

Abstract Submitted  
for the DAMOP13 Meeting of  
The American Physical Society

**Critical nuclear charge to bind two-electron atoms<sup>1</sup>** MICHAEL BUSUTTIL, HAJAR AL-KHAZRAJI, AMIRREZA MOINI, TRAVIS VALDEZ, G.W.F. DRAKE, University of Windsor — For an atom with infinite nuclear mass, there exists a critical nuclear charge  $Z_c$  that is just sufficient to bind the nucleus plus two electrons into a heliumlike structure. As recently discussed by Guevara and Turbiner [1], the value of  $Z_c$  in the nonrelativistic limit is in the neighborhood of 0.91085. The objective of the present work is to present results of improved accuracy for  $Z_c$  by use of our double basis set method in Hylleraas coordinates [2]. The method is particularly well adapted to the case where one electron is strongly bound and the other is at the limit of becoming unbound. The results are analysed in terms of a Puiseux expansion in fractional powers of  $(Z - Z_c)$ , yielding the somewhat smaller preliminary value  $Z_c = 0.910730(6)$ . The value of  $Z_c$  is related to the analytic structure of the energy  $E(Z)$  and the radius of convergence of a  $1/Z$  expansion for the energy.

[1] N.L. Guevara and A.V. Turbiner, Phys. Rev. A **84**, 064501 (2012).

[2] G.W.F. Drake and Z.-C. Yan, Phys. Rev. A **46**, 2378 (1992).

<sup>1</sup>Research supported by NSERC and SHARCNET.

Gordon Drake  
University of Windsor

Date submitted: 30 Jan 2013

Electronic form version 1.4