

Abstract ID: 17299 Title: X-ray Phase Sensitive Imaging Methods

The basic principles of image formation and interpretation in x-ray imaging, including x-ray computed tomography (CT), have remained essentially unchanged since Roentgen first discovered x-rays in 1895. As a result, absorption contrast is the sole contrast mechanism for x-ray biomedical imaging, unlike some other imaging modalities such as magnetic resonance imaging (MRI) where multiple contrast mechanisms are available for use in clinical practice. In recent years, tremendous progress has been made in exploring other contrast mechanisms in x-ray imaging by studying their wave nature. These methods have been classified as x-ray phase sensitive imaging methods. To enable practical medical applications, the research of x-ray phase sensitive imaging methods must overcome the limitations of the requirement of highly temporally and spatially coherent x-rays. Recently, using laboratory x-ray tubes, several x-ray wave imaging methods have been successfully developed, including in-line holography, diffraction enhanced imaging (DEI), and differential phase contrast computed tomography (DPC-CT).

The overall objective of this symposium is to present the AAPM community with an overview of x-ray phase sensitive imaging methods including basic physics, basic implementation methods, pros and cons for each implementation method, and future research directions. The symposium consists of four lectures presented by invited speakers and a panel discussion with the audience at the end of the symposium.

Dr. Guang-Hong Chen will be presenting an overview of basic x-ray wave physics and other research directions not covered by the other three invited speakers.

Dr. Dean Connor will be presenting the basic principles and applications of diffraction enhanced imaging method (DEI). The most promising application is breast imaging, for which DEI has improved feature contrast relative to conventional mammography and could significantly reduce dose. Though DEI was first implemented only at synchrotron research facilities, Dr. Connor and his collaborators have developed an x-ray tube-based DEI system. He will discuss progress towards a clinical DEI mammography system.

Dr. Hong Liu and Dr. Xizeng Wu will be presenting the basic principles, newly developed prototype systems and results of experimental investigations on x-ray in-line phase contrast; as well as quantitative phase retrieval imaging methods.

Dr. Joseph Zambelli will be presenting basic principles and applications of differential phase contrast computed tomography imaging. Fundamentals of system design, measurements of performance on an experimental system, and comparisons this new imaging technique with conventional absorption imaging will be presented. Technical details such as of the fabrication of the specialized x-ray phase and absorption gratings and unique system requirements imposed by the technique will also be discussed.

