X- ray wavelengths and Auger transition energies of $1s2p^4$ (^2S, $^{2,4}P$, ^2D) resonances in B-like (Z = 6-18) ions

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Synopsis Please Auger energies and X-ray wavelengths of the 1s $2p^4$ (^2S, $^{2,4}P$, ^2D) resonances in B-like ions (Z = 6-18) are reported. New Auger energies and wavelengths for B-like N^{2+}, F^{4+}, Na^{6+}, Al^{8+}, P^{10+}, S^{11+}, Cl^{12+}, and Ar^{13+} ions are tabulated as benchmarked values for future experimental and theoretical studies.

Studies of core-excited doublet and quartet many electron systems are very challenging because of their importance for the diagnostic of astrophysical and laboratory plasma. For boron isoelectronic sequence, Auger energies of the 1s $2p^4$ (^2S, $^{2,4}P$, ^2D) resonances have been investigated in the past on the both side of experiment and theory. The most recent saddle-point variation and saddle-point complex-rotation (SPCR) calculations of Sun *et al*. [1] has been used to solve earlier theoretical discrepancies and to identify some former unknown experimental lines from $1s2p^4$ resonances in B-Like C^+, O^{3+}, and Ne^{5+} ions. However, the high-relativistic calculations reported by Sun *et al*. [1] have been limited to the 1s $2p^4$ (^2S, $^{2,4}P$, ^2D) resonances in B-like C^+, O^{3+}, Ne^{5+}, Mg^{7+}, and Si^{9+} ions.

We present theoretical Auger energies and X-rays wavelengths of the $1s2p^4$ levels in the entire boron isoelectronic C^+ to Ar^{13+} using the Screening constant by unit nuclear charge (SCUNC) method compared with existing literature data. Overall, the present results published [2] for B-like C^+, O^{3+}, Ne^{5+}, Mg^{7+}, and Si^{9+} ions agree well with various theoretical and experimental data. The tabulated new Auger energies and X-ray wavelengths for the 1s $2p^4$ resonances in B-like N^{2+}, F^{4+}, Na^{6+}, Al^{8+}, P^{10+}, S^{11+}, Cl^{12+}, and Ar^{13+} ions may be benchmarked values for future experimental and theoretical studies.

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Tables 1 and 2 illustrate the agreement between theories in the particular case of B-like Ne^{5+} ion. Results for other B-like ions compared with theory and experiment will be presented in the meeting.

Table 1. Auger energy (in eV) for some transitions in Ne^{5+} ion from the 1s $2p^4$ ^2S initial state.

Levels	SCUNC	SPCR	MDFC
$1s^2\ 2p^2\ ^2S$	1042.48	1043.28	1045.23
$1s^2\ 2p^2\ ^2D$	1054.21	1054.94	1057.50
$1s^2\ 2s\ 2p\ ^1P$	1070.75	1071.48	1073.72
$1s^2\ 2s\ 2p\ ^3P$	1086.82	1087.53	1091.25

SCUNC: screening constant by unit nuclear charge data, present results [2].
SPCR: saddle-point variation and saddle-point complex-rotation results of Sun *et al*. [1].
MCDF: multiconfiguration Dirac-Fork values of Chen and Crasemann [3].

Table 2. Theoretical wavelength (in Å) for Ne^{5+} ion.

Transition	SCUNC	SPCR	MDFC
$1s2p^4\ ^4P \rightarrow 1s^2 2p^3\ ^4S°$	14.064	14.069	14.062
$1s2p^4\ ^2S \rightarrow 1s^2 2p^3\ ^2P°$	13.998	14.006	13.987
$1s2p^4\ ^2P \rightarrow 1s^2 2p^3\ ^2P°$	14.121	14.123	14.126
$1s2p^4\ ^2P \rightarrow 1s^2\ 2p^3\ ^2D°$	14.017	14.029	14.038
$1s2p^4\ ^2D \rightarrow 1s^2\ 2p^3\ ^2P°$	14.152	14.154	14.122
$1s2p^4\ ^2D \rightarrow 1s^2 2p^3\ ^2D°$	14.053	14.060	14.048

SCUNC [2]; SPCR [1]; MCDF [3].

References

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