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# Energy levels, transition rates and lifetimes for Li-like ions with $Z \leq 10$ in the $1s2s(^3S)3\ell$ states

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**Synopsis** Energy levels, transition rates and lifetimes for Li-like ions with $Z \leq 10$ in the $1s2s(^3S)3\ell$ states were calculated using the Dirac-Fock approach.

In the continuation of the study of the selective enhancement of $1s2sn\ell$ metastable states populated by cascades in single-electon transfer collisions of ions with He and $H_2$ targets [1], we calculated the energy levels, transition rates and lifetimes for Li-like ions with $Z \leq 10$ in the $1s2s(^3S)3\ell$ states states using the multiconfiguration Dirac-Fock (MCDF) code of Desclaux and Indelicato [2, 3].

**Table 1**. Energy levels (EL), Auger and radiative transition rates (ATR, RTR, respectively) and lifetimes for Ne Li-like ions in the $1s2s(^3S)3s\ ^{2,4}S$ states

| | $^2S_{1/2}$ | $^4S_{3/2}$ |
|---|---|---|
| EL (eV) | -1750.35 | -1760.53 |
| ATR ($s^{-1}$) | $3.23\times10^{13}$ | $3.02\times10^{13}$ |
| RTR ($s^{-1}$) | $3.16\times10^{10}$ | $6.69\times10^{10}$ |
| Lifetime (s) | $3.10\times10^{-14}$ | $3.30\times10^{-14}$ |

The radiative and radiationless decay rates were calculated using the code in the single-configuration approach, with the Breit interaction and the vacuum polarization terms included in the self-consistent field calculation, and other QED effects, such as self-energy, included as perturbations [4]. Regarding the radiationless transitions, we have assumed a two-step process, in which the decay is independent from the ionization. Hence, the two electrons do not interact with each other and the core hole state interacts very weakly with the continuum electron, allowing for the transition rates to be calculated from perturbation theory. Initial-state wavefunctions were generated for configurations that contain one initial inner-shell vacancy while final state wavefunctions were generated for configurations that contain two higher shell vacancies. Continuum-state wavefunctions were obtained by solving the Dirac-Fock equations with the same atomic potential of the initial state, normalized to represent one ejected electron per unit energy. The preliminary results obtained for Ne Li-like ions in the $1s2s(^3S)3s\ ^{2,4}S$ states are listed in Table 1.

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