α, cluster and 2α decays with covariant energy density functional method

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The use of Energy Density Functional (EDF) method within a relativistic framework showed, this last decades, that it can both describe the bulk properties of nuclei (radii, ground state energy, binding energy, ...)[1] as well as clusters formation[2]. The study of cluster structures allow for many applications ranging from α or cluster decay to fission or many different kinds of excitations.

During the last decades, cluster decay and fission have been extensively studied within EDF framework[3] leading to both qualitative and quantitative results in agreement with experiments. Still, α radioactivity had yet to be described within this framework. Last year, its description has been achieved using covariant EDF in mid-mass nuclei ^{108}Xe and ^{104}Te [4] opening the possibility to obtain a unified description of the different radioactivity processes. More recently, the joint description of both α and cluster decays has been performed leading to a more global description of radioactivity processes in a single framework.

These studies also lead to the prediction of a new kind of radioactivity process involving not one but two α particles emitted in opposite directions[5]. The lifetimes associated with this decay mode have been computed for two different nuclei and appear to be of the same order of magnitude than the one of cluster decays that have already been experimentally observed. Hence, if it turns out that this mode exists, it would theoretically be possible to detect it with current technologies.

References

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