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Coupled-channel calculations for transfer at high energies; The Thomas double-scattering mechanism; Relativistic collisions; Relativistic kinematics and fields of moving charges; The Lorentz transformation; Transformation between a moving frame and the laboratory frame; Transformation of differential cross sections; Relativistic motion of interacting point charges; Lienard-Wiechert potentials
The equivalent-photon methodRelativistic electron motion; The Dirac equation for a central potential; Bound states in a Coulomb potential; Coulomb-Dirac continuum wavefunctions; Relativistic ion-atom collisions: General theory; Dirac equation for moving Coulomb potentials; Perturbative transition amplitudes; Two-center coupled-channel methods; Asymptotic solutions; Basis states satisfying Coulomb boundary conditions; Numerical solutions on a lattice in position space; Numerical solutions on a lattice in momentum space; Direct reactions: Excitation and ionization
First-order perturbation theoryLong-range couplings in perturbation theory; Two-center coupled-channel methods; Calculations on a lattice; Relativistic electron transfer; The cross section in first order; The relativistic eikonal approximation; Two-center coupled-channel methods; Theoretical and experimental cross sections; Frame- and basis-set dependence; Radiative electron capture (REC); The impulse approximation; Some basics: Born approximation for K-shell photoionization and REC; The Stobbe formula for K-shell photoionization and REC; Exact relativistic calculations
REC cross sections from exact calculations

Sommario/riassunto

Atomic collisions offer some unique opportunities to study atomic structure and reaction mechanisms in experiment and theory, especially for projectiles of high atomic number provided by modern accelerators. The book is meant as an introduction into the field and provides some basic theoretical understanding of the atomic processes occurring when a projectile hits another atom. It also furnishes the tools for a mathematical description, however, without going deeper into the technical details, which can be found in the literature given. With this aim, the focus is on reactions, in which only