Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Mean Excitation Energy for the Stopping Power of Silicon from Oscillator-Strength Spectra[1] MITIO INOKUTI, Argonne National Laboratory, WILLIAM KARSTENS, Saint Michael's College, E. SHILES, Univ. of Vermont, DAVID Y. SMITH, Univ. of Vermont and Argonne National Laboratory — The mean excitation energy, I, is the sole nontrivial property of matter appearing in Bethe's expression for the stopping power for a charged particle at high speed. When the dipole oscillator-strength spectrum, $\mathrm{d}f/\mathrm{d}E$, is fully known as a function of excitation energy, E, the I value may be evaluated from $\ln(I) = \int \ln(E)\,(\mathrm{d}f/\mathrm{d}E)\,\mathrm{d}E \,/\, \int (\mathrm{d}f/\mathrm{d}E)\,\mathrm{d}E$. Following up work on metallic aluminum, we are analyzing experimental data for the dielectric response of crystalline silicon using Kramers-Kronig dispersion relations and sum rules. The experimental data include absorption, refraction, reflection, and EELS. For silicon, the best set of data in our current judgment gives $I = 163.5 \pm 2$ eV, where the uncertainty arises from using different but apparently equally reliable data and from numerical procedures. Our result is appreciably lower than the standard value, 173 ± 3 eV. It is noteworthy that our result for silicon is remarkably close to that for aluminum, both in the I value and in the contributions to it from each electron shell (when scaled for electron occupation and shell-edge energy).

[1] Supported by US Department of Energy, Office of Science, Office of Nuclear Physics under contract W-31-109-Eng-38, and Materials Science Division under contract No. DE-FG02-02ER45964.

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Date submitted: 11 Dec 2004 Electronic form version 1.4