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Lucas Cell Simulation using Geant4

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Since 2018, the SNO+ experiment has been using Lucas Cells to measure the radon concentration in the water cavity and its cover gas system. SNOLAB has also performed radon emanation measurements from materials with Lucas Cells. These scintillation counters are primarily sensitive to alpha particles, notably those emitted from radon and its progeny. Photomultiplier tubes (PMTS) are then able to detect the light emitted by the silver doped zinc sulfide scintillator, originating from the individual alpha decays. The counting efficiency of these cells has been measured but the value provided doesn't match our radon board's efficiency. To assess this counting efficiency, I constructed a Lucas Cell model in a Monte-Carlo based physics simulation toolkit, Geant4. The Lucas Cell geometry was formulated using the Geometry Description Markup Language (GDML) and FreeCAD. A radioisotope decay timing model was devised for radon's relevant alpha emitting progeny. Further, the silver doped zinc sulfide scintillator was characterized and the counting efficiency was calculated. This software tool and its results will help guide further Lucas Cell based radon assay research and refine current radon measurements.

What area of study best describes your talk?

Physics

If you answered 'Other', please provide the study area.

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