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Searching for Alpha-Cluster States in ^{126}Te

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Clustering in nuclei provides an alternative description to their nuclear structure in addition to the Nuclear Shell Model. Although alpha (^{4}He nucleus) clusters are widely accepted to be essential to the understanding of the structure of light nuclei, such as the Hoyle state in ^{12}C, it was experimentally observed in heavy nuclei only recently in ^{212}Po. The observation showed that ^{212}Po had mixed shell and cluster configurations, where the structure of ^{212}Po could be explained by an alpha cluster coupled to the doubly-magic ^{208}Pb core. In particular, the clustering structure resulted in enhanced $E1$ (electric dipole) transitions from non-natural parity states, which were measured using gamma-ray spectroscopy.

Another recent experiment at INFN Legnaro observed an excess cross section for the parasitic ^{122}Sn(^{13}C,^{9}Be)^{126}Te reaction. Because the fusion-evaporation cross section for this channel was negligible in PACE4 calculations, the ^{126}Te was likely populated through an alpha transfer reaction which suggests alpha-clustering in its structure. In this experiment gamma rays were detected with the GALILEO array which is composed of 25 Compton-suppressed HPGe detectors while charged particles with particle identification were detected in the EUCLIDES $E - \Delta E$ 4π Si-ball array. Gamma-ray spectroscopy with coincidence techniques, such as particle-particle, particle-gamma, and gamma-gamma, is underway to extract previously unobserved transitions and levels in ^{126}Te from this data set. Preliminary results from the Legnaro data, together with plans for a future experiment, will be presented and discussed.

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