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Using the Earth as a Polarized Electron Source to Search for Long-Range Spin-Spin Interactions

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Many extensions of the standard model of particle physics predict the existence of long-range spin-spin interactions. We have developed an approach which uses the Earth as a polarized spin source to investigate these interactions. We combine recent deep-Earth geophysics and geochemistry results with precise tabulations of the geomagnetic field to create a comprehensive map of electron polarization within the Earth. We examine possible long-range interactions between these spin-polarized geoelectrons and the spin-polarized electrons and nucleons in three laboratory experiments. By combining our model and the results from these experiments we establish new stringent bounds on torsion gravity and possible long-range spin-spin forces associated with the virtual exchange of either spin-one axial bosons or unparticles. The resulting bound on the spin-spin force between an electron and a neutron is one million times smaller than their gravitational attraction.