Neutron Cross Sections Measurements at ORELA for Improved Nuclear Data and their Application

K.H. Guber, L.C. Leal, R.O. Sayer, P.E. Koehler, T.E. Valentine, H. Derrien, and J.A. Harvey

Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN 37831-6354, USA

The Oak Ridge Electron Linear Accelerator (ORELA) has been used to measure the neutron total, fission and capture cross sections of several elements in the energy range from 100 eV to ~600 keV. ORELA is the only high power white neutron source with excellent time resolution and ideally suited for these experiments still operating in the USA. These measurements were carried out in order to support the Nuclear Criticality Predictability Program. Concerns about the use of existing cross-section data in the Nuclear Criticality calculations using Monte Carlo codes and benchmarks have been a prime motivator for the new cross section measurements. In the data libraries such as ENDF/B-VI or JENDL-3.2 most of the older neutron-induced cross section data show deficiencies or do not cover the neutron energy range which currently is important for a wide variety of applications. Many of the older measurements suffer from poor time-of-flight resolution, and because of computer storage limitations the description of some data in the neutron energy range above several tens of keV is crude. In many cases the number of data points may not describe the resonances accurately enough in order to apply certain corrections, such as self-shielding, multiple-scattering or Doppler broadening of individual resonances. This impacts not only the resolved cross section region but also the unresolved region, and could lead to problems in the correct processing of data from data libraries, and eventually also to erroneous Maxwellian average cross sections. In addition to that, many neutron capture cross sections data are in question, because many of the older measurements underestimated the neutron sensitivity of the experimental set up.

More accurate nuclear data are needed not only for benchmark calculations but also for input parameters for *s*-process stellar models. In this paper the facility and experimental setup at ORELA will be described. The impact of the new data will be discussed as well as the implication for criticality calculations involving the combination of ^{235}U and several other materials.

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