Abstract Submitted
for the DAMOP12 Meeting of
The American Physical Society

Quantum entanglement in helium-like ions[1] Y.-C. LIN, Y.K. HO, Institute of Atomic and Molecular Sciences — Recently, there have been considerable interests to investigate quantum entanglement in two-electron atoms [1-3]. Here we investigate quantum entanglement for the ground and excited states of helium-like ions using correlated wave functions, concentrating on the particle-particle entanglement coming from the continuous spatial degrees of freedom. We use the two-electron wave functions constructed by employing B-spline basis to calculate the linear entropy of the reduced density matrix $L = 1 - Tr_A(\rho_A^2)$ as a measure of the spatial entanglement. Here$\rho_A = Tr_B(|\varphi\rangle_{AB\ AB}\langle\varphi|)$ is the one-electron reduced density matrix obtained after tracing the two-electron density matrix over the degrees of freedom of the other electron. We have investigated the spatial entanglement for the helium-like systems with Z=1 to Z=10. For the helium atoms (Z=2), we have calculated the linear entropy for the ground state and the $1sns^1S^e$ (n=2-10) excited states. Results are compared with other calculations [1-3].

[1] J. P. Coe and I. D'Amico, *J. Phys.: Conf. Ser.* **254**, 012010 (2010)
[2] D. Manzano *et. al.*, *J. Phys. A: Math. Theor.* **43**, 275301 (2010)
[3] J. S. Dehesa *et. al.*, *J. Phys. B* **45**, 015504 (2012)

[1]Work supported by NSC of Taiwan, ROC.

Yew Kam Ho
Institute of Atomic and Molecular Sciences

Date submitted: 18 Jan 2012 Electronic form version 1.4