PRACTICAL AND EFFICIENT DERIVATIONS OF MOLIÈRE ANGULAR DISTRIBUTION WITH IONIZATION

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Molière theory of multiple Coulomb scattering is reconstructed by Kamata-Nishimura formulation. The new formulation is equivalent to the traditional Molière-Bethe one, neglecting cut-off error of the same order in expansion of the diffusion factor. We have found various superior aspects of the new formulation; ionization loss is taken into account, properties of substance are reflected in the Kamata-Nishimura constants, mixed or compound substances can easily be treated, the formulation is simple as a thorough extension of the Rossi-Greisen or Fermi-Yang theory, the theory is easily applicable to other problems, and so on.

Under the moderate energy condition with ionization, evaluation of the scale factor characterizing ionization process requires heavy calculations of numerical integration, which will lose efficiencies of simulation works and other applications. We have found an expansion of the integration up to the first rest-mass term gives a good approximation formula to the scale factor, which is more simple and accurate enough for a practical application. We propose a practical and efficient procedure of getting Molière angular distribution applicable in simulations and analyses.