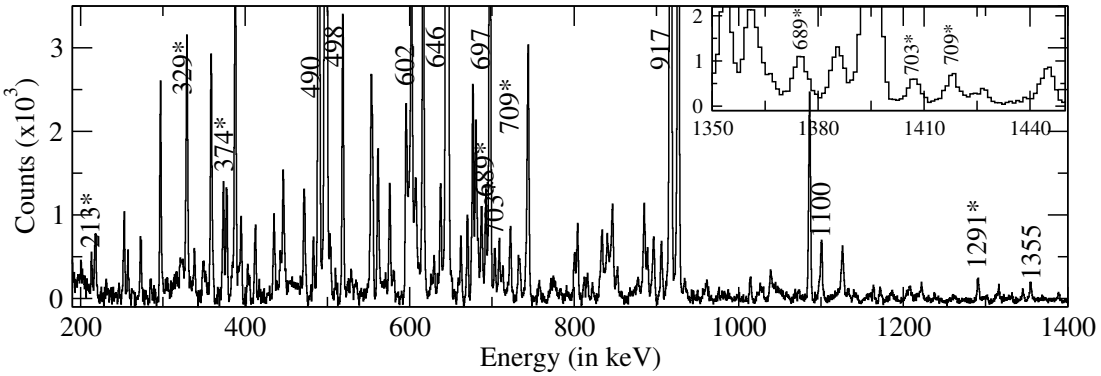

FIG. 2: 603 keV energy gated spectrum of ^{124}Te, asterisk (*) marked are new transitions.

sufficient statistics with high angular momentum. The present work is mainly focused on low lying multiplets of ^{124}Te, several mutliplets up to 10 $\hbar$ have been tentatively placed

Experimental Details

The excited states of ^{124}Te have been populated via ^{122}Sn(^{9}Be, α3n)^{124}Te fusion evaporation reaction, with 48 MeV beam energy. The experiment was performed on INGA array [12] with 15UD tandem accelerator facility [10, 11] at IUAC, New Delhi. The array contain 14 Compton suppressed Clover detectors. The data were recorded with two or higher fold coincidence relationship. Off-line data analysis has been carried out using the computer code INGA-sort [13].

Results and Discussion

The present analysis was carried out, on the basis of $\gamma-\gamma-$ coincidence measurements. Previously, several multiplets have been found in ^{124}Te up to 6 $\hbar$ [3]. In present study, two new mulyiplets for 8^+ (2664 keV and 3038 keV) and for 10^+ (3154 keV and 3367 keV), were observed. The spin and parity of these states were confirmed on the basis of results obtained from angular correlation measurements and polarization measurements of decaying $\gamma-$transitions, respectively. on the basis of systematics, these could be possible candidates for 4p$-$2h intruder staes, as such intruder states has been systematically observed in neighbouring even$-$even nuclei [3]. hence, it is essential to study these multiplets, to understand the structural behaviour of heavier Te$-$isotopes.

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References

[1] R Georgii et al, NPA **592**, 307-337, (1995)
[2] M Saxena et al, PRC **90**, 024316 (2014)
[3] N War et al, NPA **636**, 379-418 (1998)
[4] T von Egidy et al, PRC, **74**, 034319 (2006)
[5] A Astier et al, EPJA **50**, 2, (2014)
[6] N Fotiades et al, PRC **89**, 017303, (2014)
[7] A Banu et al, PRC **72**, 061305(R) (2005)
[8] M Grinberg et al, PRC **61**, 024317, (2000)
[9] Hess et al, ZPA **296**, 147 (1980)
[10] G K Mehta et al, NIM A **268** 334 (1988)
[11] D Kanjilal et al, NIM A **97** 97 (1993)
[12] S Muralithar et al, NIM A **281** 281 (2010)
[13] R K Bhowmik et al, DAE-SNP 44B **422** (2001)