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Nanoscale models for energy deposition of photons, electrons and positrons in atomic and molecular gases[1]

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Many radiation applications require detailed energy deposition maps in reduced volumes, typically at the nanoscale. In addition, information about the type of interaction processes taking place in these reduced areas is usually needed. In order to achieve this level of description, single particle tracks, both for primary radiation and secondary generated species, should be simulated upon reasonable physical descriptions of the interaction processes in terms of cross sections and energy loss. In this study we present a Low Energy Particle Track Simulation (LEPTS) Monte Carlo code which is based on experimental and theoretical cross section data we have previously derived as well as on the observed energy loss distribution functions. This model will be applied to the irradiation of atomic (Ar) and molecular (SF_6) gases with high energy electrons, positrons and photons by simulating single particle tracks until their final thermalization in the medium. Special attention will be paid to the low energy secondary electrons generated along the tracks. Detailed energy deposition pictures and local radiation effects will be derived from the simulated track structure and compared with direct observations in simple experiments.

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