Single-Level Resonance Parameters Fit Nuclear Cross-Sections

For the first time, least-squares analyses of experimental differential cross-section data for the nucleus U\(^{235}\) have yielded single-level Breit-Wigner resonance parameters that fit, simultaneously, three nuclear cross-sections — capture, fission, and total. Previous measured values of the parameters yielded derived cross-sections that agreed at best with only one or two of the three measured cross-sections.

The resonance-capture and fission integrals calculated from the resonance parameters obtained for neutron energies of less than 63 eV agree within 3% with the corresponding direct numerical integration of the cross-section data. Earlier simultaneous measurements of the fission and capture cross-sections for U\(^{235}\) (ref. 1) were used in the analyses, resolving the discrepancy between measured and calculated values of the quantity \(\alpha\) (\(\alpha =\) ratio of capture-resonance integral to fission-resonance integral).

Two sets of resonance parameters have been derived. They differ only in that unit weighting was used in one analyses, while weighting inversely proportional to the cross-section was used in the other. In addition, the effects of fitting only two of the three nuclear cross-sections — total and fission, and capture and fission — were studied.

Two multigroup cross-section libraries for the reaction (neutron + U\(^{235}\)) have been generated. Each library treats a different section of the energy range to which the two sets of resonance parameters were applied. The value, 0.51, calculated for the ratio \(\alpha\) for either library agrees with the accepted value, 0.50 ± 0.02, derived from reactor integral measurements.

The two sets of resonance parameters and the cross-section libraries should be useful in reactor calculations for any nuclear reactor fueled with U\(^{235}\).

Reference:

Note:
Requests for further information may be directed to:
Technology Utilization Officer
AEC-NASA Space Nuclear Propulsion Office
U.S. Atomic Energy Commission
Washington, D.C. 20545
Reference: B70-10686

Patent status:
No patent action is contemplated by the AEC or NASA.

Source: G. Gibson, D. W. Drawbaugh, M. Miller, and S. L. Page of Westinghouse Astronautical Laboratory under contract to Space Nuclear Propulsion Office (NUC-10101)