Pionic Fusion Experiments at Subthreshold Energies

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In order to study the role of pions and clustering phenomena in nuclei, two pionic fusion experiments have been performed using the AGOR accelerator facility. Pionic fusion is a highly coherent process in which two nuclei fuse to a united nucleus and the available center-of-mass energy is emitted in the pion channel. The examined reactions were $^4He(^3He,\pi^0)^7Be$ and $^6Li(^4He,\pi^0)^{10}B$ at beam energies about 10 MeV above the coherent pion production threshold (256 MeV and 236.4 MeV, respectively) [1]. Since the available energy is well below the pion production threshold in an elementary nucleon-nucleon process, a highly coherent mechanism is needed. We identified the reaction by measuring the fused system in the magnetic spectrometer and the produced neutral pions in the Plastic Ball detection system [2] with large acceptance. Our experimental setup provided the exclusive cross sections by identifying all products in overdetermined kinematics. Here we present the preliminary results of the ongoing analysis for the $^6Li(^4He,\pi^0)^{10}B$ reaction. The angular distribution of neutral pions will be discussed. Model calculations [3] are in favor of clustering phenomena in nuclei.

[1] L. Joulaeizadeh et al., Pionic Fusion Experiments at Subthreshold Energies, AIP proceedings, Carpathian Summer School of Physics 2007, 475 (2008), ISBN 978-0-7354-0490-8.
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