Challenges in Nuclear Data Evaluations of Light Nuclear Systems

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Abstract: Reactions of light nuclear systems play an important role in the development of nuclear technologies and design of nuclear facilities, but also in various fields of science e.g. in nuclear astrophysics, medicine, materials science, space science etc. Therefore a good knowledge of the relevant reaction cross sections on the basis of reliable and consistent nuclear data evaluations are required. At present the situation of evaluated nuclear data files for light nuclear systems is not fully satisfactory. There are several difficulties in the evaluation of reaction data of light nuclear systems, e.g. the extended resonance range up to high energies, the lack of quantitative microscopic models, the occurrence of dominant breakup channels and open questions concerning uncertainty information. Usually R-matrix theory is applied to describe the resonance range. Albeit non microscopic, R-matrix theory satisfies the conservation rules and yields a consistent and quantitatively reliable set of reaction cross sections. However, R-matrix theory is limited to two-body channels. The description of breakup channels is frequently given within a perturbative approach, whose applicability to a dominant channel is questionable. Another problem represents the determination of reliable uncertainty information from R-matrix analyses. In this contribution various challenges of nuclear data evaluations of light nuclear systems are addressed and possible solutions are discussed. Especially, we will consider at the example of specific light nuclear systems the treatment of dominant breakup channels within an R-matrix analysis, the extension of R-matrix analyses to higher energies and a suggestion for the generation of uncertainty information associated with R-matrix analyses.