

CALCULATION OF PASCHEN LINES FOR ASTROPHYSICAL AND FUSION PLASMAS

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A selection of problems related to the modeling of Stark broadening is considered, for astrophysical and laboratory plasma diagnostic applications. At the atomic level, a proper description of a line shape requires the ion microfield evolution be accounted for during the time of interest of the transition under consideration; this is the so-called ion dynamics issue. In addition, the lines presenting a structure such as $H\beta$ can exhibit an asymmetry due to presence of multipolar interactions, which is significant at high density regimes and must be retained in calculations. Some observed spectra from magnetized plasmas also exhibit lines with a Zeeman triplet structure due to both linear and quadratic terms in the Hamiltonian, which must also be retained in calculations. We provide a review of these problems and present new spectra calculations. A focus is put on plasma conditions relevant to stellar atmospheres, magnetic fusion experiments, and magneto-inertial fusion experiments carried out in laboratory. Features that are common to each of these plasmas (e.g., the plasmas can have the same electron density range) are discussed. We present calculations and also report on line shape fittings which have been performed for diagnostic applications.