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Modified Moliere's Screening Parameter and its Impact on Multiple Coulomb Scattering and Radiation Damage

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The Moliere approximation of elastic Coulomb scattering cross sections plays an important role in accurate description of multiple scattering, non-ionization energy, DPA radiation damage etc. The cross section depends only on a single parameter that describes the atomic screening. Moliere calculated the screening angle for the Tomas-Fermi distribution of electrons in atoms. In this paper, the screening parameter was recalculated using a more accurate atomic form-factor obtained from the self-consistent Dirac-Hartree-Fock-Slater computations. For relativistic particles, the new screening angle can differ from the Moliere approximation by up to 50%. At the same time it is rather close to other independent calculations. At low energies, the new screening angle is different for positrons and electrons. The positron screening parameter is about five times larger than the electron one for heavy nuclei at energies of ~Z keV. A simple parameterization of the updated atomic screening parameters is proposed. Its impact on particle transport and calculated quantities is discussed.

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