Stark-Zeeman line shapes model for multi-electron radiators in hot and dense plasmas submitted to large magnetic fields.

S. Ferri, O. Peyrusse, C. Mossé and A. Calisti
Aix Marseille Université - CNRS, PIIM UMR7345, Marseille, France.

We present a Stark-Zeeman spectral line shape code designed to provide fast and accurate line shapes for arbitrary atomic systems in plasmas for a large range of conditions. It is based on the coupling of the PPP code, a Stark broadened spectral line shape code [1,2], developed some years ago for multi-electron ion spectroscopy in inertial confinement fusion, and the MASCB code, recently developed to generate B-field dependent atomic physics. The latter provides energy levels, statistical weights and reduced matrix elements of multi-electron radiators by diagonalizing the atomic Hamiltonian which includes the well know B-dependent term. They are used as input in the line shape code working in the standard quasi-static ion/impact electron limit. The static ion microfield distribution is computed using the APEX model and the stochastic equation that governs the evolution of the emitter in the plasma is solved in the Liouville space by using the frequency fluctuation model [3], to introduce the corrections due to the ion dynamics effects. The physical model of the electron broadening is based on the semi-classical impact approximation including the effects of a strong collision term [4], of interference [5] and cyclotron motion [6]. As the emission is polarized, the output profiles are calculated for a given angle of observation compared to the direction of the magnetic field. We have also access to each p, s_+ and s_- components, so that the polarization degree can be inferred. Spectral line shape calculations have been performed for various experimental conditions. We focus here on a regime where the coupling on an external magnetic field to the atomic magnetic moment dominates the spin-orbit interaction.

References

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