Critical analysis of transition probabilities for forbidden lines of singly ionized iron

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Singly ionized iron is one of the most important atomic species in astronomical UV, visible, and IR spectra. Allowed and forbidden lines of Fe II are observable in a wide variety of astrophysical objects and this ion is therefore a potentially powerful source of plasma diagnostics. Yet, the Fe II spectrum remains poorly known due to insufficiently accurate atomic data and complex excitation mechanisms.

In this work, we focused our attention on forbidden lines originating from the metastable levels of Fe II. These [Fe II] have been observed in several astrophysical low density plasmas, such as nebulae, H II regions and circumstellar gas clouds. We compared seven different computations of forbidden A-values: the SUPERSTRUCTURE and relativistic Hartree-Fock (HFR) calculations by Quinet *et al.* [1], the recent CIV3 calculation of Deb and Hibbert [2], and various new HFR and AUTOSTRUCTURE calculations that extend over previous works. Those calculations were also compared to line ratio measurements in the Herbig-Haro object (HH202) in the Orion nebula from Mesa-Delgado *et al.* [3] and with new intensity measurements obtained on the HST/STIS archived spectra of the Weigelt blobs of η Carinae. These comparisons allowed us to estimate uncertainties on theoretical atomic data and to determine the best set of transition probabilities for astrophysical applications.

References:

[1] P. Quinet *et al.*, A&AS **120**, 361 (1996).

[2] N.C. Deb and A. Hibbert, A&A **536**, A74 (2011).

[3] A. Mesa-Delgado *et al.*, MNRAS **395**, 855 (2009).