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Elastic Collisions of Electrons with DNA and Water From 10 eV to 100 KeV: Scar Macro Investigation

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Abstract : Recently, understanding the interactions of electrons with the DNA molecule and its components has attracted considerable interest because DNA is the main site damaged by ionizing radiation. The interactions of radiation with DNA induce a variety of molecular damage such as single-strand breaks, double-strand breaks, basic damage, cross-links between proteins and DNA, and others, or the formation of free radicals, which, by chemical reactions with DNA, can also lead to breakage of the strand. One factor that can contribute significantly to these processes is the effect of water hydration on the formation and reaction of radiation induced by these radicals in and / or around DNA. B-DNA requires about 30% by weight of water to maintain its native conformation in the crystalline state. The transformation depends on various factors such as sequence, ion composition, concentration and water activity. Partial dehydration converts it to DNA-A. The present study shows the results of theoretical calculations for positrons and electrons elastic scattering with DNA medium and water over a broad energy range from 10 eV to 100 keV. Indeed, electron elastic cross sections and elastic mean free paths are calculated using a corrected form of the independent atom method, taking into account the geometry of the biomolecule (SCAR macro). Moreover, the elastic scattering of electrons and positrons by atoms of the biomolecule was evaluated by means of relativistic (Dirac) partial wave analysis. Our calculated results are compared with theoretical data available in the literature in the absence of experimental data, in particular for positron. As a central result, our electron elastic cross sections are in good agreement with existing theoretical data in the range of 10 eV to 1 keV.

Keywords : elastic cross scrion, elastic mean free path, scar macro method, electron collision
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