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Production of 212Polonium by alpha transfer

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212Po has been studied since 19161 and there have been numerous attempts to give a microscopic description of its structure, but with only 4 nucleons more than the doubly-magic 208Pb nucleus, the 212Po 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 model2,3.
During the Euroball campaign, strong gamma lines have been identified in 212Po, 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 208Pb 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 16O and 18O both present alpha-clustering, the corresponding states forming rotational bands. In the particular case of 18O 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 212Po cluster states, in an experiment aiming to compare the 212Po production from 16O (N=Z) and 18O (N≠Z) alpha transfer reactions.
Last year, 212Po has also been studied in inverse kinematic (208Pb beam on 12C 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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