Tune-out Wavelength of $^4$He for the $1s2s\,^3S - 1s3p\,^3P$ Transition$^1$

JACOB MANALO, GORDON DRAKE, University of Windsor — Tune-out wavelengths are those where the dynamic polarizability of an atom is zero. Several applications include laser cooling, atomic clocks and quantum information, all for the Group II atoms [1]. Of the Group II’s, helium is a useful subject as it is the simplest atom of two electrons. According to Mitroy and Tang, the tune-out wavelength closest to the $1s2s\,^3S - 1s3p\,^3P$ transition for metastable helium can serve as a useful low energy probe of atomic structure [2]. Our calculation of this wavelength, employing a full Hylleraas basis set as well as mass polarization for $^4$He, is 0.110308298255(1) in reduced mass atomic units. In order to measure this tune-out wavelength, an interferometer is needed [2]. Methods of using laser beams as waveguides for matter waves have been explored, and such techniques can be applied to interferometry as stated by Baldwin et al. [3]. Our future calculations will include relativistic and QED corrections.


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