PURDUE UNIVERSITY | School of Nuclear Engineering

Nuclear Engineering Seminar

Dr. Adam Hecht, PhD

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Adam Hecht is a professor in the Department of Nuclear Engineering at the University of New Mexico, where's he's been since 2008. He earned his PhD in Physics at Yale, with a focus on low energy nuclear physics beam experiments, and did a post-doc at Argonne National Laboratory in the Physics Division in similar research, on nuclear structure and nuclear astrophysics. His current research is on radiation detection, including making detectors, novel detector materials, detection algorithms, and collecting basic data on fission.

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3:30pm | Webex

Imaging within multi-ton used fuel storage casks using natural muon background radiation.

Abstract

Muons are created up to several GeV in the atmosphere by cosmic rays and at just 200 MeV/c2 mass they're very relativistic. These extremely fast particles are highly penetrating, they're passing through you right now at about 1 per second in the area the size of your hand. Maybe 100 tear through your head in the time you're reading this. Even so, they're charged particles and do have some Coulomb interaction with the material they're passing through, diverting their path by a very small angle or even stopping in the material. This has allowed muons to be used to image the pyramids in Egypt to look for unknown chambers.

Using these highly penetrating, naturally occurring particles allows us to image within other objects that x rays won't penetrate: Used nuclear fuel dry storage casks. Using stacks of gas filled drift tubes, which show small pulses from ionization when the charged muons pass through, we have been analyzing imaging data taken on a partially filled used fuel storage cask at INL to determine areas of missing fuel bundles. This can be used for materials verification in these several meter thick, many ton casks that are extremely difficult to open for verification. We've extended this to multi-angle analysis to perform muon tomography on the cask. We have been performing recent work to improve imaging techniques and algorithms, including multi slice imaging from a single direction to extract three-dimensional images (much like a plenoptic camera), and imaging from several angles for traditional tomography.