4 - 13 Calculation of Energy Levels in the H-like Muonic Atoms*

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A muonic hydrogen-like atom is formed when replacing the electron in it by a negative muon μ^-. Since the muon is with a mass 207 times heavier than the electron, H-like muonic atoms are more sensitive to the influence of nuclear properties and relativistic effects. We notice that there are no systematic studies on the higher levels of H-like muonic atoms at present.

In this work, both the energy levels of H-like muonic atoms with $n \leqslant 10$ in the range of $Z = 1 \sim 120$, and the multipole transition rates are calculated by using two methods implanted in Fac[1] and Mudirac[2]. The QED contributions including self-energy (SE), vacuum polarization (VP), and nuclear mass shifts (MS) are analyzed. Compared to the normal H-like ions, the trends of QED contributions to transition energies and rates of the muonic H-like ions are different.

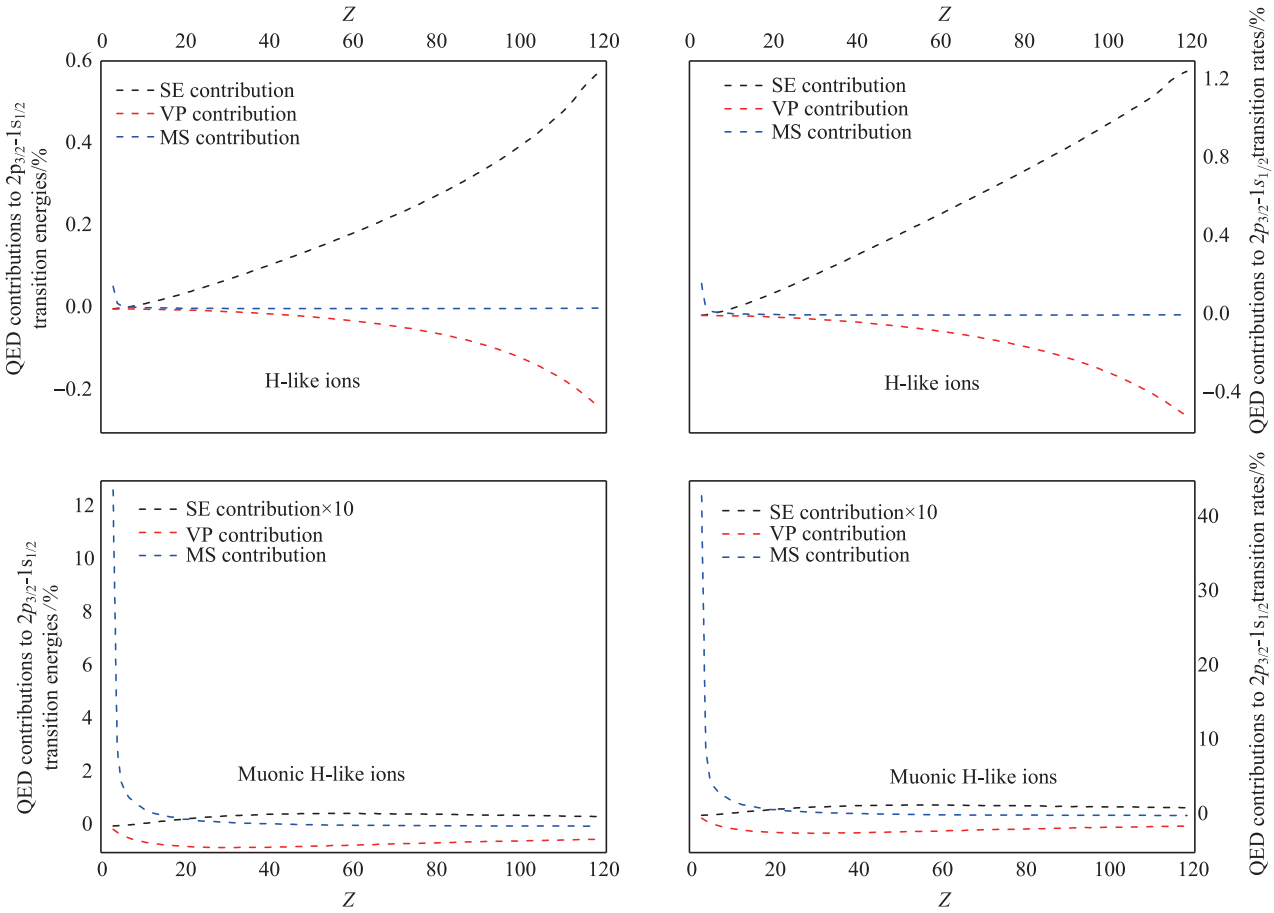

Fig. 1 (color online) QED contributions to the $2p_{3/2} - 1s_{1/2}$ transition energies (shown in Fig. 1(a) and (c)) and rates (in Fig. 1(b) and (d)) of the normal (Fig. 1(a) and (b)) and muonic (Fig. 1(c) and (d)) H-like ions. Here, the SE contributions in the Fig. 1(c) and (d) are multiplied by 10.

References

[1] M. Gu, Can. J. Phys., 86(2008)675.

[2] S. Sturniolo, A. Hillier, X-Ray Spectrom, 50(2021)180.

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