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HIGH RESOLUTION X-RAY SPECTROSCOPY AND ATOMIC PHYSICS OF HIGH ENERGY DENSITY PLASMAS USING TRANSMISSION-CRYSTAL SPECTROMETERS IN THE 6-100 KEV ENERGY RANGE

John Seely

Artep Inc., Ellicott City, Maryland, USA
The National Institute of Standards and Technology, USA

Transmission crystal spectrometers have been fielded at the USA National Ignition Facility and other major international laser and pulsed-power facilities for the purpose of recording spectra in the >6 keV energy range for studying the atomic physics and diagnostics of hot, dense plasmas. Spectrometer sensitivities and spectral resolving powers have been measured at the NIST national standard X-ray calibration facility. This presentation will describe on-going efforts to experimentally demonstrate high resolving power (>12,000) using a compact spectrometer geometry that is compatible with major laser and pulsed-power facilities. Resolving power of 12,000 has already been experimentally demonstrated using the 8 keV Cu and 22 keV Ag K lines, with the capability for 20,000 resolving power with 0.5 m long spectrometer geometry. Experimentally measuring such high resolution requires the careful measurement of the detector spatial resolution, for example of photostimulable image plates and scanners, and of the source broadening of the spectral lines resulting from natural lifetime broadening and other effects. These techniques have been developed and experimentally demonstrated at NIST. The use of these spectrometers at major laser and pulsed-power facilities for high-resolution spectroscopic diagnostics and atomic physics of energetic plasmas will be described.

Biography

John Seely after completing his PhD in Physics and several Post-doctoral appointments joined the Naval Research Laboratory in Washington DC USA in 1977 and was the Head of the Space Science Division's UV and X-Ray Spectroscopy Section prior to his retirement from NRL in 2011. During that time he was Principal Investigator on numerous projects funded by ONR, NASA, NOAA, DOE, NSA, and other government agencies. He also participated in many projects in the NRL Plasma Division and other divisions. He is the author or co-author of 274 papers in refereed scientific journals and holds seven patents in EUV and X-Ray technology. He is author of the chapter on multilayer optics for space telescopes in the book observing photons in Space (2010, ESA Communications Productions). He originated the concept of fielding high resolution hard X-ray spectrometers using transmission crystals at large laser facilities to record the K shell and L shell spectra from heavy elements.

seelyjf@gmail.com