



Canadian Association  
of Physicists

Association canadienne  
des physiciens et physiciennes

Contribution ID: 4328      Type: **Poster not-in-competition (Graduate Student) / Affiche non-compétitive (Étudiant(e) du 2e ou 3e cycle)**

## **(G) (POS-50) Nonrelativistic Eigenvalues and QED Effects for the High- $n$ Rydberg States of Helium**

*Tuesday 28 May 2024 17:53 (2 minutes)*

Variational calculations readily produce high precision energies and wave functions for the ground state, but typically the accuracy rapidly deteriorates with increasing principal quantum number  $n$ . The current limit is  $n = 10$  [1,2]. We will report the results of new variational calculations based on the use of triple basis sets in Hylleraas coordinates. The basis sets are “tripled” in that each combination of powers  $i,j,k$  in basis functions of the form  $r_1^i r_2^j r_{12}^k \exp(-\alpha r_1 - \beta r_2)$  is repeated three times with different nonlinear parameters  $\alpha$  and  $\beta$  that are separately optimized to span different distance scales. Results will be reported for the S- and P-states up to  $n = 24$ , including a comparison with high precision measurements for  $n = 24$ .

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

[2] D. T. Aznabaev, A. K. Bekbaev, and V. I. Korobov, Phys. Rev. A, **98**, 012510 (2018).

[3] ] G. Clausen et al., Phys. Rev. Lett. **127**, 093001 (2021).

### **Keyword-1**

helium Rydberg states

### **Keyword-2**

variational calculations

### **Keyword-3**

relativistic and QED effects

**Author:** SATI, Lamies (Western University)

**Co-authors:** Mr ENE, Eric (University of Windsor); Mr PETRIMOULX, Evan (University of Windsor); Dr DRAKE, Gordon (University of Windsor)

**Presenter:** Dr DRAKE, Gordon (University of Windsor)

**Session Classification:** DAMOPC Poster Session & Student Poster Competition (10) | Session d'affiches DPAMPC et concours d'affiches étudiantes (10)

**Track Classification:** Technical Sessions / Sessions techniques: Atomic, Molecular and Optical Physics, Canada / Physique atomique, moléculaire et photonique, Canada (DAMOPC-DPAMPC)