APS Scientific Computation Seminar Series

Speaker:	Daniel Orban Graduate Student University of Minnesota
Title:	Visually Navigating High-Dimensional and Complex Parameter Spaces
Date:	Monday, March 15, 2021
Time:	1:00 p.m. (Central Time)
Location:	https://bluejeans.com/653541532
Hosts:	Nicholas Schwarz and Mathew Cherukara

Abstract:
In this talk, I will discuss current visual approaches for exploring shock physics data sets. Both research and industry have embraced the hope of using Big Data (extremely large, heterogeneous, and unstructured datasets) to solve complex problems using statistical methods like artificial intelligence or machine learning. Unfortunately, these computational algorithms are black boxes that provide answers without the important explanations required for developing hypotheses. Interactive visualization offers the promise of adding intuition to Big Data, however, current approaches do not scale to the large data sizes, high-dimensionality, and ill-defined complexity.

This is especially true for experimental shock physics workflows where there are many parameters, several different types of data sets, complex technical challenges, and increasing data sizes. In fact, soon these experiments will be performed faster with orders of magnitude more data, which necessitates the development of automated processing and prompt display tools. It is important, therefore, for experimental workflows and visualization techniques to adapt to meet the demands of the next generation of shock physics experimental facilities.

I will first provide an overview of Cinema:Bandit, a tool that enables experimentalists to visualize and simultaneously navigate many data points during an experiment. Using the Cinema framework, developed at Los Alamos National Labs, experimentalists are able to flexibly integrate their complex workflows into our web based tool. Cinema:Bandit uses a parallel coordinate chart and multiple linked views to help inform decisions by scientists, optimizing their use of time at the beamline facility. I will then briefly discuss visualization techniques that enable the understanding of complex and high-dimensional parameter spaces. I will describe these techniques, which analyze relationships between input and output spaces, within the context of shock physics applications. Here I will show how interactive visualization combined with data driven algorithms (e.g. machine learning) adds intuition to high-dimensional data sets.