Accurate theoretical lifetimes data in the prospects of high precision future experiments

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We present a detailed investigation of the magnetic dipole (M1) line strengths between the fine-structure levels of the ground configurations in B-, F-, Al- and Cl-like Ar, Fe, Mo and W ions. Systematically improved (enlarged) multiconfiguration Dirac-Hartree-Fock (MCDHF) wave functions are employed for the evaluations of the Coulomb type inter-electronic interactions. Relativistic configuration interaction method is used to evaluate the Breit type inter-electronic interactions. The QED corrections are incorporated by correcting the transition operator of the atomic magnetic moment for the anomalous magnetic moment of the electron (EAMM). One electron QED correction going beyond EAMM approximation is also implemented. The accuracy of the calculated line strengths is analyzed by a comparison with other theories. The M1 transition rates are reported using the calculated line strengths and available accurate transition energies. Finally, the lifetimes in millisecond to picoseconds range are calculated including the contributions from the transition rate from the E2 transition channel. The discrepancy with available experiments is discussed and a benchmark dataset of theoretical lifetimes is provided in the prospects of future experiments.

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