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Production of ^{212}Po by alpha transfer

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^{212}Po has been studied since 1916 and there have been numerous attempts to give a microscopic description of its structure, but with only 4 nucleons more than the doubly-magic ^{208}Pb nucleus, the ^{212}Po structure is still not well understood. Since the use of shell-model configurations failed to reproduce the large alpha-decay rate of the ground state, it has been completed by an alpha-cluster model^{2,3}.

During the Euroball campaign, strong gamma lines have been identified in ^{212}Po , leading to the discovery of several states with non-natural parities. Their very large $B(E1)$ revealed strong dipolar momenta, which can only be explained, until now, by a high alpha-clustering with a vibration of the distance between the α -cluster and the ^{208}Pb core^[2]. This very unique situation brought several questions, related to both the origin and the properties of this phenomenon. Among them, the mechanism of alpha-transfer leading to this nucleus and feeding the cluster states needs more investigations.

At high excitation energy ^{16}O and ^{18}O both present alpha-clustering, the corresponding states forming rotational bands. In the particular case of ^{18}O which is not self-conjugate, a strong electric dipolar momentum is associated with such α -core configurations. This led us to study the influence the dipole excitation of the projectile for the population of the ^{212}Po cluster states, in an experiment aiming to compare the ^{212}Po production from ^{16}O ($N=Z$) and ^{18}O ($N\neq Z$) alpha transfer reactions.

Last year, ^{212}Po has also been studied in inverse kinematic (^{208}Pb beam on ^{12}C target) at GANIL to measure the lifetimes of these levels. A silicon detector registered the alpha-particles from the break-up of the ejected ^8Be residues. Even if this experiment was not dedicated to study the reaction mechanism, we extracted the relevant information to prepare an experiment which will take place next Autumn.

[1] E. Rutherford, A.B. Wood, Philos. Mag. 31, 379 (1916)

[2] A. Astier et al. Eur. Phys. J. A 46, 165–185 (2010)

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