

Consistent Treatment of Dense Plasma Effects on Atomic Structures, Collisions, and Spectral Signatures

I. E. Golovkin¹*, M. F. Gu¹ and J. J. MacFarlane¹

¹Prism Computational Sciences, Inc., Madison, WI, USA

Many existing models for dense plasma effects on the atomic structure often rely on ad-hoc ionization potential depression formulas. However, these models do not capture the entire influence of the plasma screening effects at high densities [1-3]. We report on development of a complete and consistent atomic database, with all atomic parameters required for collisional radiative modeling computed from appropriate plasma screening potentials. A grid of models depending on plasma temperature and density will be calculated with the Flexible Atomic Code (FAC) [4], and new capability in the suite of Prism modeling codes [5] will be developed to utilize such a database. We will explore several different forms of plasma screening potentials, such as ion-sphere, Stewart-Pyatt, and those based on the average atom models. The resulting spectral models will not only address the modification of ionization balance due to the continuum lowering, but also shifts of spectral lines from the altered energy level structures, as well as the effects of screening potentials on other collisional and radiative process, such as radiative transition, electron impact excitation, photo-ionization, autoionization, and collision ionization. The new development required in FAC, and the resulting atomic data from this project will be made publicly available and hosted in the GitHub repository for FAC.

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References

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* E-mail: golovkin@prism-cs.com