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Decay Spectroscopy of ^{126}Xe

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The low-spin excited states in the non-yrast bands of Xe nuclei in A=120-130 mass zone exhibit excitations built on both rotational and vibrational degrees of freedom.The precise branching ratio measurements of the often weak transitions that connect these low-lying collective states and the determination of their $B(E2)$ values play an important role in characterization of the excited states with low and medium angular momenta. This information is also essential in determination of the extent to which a certain dynamical symmetry is preserved or broken in the chain of even mass xenon isotopes which lie below $N = 82$ closed shell and approach the mid-shell at $N = 66$ [1,2].

Of particular interest in this regard are the appearance of the low-energy excited 0^+ states in even mass $^{124-130}$Xe isotopes with a population cross section of approximately 30% to that of the ground state [5]. In ^{124}Xe the 0_2^+ and the 0_3^+ excited states have been investigated and their structure is interpreted as proton-pairing vibrational states but for other stable even-even Xe isotopes in the mass range $A = 126 - 130$ this information is scarce [5].

The excited states in ^{126}Xe have been studied in β^+/EC decay spectroscopy of ^{126}Cs using 8π γ-ray spectrometer located in ISAC-I facility at TRIUMF in the past. Currently there are 29 γ-transitions that are reported in the Nuclear Data Sheet only by their energy and are not placed in the level scheme. The high statistics ^{126}Xe β^+ decay experiment allowed careful examination of these transitions in order to place them in the level scheme and also the measurement of their corresponding branching ratios.
Some of the highlights of the $\gamma - \gamma$ coincidence and the angular correlation analyses presented here include:

- The direct observation of the 326 Kev ($2_5^+ \rightarrow 0_3^+$) in-band transition and determining the absolute $B(E2; 2_5^+ \rightarrow 0_3^+)$ value for the first time.
- Determining the multipolarity and the mixing ratios of transitions de-exciting the level energies at 2455 Kev, 2064 Kev and 1679 KeV in order to measure the $E2$ strength of mixed transitions which are previously reported as the upper limits only.

The results presented here are preliminary as the coincidence and correlation analyses are currently under progress to assure that all observed new transitions are placed in the level scheme correctly and hence the best precision is obtained for the measurement of branching ratios.

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