Photoionization of potassium-like transition metal ions: Ti$^{3+}$ to Fe$^{7+}$

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Photoionization cross section calculations are performed on potassium-like transition metal ions (Ti$^{3+}$, V$^{4+}$, Cr$^{5+}$, Mn$^{6+}$ and Fe$^{7+}$) using both non-relativistic (LS-coupling) and relativistic (Breit-Pauli) R-matrix methods for the ground ([Ne]3s$^2$3p$^6$3d $^2$D$^e_{3/2}$) and the first excited ([Ne]3s$^2$3p$^6$3d $^2$D$^e_{5/2}$) states of each of the five ions. Photon energies up to the first 3p ionization threshold are considered. The results show that for Ti$^{3+}$, the cross sections are dominated by the giant (3p $\rightarrow$ 3d) resonances which are analyzed and identified, while for the four other ions (V$^{4+}$, Cr$^{5+}$, Mn$^{6+}$ and Fe$^{7+}$), the 3p $\rightarrow$ 3d resonances lie below the ionization threshold, and the cross sections are dominated by 3p$^5$3d ns and 3p$^5$3d nd Rydberg series of resonances. Comparison of the Ti$^{3+}$ results with available theoretical and experimental data shows good agreement. This work is supported by DOE and NSF.

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