

Referee Report to the 51st Nuclear Physics P.A.C. on the Project

“Prospects for Study of Multinucleon Transfer Reactions”

Multinucleon transfer (MNT) has emerged recently as the only possible mean to produce neutron rich nuclei in the Terra Incognita and in the region of transactinide nuclei. At several laboratories, there are currently upcoming programs to study such reactions.

I consider extremely positive for the FLNR and the JINR the proposal of starting a new project on this theme. Even though there are already many articles claiming the production of several neutron-rich nuclei, especially in the Terra incognita at shell closure around $N=126$, it is still not clear what are the details of the mechanism of the nucleon transfer at the energy around the Coulomb barrier. Several theoretical approaches have indeed highlighted some of the MNT features. Nevertheless, the choice of an optimal reaction to produce a specific neutron-rich nuclide is still an unsettled task.

From the experimental point of view, the proposed project is challenging because it has to face production cross sections of the order of microbarn or less, angular distributions usually side-peaked, and problematic identification of the fragments atomic number given the low energy of the products. Added to this is the fact that the excitation energy of the products make them quickly loose neutrons because of the low separation energy in such targeted exotic species. The choice of optimal reactions is therefore a critical task. The availability of a dedicated new facility, with innovative fragment identification methods, would decisively serve also the purpose of exploring a relatively large selection of reactions, given also the upgrade of the U400, and therefore contributing to enlighten the knowledge of such mechanism.

In conclusion, I recommend JINR and FLNR directorate to fully support the research program as proposed with first priority.

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