The Asymptotic Expansion Method as a Test of Large-Scale CI Calculations for Helium[1] RIDA EL-WAZNI, GORDON W.F. DRAKE, University of Windsor — The asymptotic expansion (AE) method based on a core polarization potential for the Rydberg electron continues to be of interest as a test of other computational methods because of the exceptionally high accuracy that the AE method yields for states of high angular momentum. The method itself is well established from earlier work by R. Drachman and by G. Drake [1]. In the present work, we extend that tabulated results for the Rydberg states of helium up to $L = 15$. A comparison with recent large-scale configuration interaction calculations for the nonrelativistic energies reveals that there are serious disagreements unless one takes care in the CI calculation to include all the possible angular momentum couplings that contribute [2]. The results will be extended to include a complete set of relativistic and QED corrections to give final energies that are essentially exact for all practical purposes.

[1] G.W.F. Drake and Z.-C. Yan, Phys. Rev. A **46**, 2378 (1992).
[2] R. El-Wazni and G.W.F. Drake, Phys. Rev. A **80**, 064501 (2009).

Gordon W.F. Drake
University of Windsor

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