Relativistic many-body calculations of multipole (E1, M1, E2, M2, E3, M3) transition wavelengths and rates between 3l-14l' excited and ground states in nickel-like ions

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Abstract
Wavelengths, transition rates, and line strengths are calculated for the 76 possible multipole (E1, M1, E2, M2, E3, M3) transitions between the excited 3s23p63d94l, 3s23p53d104l, and 3s3p63d104l and the ground 3s23p63d10 states in Ni-like ions with the nuclear charges ranging from Z = 30 to 100. Relativistic many-body perturbation theory (RMBPT), including the Breit interaction, is used to evaluate energies and transition rates for multipole transitions in hole-particle systems. This method is based on relativistic many-body perturbation theory, agrees with MCDF calculations in lowest-order, includes all second-order correlation corrections and includes corrections from negative energy states. The calculations start from a 1s22s22p63s23p63d10 Dirac-Fock potential. First-order perturbation theory is used to obtain intermediate-coupling coefficients, and second-order RMBPT is used to determine the matrix elements. The contributions from negative-energy states are included in the second-order E1, M1, E2, M2, E3, and M3 matrix elements. The resulting transition energies and transition rates are compared with experimental values and with results from other recent calculations. As a result, we present wavelengths and transition rates data for the selected transitions that includes the 76 possible multipole (E1, M1, E2, M2, E3, M3) transitions between the excited 3s23p63d94l, 3s23p53d104l, and 3s3p63d104l states and the ground 3s23p63d10 state in Ni-like ions. Trends of the line strengths for the 76 multipole transitions and oscillator strengths for the 13 E1 transitions as function of Z are illustrated graphically. The Z dependence of the energy splitting for all triplet terms of the 3s23p63d94l, 3s23p53d104l, and 3s3p63d104l configurations are shown in the range of Z = 30(100).