Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

**Asymptotic Expansions, 1/Z Expansions, and the Critical Nuclear Charge**[1]

GORDON DRAKE, University of Windsor

The quantum mechanical three-body problem defies analytic solution, and so computationally intensive approximation methods involving, for example, variational calculations with large correlated basis sets must be used. This talk will review recent work to explore the outer fringes of the quantum mechanical three-body problem for heliumlike atoms. Asymptotic expansions provide a surprisingly simple and accurate account of highly excited Rydberg states with high angular momentum. $1/Z$ expansions, where $Z$ is the nuclear charge, provide results for an entire isoelectronic sequence within a single calculation. Its radius of convergence is thought to be related to the critical nuclear charge $Z_c$ for a state to be bound. For $Z < Z_c$, there may still be quasibound states (shape resonances) imbedded in the scattering continuum. Relationships amongst all three topics will be discussed, and new results presented for both asymptotic expansions and the critical nuclear charge.