§11. Atomic Nuclear Charge Scaling for Dielectronic Recombination to Be-like Ions

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Atomic nuclear charge(Z) scaling for dielectronic recombination rate coefficient (α) to Be-like ions as well as energy level (E), radiative transition probability (Ar), and auto-ionization rate (Aa) of Be-like ions are studied. We treat C^{2+}, O^{4+}, Ne^{6+}, Mg^{8+}, P^{11+}, Ar^{14+}, Ca^{16+}, V^{19+}, Fe^{22+} ions as Be-like ions and not only $1s^2 2pnl$ states but also $1s^2 3lnl'$ states as auto-ionization state. For the calculation for E, Ar, Aa, Cowan's code is employed in order to consider electron-electron correlation enough.

The Z-scaling is affected by the electron-electron correlation for small Z and relativistic effect for large Z. Furthermore, different mechanism between the $\Delta n = 0$ and $\Delta n \neq 0$ transitions is seen. Here Δn is the different quantum number between the auto-ionization state and the final bound state.

In the Z-scaling for the α values, only the $1s^2 2pnl \rightarrow 1s^2 2snl$ transition dominates at low Z(see Fig.1), on the other hand, at high Z, the transitions through the $1s^2 3lnl'$ states also become important (see Fig.2). The α values to the final excited $1s^2 2snl$ show weak Z-dependence, on the other hand, those to the $1s^2 2pnl$ state have a strong Z-dependence.
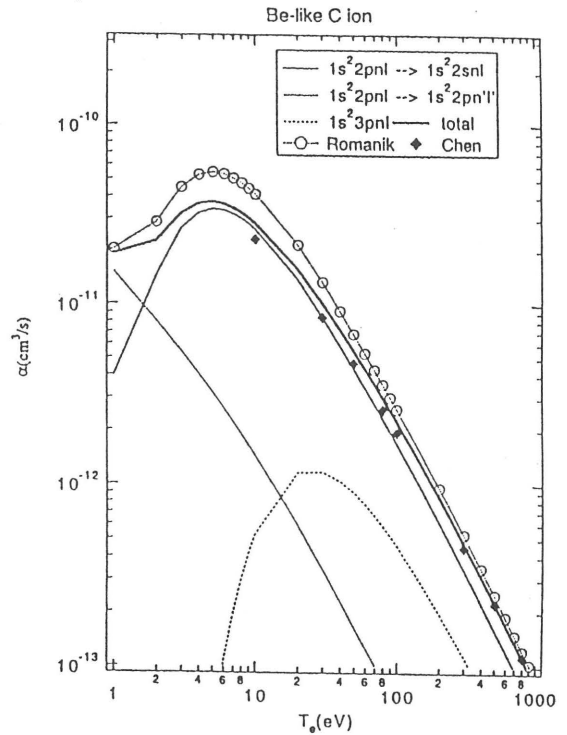

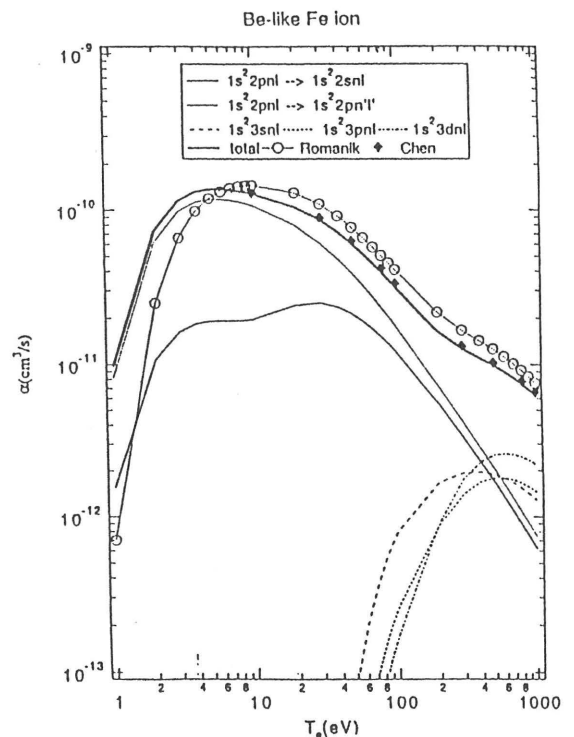Fig.1 Dielectronic recombination rate coefficient α vs. electron temperature Te for Be-like C ion.

Fig.2 The same as Fig.1 for Be-like Fe ion