



The Institute for Shock Physics SEMINAR SERIES *Presents*

Quantitative X-ray Phase Contrast Imaging for Dynamic Experiments at Coherent X-ray Light Sources

David Montgomery

Los Alamos National Laboratory (retired)

X-ray radiography has been used for decades in dynamic experiments to measure material flow in extreme conditions via absorption of x-rays propagating through materials. Image contrast in traditional radiography is determined by the absorption coefficients and areal densities of the materials at a given x-ray wavelength, and often limits these measurements to materials with sufficiently high atomic numbers and density, while low-Z materials and small areal density variations are either completely transparent or not sufficiently visible in the image. Coherent x-ray sources, such as those found at synchrotrons and x-ray free-electron lasers, provide new opportunities for imaging dynamic experiments due to their high spatial and spectral coherence, high brightness and short temporal duration ($\ll 100$ ps).

Phase sensitive techniques, such as x-ray phase contrast imaging (XPCI), rely on the overlap and interference of the x-rays due to spatial variations in their transmitted phase, and are enabled primarily by the high spatial coherence of the x-ray source. Objects that are otherwise transparent to x-rays can be imaged with XPCI, and small variations in areal density become visible that would not be observable with traditional radiography. In this two day series of lectures, an overview of XPCI and image formation theory will be given, and current applications of this technique in shock physics, material dynamics, and high energy-density physics will be presented on Day 1. Related applications of neutron phase contrast imaging with cold neutron sources will also be presented. On Day 2, quantitative phase retrieval methods and algorithmic approaches will be presented, as well as example algorithms.

Part I:

Thursday, July 18 || 9:00 AM – 12:00 PM (Pacific)

Zoom Meeting ID: 916 5855 2209 || Passcode: WSUISP

Part II:

Friday, July 19 || 9:00 AM – 12:00 PM (Pacific)

Zoom Meeting ID: 960 2681 5378 || Passcode: WSUISP

