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DECAY0 event generator for initial kinematics of particles in alpha, beta and double beta decays

The computer code DECAY0 is presented which allows to generate initial energies, times, directions and angular distributions of particles emitted in radioactive decays of atomic nuclei (α , β , 2β , some special events like Compton scattering, e^+e^- pair creation and others). Such information is needed for simulation of a detector response for investigated (or searched for) nuclear decays with the help of general simulation tools like GEANT, EGS, MCNP or other programs. For 2β decay, the code generates kinematics for 40 nuclei-candidates (the most interesting from the full list of 69 2β nuclei) for transitions to the ground state and few excited levels of daughter nuclides; 17 different modes of 2β decay are described ($2\beta 2\nu$; $2\beta 0\nu$ with neutrino mass, or λ or η terms in right-handed currents; $2\beta 0\nu$ with emission of Majorons with different spectral index; $2n$ and N^+ mechanisms; $2\beta 2\nu$ with bosonic neutrinos, etc.). The main aim of the DECAY0 is generation of 2β decays, but α and single β decays of 59 nuclides which are the most dangerous from the point of view to imitate 2β decays (or are calibration sources) are also described. The full decay schemes are taken into account with transition to the ground state and up to 48 excited levels with up to 166 γ quanta emitted in deexcitation process. For each transition, 3 concurrent processes are considered: emission of γ quantum, conversion electron or e^+e^- pair. The code is written in Fortran (near 17,000 lines now). Output is given as plain text file, convenient to be read by any program (but the code can be used also as subroutine in bigger program). Initially created near 20 years ago, the code – with updates – still is used by a number of groups (LPD KINR, NEMO-2,3 and SuperNEMO, DAMA, COBRA, SNO+, AMoRE, NEXT, GERDA/Majorana for 2β , and others).

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