Abstract Submitted
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Complex-scaling treatment for quantum entanglement in doubly excited helium atom[1] CHIEN-HAO LIN, YEW KAM HO, Institute of Atomic and Molecular Sciences, Taiwan — Recently, we have investigated entanglement measures in natural atomic systems that involve two highly correlated indistinguishable spin-1/2 fermions (electrons). Linear entropy and von Neumann entropy were calculated for spatial (electron-electron orbital) entanglement measures for ground and singly excited bound states in two-electron atomic systems, such as He, H^- and Ps^- [1]. In our present work, we carry out an investigation on entanglement in doubly excited resonance states of helium. Since resonance states are lying in the scattering continuum, their energies are no longer bound by the variational theorem; we apply the complex scaling method [2] to solve the complex energy pole with which the resonance energy and resonance width are deduced. Hylleraas-type wave functions are used to consider correlation effects. Once the wave function for a doubly excited state is obtained, we apply the Schmidt decomposition method [3] to calculate the linear entropy and von Neumann entropy for the doubly excited $2s^2$, $2s3s$, $2p^2$, $3s^2$, and $3p^2$ $^1S^e$ resonance states in the helium atom. [1] Y.-C. Lin, C.-Y. Lin, and Y. K. Ho, *Phys. Rev. A* **87**, 022316 (2013); Y.-C. Lin and Y. K. Ho, *Can, J. Phys.* (2014), accepted; C. H. Lin, Y.-C. Lin, and Y. K. Ho, *Few-Body Syst.* **54**, 2147 (2013). [2] Y. K. Ho, *Phys. Rept.* **99**, 1 (1983). [3] C. H. Lin and Y. K. Ho, *Few-Body Syst.* **55**, 1141 (2014); *Phys. Lett. A* **378**, 2861 (2014).

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