Shortcomings of the R-Matrix Method for Treating Dielectronic Recombination

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By performing new radiation-damped R-matrix scattering calculations for the photorecombination of Fe^{17+} forming Fe^{16+}, we demonstrate and discuss the difficulties and fundamental inaccuracies associated with the R-matrix method for treating dielectronic recombination (DR). Our new R-matrix results [1] significantly improve upon earlier R-matrix Results [2] for this ion. However, we show theoretically that all R-matrix methods are unable to account accurately for the phenomenon of radiative decay followed by autoionization. For Fe^{17+}, we demonstrate numerically that this results in an overestimate of the DR cross section at the series limit, which tends to our analytically predicted amount of 40%. We further comment on the need for fine resonance resolution and the inclusion of radiation damping effects. Overall, slightly better agreement with experiment [3] is still found with the results of perturbative calculations, which are computationally more efficient than R-matrix calculations by more than two orders of magnitude.

References:

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