A STUDY OF NEUTRON THERMALISATION IN VARIOUS MODERATORS

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PREFACE

The present thesis is a study of neutron thermalisation in some moderators. The important techniques which exist in thermalisation experiments have been studied theoretically to analyse the experimental data. The whole thesis is divided into five chapters.

In Chapter I, we start by giving a brief introduction to the subject of "neutron thermalisation" and give an outline of the work presented in the following chapters.

In Chapter II, we discuss the results of our calculation of the fundamental mode eigen value and the corresponding eigen function of the one velocity transport operator and the effects of anisotropy in the scattering in such calculations. Some of the results of this chapter have been reported in the following two papers:

(1) "On the calculation of the fundamental mode of the one velocity neutron transport operator", Canadian Journal of Physics, 45, 3793 (1967).

(2) "On the fundamental mode decay constant for spherical assembly (one velocity considerations)", Canadian Journal of Physics, 46, 318 (1968).

In Chapter III, we consider the multivelocity case and discuss the results of a series of calculations on neutron thermalisation in graphite. Slowing down spectrum, effective neutron temperature, reaction ratio, steady state spectra, slowing down time and the mean time have been calculated. Most of the results of this chapter are published in the following paper:

> "Some calculations on thermalisation of neutrons in graphite", Journal of Nuclear Energy, Pts. A/B, 22 (1968).

In Chapter IV, we have calculated non-1/v thermalisation parameters in water using cadmium, gadolinium and samarium as typical non-1/v absorbers. The results of this chapter are published in the following paper:

> "Non-1/v thermalisation parameters in water", Journal of Nuclear Energy, Pts. A/B, 22, 517 (1968).

In order to compare the results of this chapter with the recent experiment of Larsson and Moller (1968), which was published after the publication of our work, some extra calculations have been performed and incorporated in this chapter.

In Chapter V, we consider the neutron wave propagation in graphite. Fundamental eigen values have been calculated by numerically solving the transport equation. The effect of chemical binding, group structure and the effect of the P_1 component of the scattering cross-section have been studied. The following paper will soon be communicated for publication:

> "Neutron wave propagation in graphite".

In Appendix I, we consider the diffusion length problem. Assuming a separable kernel, some calculations of the diffusion length for a 1/v absorber have been performed and the results have been compared with previous calculations.

In Appendix II, we give the method of numerically soving the one velocity Boltzmann transport equation in the isotropic scattering approximation. In Appendix III, we tabulate the velocity mesh used in various multigroup calculation Appendix IV deals with the values of microscopic absorption cross-sections for non-1/v absorbers, cadmium, gadolinium and samarium. In Appendix V, we have outlined the method of solution of a system of coupled integral equations.

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