STUDIES OF FAST NEUTRON INELASTIC SCATTERING TO VIBRATIONAL STATES OF THE
ACTINIDE NUCLEI ^{232}Th AND ^{238}U BY THE LOWELL GROUP (EXPERIMENTAL AND THEORETICAL)*

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ABSTRACT: A survey is presented of the Lowell group's latest experimental and theoretical results for the inelastic scattering of fast neutrons to vibrational states of the deformed actinide nuclei ^{232}Th and ^{238}U . Excitation functions are shown from 0.8 to 2.5 MeV; angular distributions have been determined at 1.2 MeV and 1.5 MeV. The theoretical curves have been calculated using the "standard" (CN + DI) and "unified" (statistical S-matrix) formalisms. Generally good agreement has been found to prevail between experimental and theoretical data.

1. INTRODUCTION

As elastic and inelastic scattering of fast neutrons crucially influences the slowing-down rate and neutron flux characteristics in nuclear reactors, an accurate detailed knowledge of the variation of the major level cross sections with energy and angle for scattering of neutrons on fertile even-A actinide nuclei (Th/U) is essential for the efficient design and operation of power (breeder) reactors. Particularly over the past decade, intensive effort has been devoted by several of the leading neutron research groups to the determination of high-precision, reliable elastic and inelastic cross-section data, with the main emphasis to scattering to the members of the ground-state rotational group. The findings have been presented at the Kiev Conferences and at numerous other recent conferences and meetings [1-12], as well as in reports and publications [13-25]. Although the data for the lower-lying rotational states are now well established, they remain sparse and not sufficiently accurate for the higher-lying quadrupole and octupole vibrational states above an excitation energy of about $E^* \approx 0.7$ MeV, where the level spacing becomes narrow and the level schemes evince a complicated collective vibrational-band structure. To supplement its investigations of the rotational levels [17, 25-28], the Lowell group has recently concentrated its efforts upon studies of the vibrational levels, and in particular has not only extended its results for level excitation functions but has obtained preliminary results for angular distributions. These data have been analysed with theoretical computations using the "unified" [24, 25, 29, 30] and "standard" [23] formalisms in the computer codes "NANCY", "CINDY" and "KARJUP" [31-33]. This paper reviews these latest findings and points to future investigations now in preparation.

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