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Relativistic energy approach to cooperative electron-gamma-nuclear processes: NEET effect

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Consistent relativistic energy approach (REA) to calculation of the cooperative electron-gamma-nuclear processes combined with the relativistic PT [1] is presented. The nuclear-excitation – electron transition (NEET) effect is studied. The NEET probability is determined as the probability that decay of the initial excited atomic state will result to the excitation of and subsequent decay from the corresponding nuclear state. Within REA the probability is connected with an imaginary part of energy shift for the system (nuclear subsystem + electron subsystem + photon) excited state. The effects of purely nuclear transition, purely electron-(hole) transition and combined electron – nuclear transition can be distinguished. The calculation results are presented for the atomic/nuclear systems 189Os,193Ir, 197Au, 235U and compared with available theoretical and experimental data [2]. Studying the cooperative electron- gamma-nuclear process such as the NEET effect is expected to allow the determination of nuclear transition energies and the study of atomic vacancy effects on nuclear lifetime and population mechanisms of excited nuclear levels.

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