Using geoelectrons to search for velocity-dependent spin-spin interactions

LARRY HUNTER, DANIEL ANG, Amherst College — We use the recently developed model of the electron spins within the Earth to investigate all of the six possible long-range velocity-dependent spin-spin interactions associated with the exchange of an intermediate vector boson.\(^1\) Several laboratory experiments have established upper limits on the energy associated with various spin orientations relative to the Earth.\(^2\),\(^3\),\(^4\) We combine the results from three of these experiments with the Earth-spin model to obtain bounds on the velocity-dependent interactions that couple electron spin to the spins of electrons, neutrons and protons. Five of the six possible potentials investigated were previously unbounded. The bound achieved on \(V_8\) is about 30 orders of magnitude more restrictive in the long-range limit than the only previously established constraint.\(^5\)