ATOMIC DATA AND SPECTRAL MODEL FOR

Lyα FLURESCENCE OF Fe II

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Strong Fe II emission from some highly excited levels ($\sim$11 eV) in the ultraviolet of stars and active galactic nuclei (NGA) has been well known for decades. On the other hand, many other levels of similar or lower excitation yield no emission. It s found that excitation to such highly excited levels results, for the most part, from fluorescent pumping by hydrogen Lyα radiation coinciding in wavelength with various 4s – 5p transitions in Fe II. While this mechanism is conceptually well understood, there has been little consensus as to the details of the spectral models used thus far and the accuracy of the atomic data employed in such models.

We have build a large spectral models for Fe II of almost 2000 levels. This accounts for every line pumping mehcanism with hydrogen and other species. For this model, we have done extensive calculations of radiative transition rates and electron impact collision strengths for Fe II. Computations of A-values are carried out with a combination of state-of-the-art multiconfiguration approaches, namely the relativistic Hartree–Fock, Thomas–Fermi–Dirac potential, and Dirac–Fock methods, while the R-matrix plus intermediate coupling frame transformation, Breit–Pauli R-matrix, and Dirac R-matrix packages are used to obtain collision strengths. We examine the advantages and shortcomings of each of these methods, and estimate rate uncertainties from the resulting data dispersion. We proceed to construct excitation balance spectral models, and compare the predictions from each data set with observed spectra from various astronomical objects. We are thus able to establish benchmarks in the spectral modeling of FeII emission in the IR, optical UV. All atomic data and models are available online and through the AtomPy atomic data curation environment.