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Isotopenforschung und **Kernphysik**

E I N L A D U N G

zum

V E R A - S E M I N A R

von

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Complete Monte Carlo Simulation of Neutron Scattering Experiments

The majority of experiments investigating the elastic scattering of fast neutrons were done some 30 years ago. At that time it was not possible to obtain valid corrections for the finite geometry and the finite sample size of the experimental set up, not even having the main frame computers of the Los Alamos National Laboratory at one's disposal. The reason was not only the limited calculation capacity of those ancient computers but also, to an even higher degree, the lack of powerful Monte Carlo codes and the very limited data base for the isotope in question. The computing power of a present day PC is about ten thousand times that of a super computer of the1970ies. Moreover, most PCs are idle over-night so that using a powerful Monte Carlo program, like MCNPX from Los Alamos, corrections of important scattering experiments can be determined reliably at practically no computer cost.

Surely one of the most important experiments is neutron scattering from liquid helium-3, especially considering the expensive and complicated cryogenic target. A complete documentation of such an experiment as performed in the year 1971 at the Los Alamos National Laboratory is available. Therefore it is now possible to perform a thorough simulation of the experiment: starting from the production of mono-energetic neutrons in a gas target, followed by the interaction in the ambient air, and the interaction with the cryostat structure, and finally the scattering medium itself. Another simulation deals with the scattering from hydrogen as a reference measurement. As two thirds of all available differential scattering cross sections of that reaction depend on these measurements the newly arrived at corrections prove to be highly significant because they are smaller by a factor of five! Moreover, it was necessary to simulate another experiment on this reaction, using a white neutron source. This way it was possible to convert the corresponding relative yield excitation functions to absolute differential cross sections. I will describe both experiments and their simulation and discuss the impact of the improved cross sections on the data base.

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