The fundamental nature of neutrinos, and using neutrinos to study the Earth

There are many important unknown properties of neutrinos, which creates exciting opportunities for future discoveries. It is possible that neutrinos are their own antiparticles, which may be an important part of the explanation for the excess of matter over antimatter in the universe. Observing neutrinoless double-beta-decay would show that neutrinos and antineutrinos are equivalent demonstrating lepton number violation. It could also allow us to determine the neutrino mass. Utilizing the now empty Sudbury Neutrino Observatory (SNO) cavern, the ”SNO+" experiment plans on adding nearly one ton of 150Nd to 1000 tons of liquid scintillator. SNO+ could also measure neutrinos coming from uranium and thorium decays in the Earth. These "geoneutrinos" allow us to directly measure the Earth's poorly understood uranium and thorium content, which is thought to provide the heat necessary to power mantle convection, plate tectonics, and earthquakes.