DISTRIBUTIONS OF ENERGY LOSSES BY FAST IONS ALONG THEIR PROPAGATION PATHS IN SOLIDS

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S u m m a r y

The integro-differential equations for cumulants of the distribution function that describes energy losses by fast ions during their propagation in solids have been obtained. The equations differ from those obtained by other authors by one new term. The term describes accurately the process of slowing down of an ion at the start of its path. The equations have been numerically solved for the first seven cumulants of the distribution function for both elastic and inelastic energy losses, and the results have been compared with the results for ion ranges. It has been found that: 1) for energies in the interval 1 keV–1 GeV, the average ranges with energy losses are approximately 30–90% of the ion ranges; 2) for low energies, the straggling of the distribution of energy losses are slightly larger than or equal to the straggling of the distribution of ion ranges, while, for high energies, the former can be 10 times as large as the latter; 3) for low energies, the skewnesses and excesses of the distributions of energy losses and ion ranges are approximately the same, while their changes for the former at higher energies are several orders smaller than those for the latter. This implies that the distribution of energy losses are wider and closer to the normal distribution than the distribution of ion ranges. We show that these properties of energy loss distributions are a result of the inclusion of the new terms in the equations which dominate at high energies.