ASESSMENT OF ATOMIC DATA: PROBLEMS AND SOLUTIONS

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Atomic data, namely energy levels, radiative rates (A- values), and effective collision strengths (Υ), which are obtained from the electron impact collision strengths (Ω), are required for a range of ions for the analysis and modelling of a variety of astrophysical and laboratory plasmas. Experimental energy levels for several ions are available on the NIST website, in particular for low-lying levels. For some ions, critically evaluated theoretical results are also available, but often the range available on the NIST website is limited. Therefore, in modelling applications there is sometimes no choice but to adopt unassessed theoretical results. However, discrepancies for energy levels, in both orderings and magnitude, are often noted among different calculations. Some of these discrepancies will be shown during the meeting, reasons for these discussed, and suggestions offered for the assessment of accuracy.

Similar results for collision strengths are also available for many ions of interest, but often either the available data are limited (to only a few transitions and/or to a few energies) or lack accuracy, particularly for the effective collision strengths (Υ). This is because calculations for Υ are computationally intensive, with resonances in the thresholds region needing to be resolved in a fine energy mesh, in practice at thousands of energies depending on the ion. These closed-channel (Feshbach) resonances often significantly contribute to the determination of Υ, particularly for lighter ions and at low temperatures. However, their contribution is also significant for many heavier ions, such as Kr, Mo and Gd, and at the high temperatures ($\geq 10^6$ K) found in fusion plasmas. Nevertheless, calculations are available in the literature for many of the required ions. However, the accuracy of the available results is often suspect, because different calculations using similar methods/codes sometimes differ by up to two orders of magnitude for some transitions, such as in He-like and Li-like ions. Reasons for discrepancies, large and small, among different calculations for both allowed and forbidden transitions, can be many, such as: inadequacy of configuration interaction, limited range of partial waves and/or the energy range, limited inclusion (or exclusion) of relativistic effects, or errors in the adopted version of the code. Examples of such discrepancies will be shown, reasons explained, and suggestions offered for avoiding large errors, so that comparatively more accurate data can be generated for the benefit of user fusion community.