Experimental and theoretical problems around actinides for future reactors.

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I. SCIENTIFIC ISSUE

Since the two last decades, in the framework of general researches on future reactors, strong efforts have been devoted to improve the quantity and quality of nuclear data. Indeed, in order to improve safety margins and fuel optimization, but also to develop new kind of reactors or fuel cycles, accurate nuclear data are mandatory. At the end of the twentieth century, nuclear data bases did not reach the required quality level to be used in future reactor simulations [1]. Therefore, both experimentalists and theoreticians, in the framework of several European research programs (HINDAS, NUDATRA, ANDES, CHANDA...), have tried to make the situation better. New sets of precise data measurements concerning fission, capture, (n,xn), ..., reaction cross sections for a large variety of nuclei [2] have been initiated. From evaluation point of view, the JEFF project has also improved the quality of nuclear data bases for several nuclei [3]. In parallel, on the theoretical side, progress has also been made concerning cross section modeling in a wide range of energy (eV to GeV). The goal was to provide theoretical models with a good predictive power to feed data bases where experimental data are still missing and where the measurement is too complex. In this context, for example, a new nuclear reaction code TALYS [4] has been developed. Collaboration between experimentalists, theoreticians and evaluators are then of strong interest to make progress.

The number of problems to be solved covers various fields of nuclear reactions such as fission, capture or inelastic scattering. In order to avoid too large an audience we have decided, as a first step, to focus on inelastic scattering on actinides. Experimentally, three main methods exist to measure the total inelastic cross section: activation, detection of the emitted neutrons and prompt-gamma spectroscopy. This last method is, nevertheless, dependent on theoretical models since it provides (n,xn γ) cross sections and not the total inelastic cross sections. As it is impossible to observe experimentally all the γ transitions, model predictions are required to provide missing information. Few years ago, a collaboration between experimentalists and theoreticians has been engaged on actinides studies. It has recently led to a joint publication [5] in which it was shown that specific theoretical work is needed to obtain better agreement between code predictions and measured cross sections.

New sets of experimental data are now available [5–7] and provide new severe constraints. Deeper theoretical studies could thus start. The first results have emphasized that improvements of the knowledge of nuclei structure parameters are required. Studies on reaction mechanism models have also shown that more realistic model, based on a microscopic description of the target's spectrum, could be used to noticeably improve the quality of the predictions [8].

For actinides, as measurements could be very difficult or even impossible to implement due to target activity it would be very useful to have a nuclear reaction code with a real predictive power and in which we could have confidence.

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II. GOALS OF THE PROJECT

In summary, the goals of the project are

1. to gather theoreticians, evaluators and experimentalists who are working in the inelastic scattering on actinides field.
2. to present the last results concerning (n,xn) and (n,xn γ) measurements performed on actinides.
3. to present the last theoretical developments.
4. to compare experimental and theoretical results.
5. to discuss and highlight which are the possible improvements concerning theoretical models as well as new measurements.
6. to discuss other issues related to experimental and theoretical studies around actinides.

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