Progress in the Simulation of non-LTE Opacities.

SCROLL is the non-LTE extension of the well-known STA code. It is based on a quasi steady state collisional radiative model (CRM) using superconfigurations, where the populations are solutions of rate equations with all relevant processes included. It is capable of generating accurate non-LTE opacities and emissivities for any element, when the atomic transition time scale is much shorter than plasma evolution time scale e.g. Nike laser plasma. The advantage over the present setup is that it avoids Busquet's model shortcomings (relying on empirical parameters and inaccurate emissivities) for non-LTE corrections. Figure 1 (left) shows the influence of a Planckian radiation field (T_r) on the ionization balance for Lu (Z=71), measured by the ionization temperature T_z. The latter is defined as: $Z^*_{nonLTE}(T_e) = Z^*_{LTE}(T_z)$. As long as $T_r < T_{zo}$ (i.e. T_z without radiation) the radiation field practically has no effect. If, on the other hand $T_r > T_e$, one obtains LTE at T_r. Consequently, there is only a limited range $T_{zo} < T_r < T_e$ for which a radiation dependent CRM has to be solved.

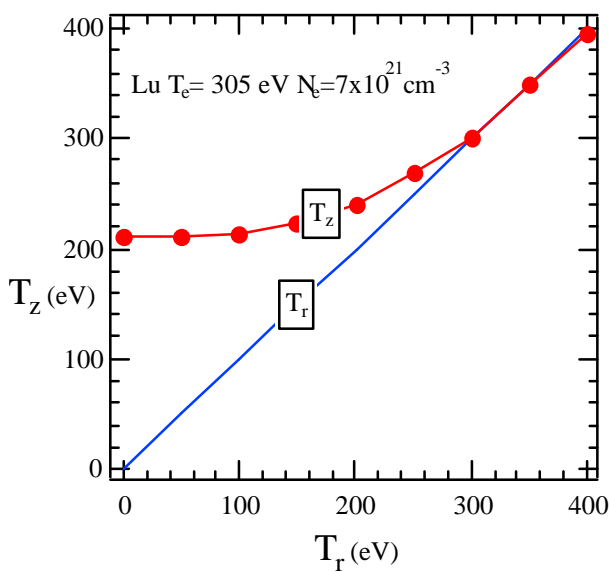Lu T_e= 305 eV N_e=7x10^{21} cm^{-3}

Figure 2 (right) shows how the source function evolves toward the Planck function when T_r increases. We have optimized and implemented SCROLL on a "beowulf" cluster of 16 cpus. A T_r =0 database for Au (45 temperatures, 80 densities) takes ˜10 hours. We plan to interface FAST with the new databases.

$(T_r=300 \quad T_z=300)$
$(T_r=250 \quad T_z=269)$
$(T_r=200 \quad T_z=240)$
$(T_r=150 \quad T_z=222)$
$(T_r=0 \quad T_z=211)$