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The Effect of Electron Capture on Spectral Line Broadening in Hot Dense Plasmas[1]

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Spectral line broadening calculations are important for atomic behavior in high-energy-density plasmas and in wide-ranging applications that include stellar opacities and plasma diagnostics. Spectral lines are shifted and broadened due to the random perturbations of the atomic states by the surrounding plasma ions and electrons, caused by quantum mechanical many-body Coulomb interactions. Thus, line-shape theory is complex, multi-disciplinary, and employs many approximations. Laboratory measurements and astronomical observations sometimes question the validity of those approximations. We explore the validity of these approximations, thereby refining line-shape calculations. In this talk, we present our recent re-scrutiny of line-shape formalism, aiming to resolve decades-old *isolated-line* problem [Ralchenko 2003] where measured Li-like line widths are significantly broader than calculated. We found that the commonly used line-widths formula neglects a potentially important contribution from *electron-capture* (radiation-less recombination), which is the inverse process of autoionization. Including this effect removes most of the theory-experiment discrepancies in Li-like ions [Gomez (2020)]. This effect, which has been broadly neglected, is important for certain lines. We will discuss when this effect becomes important and how this may impact systems other than Li-like ions. We will further also examine possible future directions in the field of line broadening.

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