A Synergistic Approach to Modeling Astrophysical X-Ray Spectra

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Plasma emission models used in X-ray astronomy need to simulate X-ray spectra from at least 15 elements. Development of comprehensive models involve large-scale calculations; for example, Fe M-shell spectra, K-shell fluorescence from near-neutral ions, and dielectronic recombination satellite spectra from L-shell ions. Current and recent missions (*EUVE*, *ASCA*, *DXS*, etc.) have already demonstrated the need for major, rapid improvements in spectral models. The deployment in the near future of three major X-ray observatories – *AXAF*, *XMM*, and *Astro-E* – with instruments of high spectral resolving power, promises to push X-ray spectral models to their limits.

Atomic modeling problems derive from limitations in our abilities to achieve adequate levels of accuracy and completeness simultaneously. Problems related to completeness have gained attention as the result of confrontations with astrophysical data. Problems related to accuracy (wavelengths, line ratios, etc.), those that compromise our ability to extract precise physical information from high-resolution data, are best studied in the laboratory. The controllable, well-characterized conditions available in EBIT experiments at LLNL allow us to isolate specific line-formation processes in ions chosen for their astrophysical interest. The overlap of astrophysical data, laboratory data, and the results of atomic modeling works to maximize the utility of plasma emission models in interpreting high-resolution spectra from more complex (uncontrolled) environments encountered in high-energy astrophysics. Some specific examples of this interplay are presented.