

Final Report

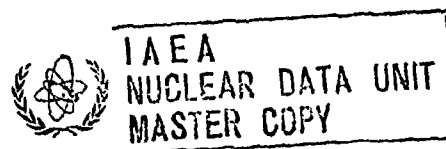
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PROGRESS REPORT TO EANDC
FROM NORWAY, JANUARY 1967

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PROGRESS REPORT TO EANDC
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1. The Planned Liquid Hydrogen Moderator at the Kjeller Research Center.
K. Otnes.

Liquid hydrogen is very suitable as a moderator for obtaining high fluxes of low energy neutrons (subthermal neutrons). As known the thermalization rate and the final energy distribution of the neutrons is determined mainly by the double differential cross section for the scattering of neutrons by the moderator atoms or molecules. A knowledge of this cross section is thus of great importance in predicting the energy distribution of the neutrons emerging from such a moderator.

In calculating the cross section for neutron energies below 1 eV it is necessary to take into account all degrees of freedom associated with the motion of the moderator molecules. Koppel and Young (ref. 1) have calculated the double differential scattering cross section for gaseous para- and ortho-hydrogen. In those calculations the effect of the spin correlation, molecular translations and rotations, as well as intra molecular vibrations are taken into account in a correct way to the extent that the vibrations are harmonic and the vibration-rotation coupling can be neglected. This model should also be applicable to liquid hydrogen when the incident neutron energy is larger than 0.002 eV.

At Brookhaven National Laboratory, Otnes, Mellor and Palevsky, using the slow chopper time-of-flight spectrometer, measured the spectra of scattered incident cold neutrons (~ 0.005 eV) from gaseous hydrogen to check the formulas given by Young and Koppel. These measurements were carried out for two scattering angles, 35° and 90° , and for two temperatures of the gas, 297° K and 80° K. It should be pointed out, however, that no attempt was made to measure the double differential scattering cross section absolutely. Only the shape of the theoretical and experimental spectra could thus be compared. The results showed that there is a good agreement between theory and experiment.

A liquid hydrogen moderator is under construction at Kjeller Research Establishment. The moderator will be placed in the tangential beam hole at JEEP II and should be in operation in January 1968. Calculations of the spectra of the outgoing neutrons from the moderator is going on using the formulas of Koppel and Young in the derivation of the scattering kernel. The purpose of these calculations is to make it possible to determine which shape and size of the moderator chamber will give max. outgoing neutron flux.

2. Angular Correlation of Fission Fragments and Prompt Gamma Rays from Slow Neutron Fission of ^{235}U .*)

K. Skarsvåg.

The angular correlation of fission fragments and prompt γ rays in slow neutron fission of ^{235}U has been measured for forward and backward angles for γ ray energies greater than 300 keV. The measurements have been performed with a target on a thick backing and for two geometries, i.e. with the semiconductor detector and the NaI(Tl) scintillation detector on opposite sides of the backing and with the detectors on the same side of the backing. The analysis shows confirmation of the features observed in spontaneous fission of ^{255}Cf (ref. 2).

A paper on the subject is submitted for publication in Nuclear Physics. The work should not be released prior to publication.

*) Work sponsored jointly by Institutt for Atomenergi, Norway, and Reactor Centrum Nederland, the Netherlands.

3. References

Ref. 1 Koppel and Young, Phys.Rev. 135 A 603 (1964)

Ref. 2 Skarsvåg and Singstad, Nuclear Physics 62 (1965) 103