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

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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 α and β 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).

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Keyword-3

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