Computer Code Abstract

MAXWEL

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1. Program Identification: MAXWEL is a general-purpose, relativistic photon-Maxwellian electron[1-3] cross-section (total and differential) processor for transport applications, cross section, and scattering analysis.

2. Function: MAXWEL computes total and differential photon-electron cross sections by numerically integrating a Lorentz invariant kernel[1] folded over a relativistic Maxwellian electron background.[4] An exact phase space (energy-momentum) integral is evaluated. MAXWEL furnishes effective cross sections (in barns) amenable to further multigroup or Monte Carlo applications and processing. Various limiting and asymptotic expansions are also computed and exhibited for comparison purposes.[2]

3. Method of Solution: A seven-point adaptive Newton-Cotes algorithm[5] performs the various three- or four-dimensional nested numerical integrations required to evaluate requisite scattering kernels. The field theoretic scattering kernel is a Lorentz invariant expression[1-3] that recovers the Klein-Nishina,[6] Thomson,[7] and Bjorken and Drell[8] limits while folded over the normalized relativistic Maxwellian electron distribution.[4] Input consists of the incident photon energy (in kilo-electron-volts), the electron temperature (in kilo-electron-volts), and the desired differential cross-section evaluation points. Output consists of total and differential cross-section predictions.

4. Restrictions: There are virtually no restrictions on the code. MAXWEL carries the adaptive integration modules as internal subroutines. Execution diagnostics are generated with convergence problems. Fixed range and convergence parameters are easily reset in the module.

5. Computer: Cray-1 or CDC 7600.

6. Running Time: Total and corresponding differential cross-section computations (ten points) require under 35 s of Cray-1 time, while similar computations on the CDC 7600 require ~120 s per incident photon energy and electron temperature.

7. Programming Languages: MAXWEL is written in FORTRAN-IV. Machine- and installation-independent coding format is also employed. MAXWEL is terminal interactive.

8. Operating System: The Cray-1 version of MAXWEL operates under the CTSS system with CFT compiler; the CDC 7600 version runs under LTSS with FTN compiler.

9. Machine Requirements: No special machine features are required. MAXWEL consists of ~900 lines of code with a few low-order arrays (dimension 20).

10. Material Available: Source code, test problems, documentation,[9] and results are available from the authors, as well as pertinent reprints.

11. Acknowledgment: This work was supported by the U.S. Department of Energy.

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