

### 3 - 9 Discovery of the New Isotope $^{251}\text{Lr}$

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The products of the  $^{203,205}\text{Tl}(^{50}\text{Ti},2n)$  fusion-evaporation reactions were studied by using the recently commissioned Argonne Gas-Filled Analyzer (AGFA) at Argonne National Laboratory. Two  $\alpha$ -decay activities with energies of 9210(19) and 9246(19) keV and the half-lives of  $42_{-14}^{+42}$  ms and  $24.4_{-4.5}^{+7.0}$  ms were observed by which were followed by the known  $\alpha$  decays of  $^{247}\text{Md}$  and  $^{243}\text{Es}$ . They are interpreted as originating from the  $1/2^- [521]$  and  $7/2^- [514]$  single-proton Nilsson states in the hitherto unknown isotope  $^{251}\text{Lr}$ . From the measured  $Q_\alpha$  values the  $1/2^-$  level was placed 117(27) keV above the  $7/2^-$  level in  $^{251}\text{Lr}$  in contrast to  $^{255}\text{Lr}$  where the  $1/2^-$  level is the lowest. Also, the  $\alpha$  decay of  $^{253}\text{Lr}$  was studied in more detail and a new  $\alpha$  line at 8660(20) keV was found and a new half-life value of 2.46(32) s for an isomeric state in  $^{253}\text{Lr}$  was measured. The  $7/2^- - 1/2^-$  level order in  $^{251}\text{Lr}$  and  $^{255}\text{Lr}$  was reproduced successfully in the cranked shell model (CSM) with the pairing treated using the particle-number-conserving (PNC) method, shown in Fig. 1. These calculations underscored an important role of  $\varepsilon_6$  hexacontetrapole deformation in the evolution of the single-proton energies in  $^{251,253,255}\text{Lr}$ .

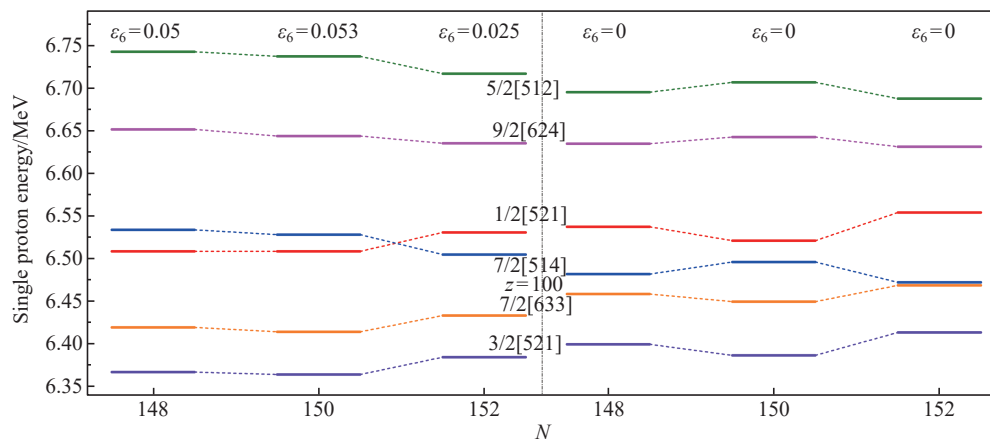


Fig. 1 (color online) Single-proton levels near the Fermi surface in  $^{251,253,255}\text{Lr}$  calculated using the particle-number-conserving cranked shell model. The  $\varepsilon_6$  values adopted in the calculation are indicated for each isotope.