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Configuration-Average Collisional-Radiative calculations, Ionization and Emission of low-density tungsten plasmas in the temperature range [800-5000] eV

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After a discussion concerning differences between "high-density"plasmas (e.g. laser-produced plasmas) and "low-density"plasmas (e.g. tokamak core plasmas) in term of collisional-radiative modeling (CRM) for high-Z elements, we present specific configuration-average CRM calculations of tungsten plasmas at low electron density Ne = 5 10^{13} cm^{-3} for electron temperatures in the range 0.8 to 5 keV. These conditions are relevant to current tokamaks. In this temperature range, the modeling of the ionization balance and of the spectra is a long-standing problem.
We discuss here the problem of ensuring completeness of the list of configurations included in the calculations. We also present comparisons of experimental measurements in the EUV range performed at tokamak WEST, with calculated spectra based on the use of the unresolved transition array (UTA) and of the spin-orbit split array (SOSA) formalisms, those formalisms having been developed rather in a "high-density"plasma context. They are particularly adapted to the study of broadband spectral features (quasi-continuum structures).
A conclusion is that standard calculation methods (e.g. the distorted-wave method for collision cross sections) used for the evaluation of the configuration-average collisional and radiative rates, are fine provided that a correct list of configurations is used in the calculations.

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