Recent Refurbishment of the Oak Ridge Electron Linear Accelerator Neutron Source

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For almost 40 years the Oak Ridge Electron Linear Accelerator (ORELA) at Oak Ridge National Laboratory (ORNL) has been operational and has provided high-resolution neutron cross-section data for many isotopes in the energy range from thermal up to 40 MeV. ORELA is a four-section radiofrequency linear accelerator with a water-cooled tantalum target to generate short neutron pulses of 2-30 ns with a repetition rate of less than 1000 Hz. The combination of short neutron pulses and long flight path leads to an excellent time-of-flight resolution. The electron beam energy can range up to 180 MeV and yield a neutron production rate of up to 10^{14} n/s at 50 kW of beam power. We report on recent refurbishment activities that include improvements to the accelerator vacuum, klystrons, improved electron gun design, and other upgrades. The current ORELA program is focused on high-resolution neutron cross-section measurements for the Nuclear Criticality Safety Program for isotopes for which deficiencies in the old data were identified. Additionally neutron-cross section measurements for nuclear astrophysics are performed to support studies of the heavy element synthesis in Asymptotic Giant Branch stars. Detection and data analysis capabilities have been developed for making highly accurate measurements of neutron capture, neutron total, and (n,α) cross sections simultaneously on different beam lines.

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