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Spin-independent interactions between fermions induced from the exchange of two light axion-like particles SHEAKHA ALDAIHAN, Indiana Univ - Bloomington, DENNIS KRAUSE, Wabash College- Purdue University, WILLIAM MICHAEL SNOW, Indiana University - Bloomington — Lab-based experiments have been extensively used to search for new macroscopic interactions originating from possible Weakly-Interacting Sub-eV Particles (WISPs). Spin-dependent experiments which search for spin-dependent interactions between fermions continue to set far less stringent limits than spin-independent searches for scalar and vector particles. A single pseudoscalar exchange gives rise to the same spin-dependent interaction for both derivative and Yukawa pseudoscalar couplings, thus limiting our ability to constrain specific models. We calculate the spin-independent potential due to the exchange of two light pseudoscalar bosons between two fermions with derivative couplings. In the massless limit, the spin-independent contribution falls off as $1/r^3$ for the Yukawa coupling, whereas we find that the derivative coupling yields a $1/r^6$ dependence, which differs from the $1/r^5$ dependence found in previous work [1]. Together, the spin-independent Yukawa and derivative coupling potentials can be used with experiments utilizing unpolarized test bodies to set tighter constraints on new pseudoscalar interactions, and allow one to distinguish the type of coupling if a new force is observed. [1] F. Ferrer and J. A. Grifols, Phys. Rev. D 58, 096006 (1998)

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