

# Formation of deeply bound pionic atoms in the (d,<sup>3</sup>He) reaction

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Deeply bound pionic atoms have attracted much attention since they would provide valuable information on the behavior of “real” pions in the interior of the nucleus [1]. Deeply bound pionic states were found experimentally for the first time in (d,<sup>3</sup>He) reactions on <sup>208</sup>Pb [2] and the observed spectrum showed an excellent agreement with our calculation made before the experiment [3]. This agreement between theoretical results and data provides a strong confidence on the predictability of the theoretical model used. Hence, we can study the spectroscopies of deeply bound pionic states precisely using the same model.

In this paper we will report recent developments of the theoretical studies for the structure and formation of the deeply bound pionic atoms. Following subjects will be included.

(1) Formation reactions of the deepest and, thus, most interesting 1s pionic states in heavy and medium heavy nuclei [4]. Especially, the isotope shifts of the deeply bound 1s pionic states in Sn isotopes are considered [5].

(2) Deeply bound pionic atom formation in  $\beta$ -unstable nuclei with halo neutron state [6].

(3) Application of our direct reaction method to produce other mesons in nuclei in order to observe medium effects clearly [7].

## References

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