^{6}Li +^{208}Pb Near Barrier Fusion Reaction

Y.W. Wu[1,] Z. H. Liu[1], C. J. Lin[1], H. Q. Zhang[1,2], F. Yang[1], M. Run[1], Z. C. Li[1], M. Trotta[3], and K. Hagino[4]

1 China Institute of Atomic Energy, Beijing 102413, China

2 Institute of Physics, Peking University, 100871 Beijing, China

3 INFN- Laboratori Nazionali di Legnaro, 35020 Legnaro (PD), Italy

4 Institute for Theoretical Physics, Kyoto University, Kyoto 606-8502, Japan

^{6}Li + ^{208}Pb near barrier fusion excitation function has been measured by means of the evaporation residue method with α radiation detection. The experiments were carried out at the HI-13 tandem accelerator of China Institute of Atomic Energy, Beijing. The ^{208}Pb targets were bombarded by the collimated beam of ^{6}Li with incident energies varied from 25.75 to 39.06 MeV in 0.58 MeV energy steps. The targets were about 350 μg/cm^2 in thickness, evaporated onto copper foils which were thick enough to stop completely the recoiling heavy residues. Two sets of ΔE-E silicon detector telescope located at mean angles of +- 160^{o} with respect to the beam direction to measure the α particles emitted by the evaporation residues. A new target was used for each beam energy. The irradiated target removed from the target frame was put into another vacuum chamber and set close to a silicon detector to detect a particles emitted by the long-lived evaporation residues in off-beam measurements. The compound nucleus ^{214}At formed following complete fusion of ^{6}Li with ^{208}Pb de-excites dominantly by 2n,3n,4n evaporations and results in a series of residual isotopes ^{212}At, ^{211}At, and ^{210}At. The proton evaporation residues were not observed. The absolute cross section normalization was deduced from ^{6}Li Rutherfold scattering on ^{208}Pb. Then the complete fusion cross sections can be obtained by sum of those of the evaporation residues ^{212}At, ^{211}At, and ^{210}At. The fusion cross sections have been calculated in terms of the coupled-channels model with CCFULL code taking into accounts one double-phonon state 3^{-} of ^{208}Pb and the 3^{+} rotational excitation of ^{6}Li by comparing the experimental results with the theoretical calculations and with the fusion cross sections of ^{16}O + ^{208}Pb have been suppressed at the energies above the barrier due to the effect of ^{6}Li breakup, but below the barrier, the effects of breakup are not clear.

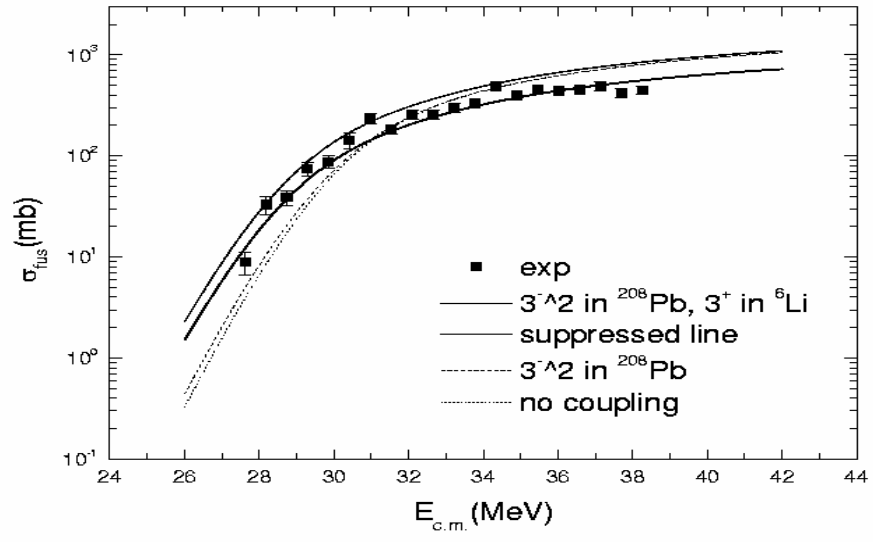

Fig. Total fusion cross sections for ^{6}Li + ^{208}Pb