Abstract Submitted
for the DNP13 Meeting of
The American Physical Society

High-Purity Germanium Crystals Study for Underground Experiments[1] LU WANG, GANG YANG, JAYESH GAVONI, GUOJIAN WANG, HAO MEI, DONGMING MEI, The University of South Dakota, CUBED COLLABORATION — The main characterization is the measurement of electrical properties such as carrier concentration, carrier mobility, resistivity of germanium crystal, as well as to identify whether the crystal is n-type or p-type. Van der pauw Hall effect measurement is conducted at room temperature and 77K separately for measuring electrical properties for shallow level impurities. The results show that the ionized impurity level of crystals grown in our lab has reached about 10^{10} /cm^3. The accumulated data are applied with theoretical analysis. The study of mobility reveals the different scattering mechanisms involved with impurities and lattice vibrations of the crystal. Theoretical calculations have been performed with reasonable parameter assumption and then compared with experimental data. It is found that neutral impurity concentration constrains mobility at 77K while ionized impurity is within the acceptable range (below 10^{12}/cm^3) in germanium crystals. Mobility can increase significantly when neutral impurity concentration is below 10^{14}/cm^3. Therefore, a large reduction of neutral impurity is a desirable approach for obtaining larger mobility, which would improve timing response of germanium detectors.

[1]Sponsored by Department of Energy- DE-FG02-10ER46709 and the State of South Dakota.

Lu Wang
The University of South Dakota

Date submitted: 31 Jul 2013 Electronic form version 1.4