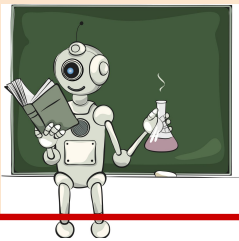
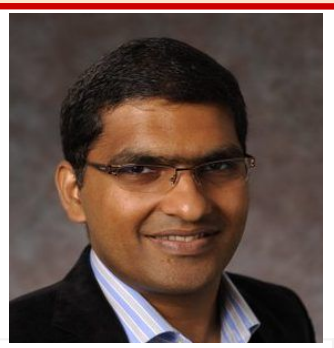
DIDACTS: Data-Intensive Discovery Accelerated by Computational Techniques for Science (didacts.org)





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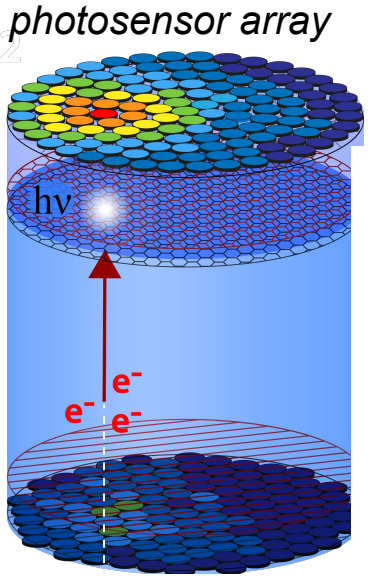
Challenge: Physical sciences are at a tipping point as current machine learning methods do not adequately address their needs



How to incorporate the physics we *know* (particle physics) into machine learning such that it can uncover the physics we *don't know* (dark matter)?

How to detect extreme rare events from the weakest phenomena in the Universe (dark matter) using sensor-based particle detectors?

Inverse problem formulation

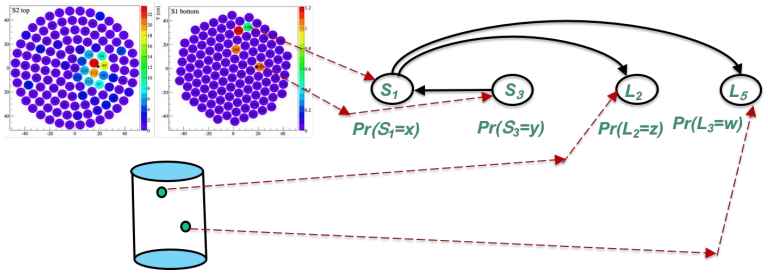
- Does not require (labeled) training data;
- Has a rich history in disciplines/areas such as seismology, x-ray scattering, etc.

Graph-regularized Inverse Problem…

Two ingredients:...

- "Sparsity" particle interactions per event
- Spatially varying correlations between different photosensors

Probabilistic modeling of sensors, events & relations through *Sparse and Constrained Graphical Models*



Nodes: Random Vars: Sensors & Tank Regions

Edges: Interdependence among Sensors/Regions/Events

Introducing Domain Knowledge via: *Priors; Distributions; Interdependency constraints*