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Truncated Coulomb potential for planar channeling

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It is shown that if the screening function of an atomic potential may be described within the Thomas-Fermi approximation, the corresponding continuous potential for planar channeling to a good accuracy reduces to a truncated Coulomb potential. The sum of two displaced Coulomb potentials also accurately approximates thermal continuous potentials for (110) Si, Ge, W and (111) Ge oriented crystals not too close to atomic planes. Such a possibility can be used to simplify description of channeled and quasichanneled particle motions. For illustration, we derive closed-form expressions for classical particle channeling periods, quantum energy levels, and the tunneling probability for a negatively charged particle in the field of a single atomic plane. Simple scaling laws in dependencies of those quantities on the atomic number Z arise in this case.

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