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Search for double alpha decay

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Alpha decay is known for more than a century, however a global microscopic description of this process has only been successfully developed recently by Mercier et al. [1]. Within the framework of covariant energy density functional, using a least action principle, the half-life of medium and heavy nuclei are in agreement within one order of magnitude with experimental value [2].

Moreover, a new type of decay was predicted : the double alpha decay, where two alpha particles are emitted simultaneously with a large relative angle. Their typical branching ratio (BR) of $\sim 10^{-7}$ with respect to the single alpha decay, makes it experimentally accessible, these values of BR being those of well-known cluster decays already detected.

A dedicated experiment was held at Isolde in June 2023. A radioactive beam of $^{220-222}\text{Ra}$ has been used to probe for possible double alpha decay of $^{220-222}\text{Ra}$ as well as $^{216-218}\text{Rn}$. The setup consisted in 4 DSSD, which allows to make accurate spatial (and temporal) coincidences and therefore to drastically reduce the background due to single alpha decays. Preliminary results on this hunt will be shown.

[1] Mercier et al., PRL 127,012501 (2021)

[2] J. Zhao et al., PRC 107, 034311 (2023)

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