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Pionic fusion study of 3N clustering in the A=6 system

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In order to provide more data on the T=1 halo state of the six-nucleon system, in particular to investigate the importance of triton-triton and triton-3He clustering, we have made an experiment studying the ${}^3\text{He}({}^3\text{He}, {}^6\text{Li}^*)\pi^+$ reaction at CELSIUS storage ring in Uppsala.

The $J^{\pi}=0^+$, T=1 state at 3.56 MeV in ${}^6\text{Li}$ is believed to have a similar structure as its analogue state; the two-neutron halo ground state of ${}^6\text{He}$. The formation of the specific state of ${}^6\text{Li}$ in the pionic fusion of alpha particles and deuterium was studied previously [1], 1.2 and 1.9 MeV above threshold. The total cross section for the two energies was found to be 228^{+-6} (stat) nb and 141^{+-12} (stat) nb respectively.

We have measured the cross section for the ${}^3\text{He}({}^3\text{He}, {}^6\text{Li}^*)\pi^+$ reaction 1.2 and 1.9 MeV above threshold. The Coulomb corrected cross section is determined to be 183^{+-41} (stat) nb and 87^{+-54} (stat) nb, respectively, which is of the same order of magnitude as for the (d,4He) initial state [1]. This is an indication that 3N-3N clustering is indeed important for the description of the ground state of ${}^6\text{He}$ and its analogue state in ${}^6\text{Li}$ as pointed out by Arai Suzuki and Lovas [2].

Technical details of the experiment along with the results from the analysis will be presented.

References:

- [1] M.Andersson et al. Nuclear Physics, A 779 (2006) 47
- [2] K. Arai, Y. Suzuki, R.G. Lovas, Phys. Rev. C 59 (1999) 1432

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