Interactions between bosonic and fermionic metastable He atoms

J. F. BABB, ITAMP, Harvard-Smithsonian — Mixtures of spin-polarized metastable $^3$He atoms and $^4$He atoms are unique systems of current interest for studies of ultra-cold gases. The $s$-wave scattering length for collisions of $^4$He atoms was measured to be $^{4-4}a = 11.3 \text{ nm (±2.5, -1 nm)}$ [1] and recent calculations find $8 < ^{4-4}a < 12 \text{ nm [2]}$. The scattering length $^{3-4}a$ for fermion-boson collisions is presently indeterminate in sign and magnitude, but it has been predicted to fall in the ranges $^{3-4}a < -25 \text{ nm or } ^{3-4}a > 46 \text{ nm [2,3]}$. In this talk, with regard to improving the theoretical value of $^{3-4}a$, the data characterizing $^3$He($^2S$)$^3$S)–$^4$He($^2S$)$^3$S) interactions primarily in the molecular $^5\Sigma^+_g$ state are reevaluated and additional calculations are presented. Supported in part by the NSF. [1] S. Seidelin, et al., Phys. Rev. Lett. 93 (2004), 090409. [2] A. S. Dickinson, F. X. Gadéa, and T. Leininger, J. Phys. B 37 (2004), 587. [3] R. J. W. Stas, J. M. McNamara, W. Hogervorst, and W. Vassen, Phys. Rev. Lett. 93 (2004), 053001.