The rapidly advancing field of high energy density physics as a frontier science incorporates many different subdisciplines. Since 2006, we have been supported by NNSA and made it a priority to train students in radiation, atomic and plasma physics to contribute in creating the future workforce needed by NNSA laboratories, and to advance in z-pinch physics and relevant subdisciplines. During the last six years, 10 graduate students have been supported; five graduate students and three undergraduate students were involved in this research during 2012. From our recently graduated students, Kenneth Williamson began working for Sandia National Laboratories (SNL) in 2012 and Nicholas Ouart continues his second year at the Naval Research Laboratory.

The year 2012 was very productive. Twelve papers were published, five of which were authored by current and former graduate students. In particular, graduate student Michael Weller published his research on radiative properties of mixed nested cylindrical wire arrays in collaboration with SNL and interdisciplinary research on extreme ultraviolet (EUV) spectroscopy and modeling of copper on the Spheromak and the compact laser plasma facility in collaboration with Lawrence Livermore National Laboratory. Graduate student Glenn Osborne completed his PhD studies on investigations of tungsten-based z-pinch planar wire arrays, and two undergraduate students earned their physics degrees.

The increase in current from 1 MA to 1.7 MA on the university-scale z-pinch generator Zebra at the University of Nevada, Reno (UNR) has allowed for experiments with implosions of larger sized wire arrays. These have provided enhanced energy coupling in plasmas and better diagnostics access. In particular, the results of the recent simulations and experiments with multiplanar wire arrays (PWA) from outer planes made from nickel (to create an effective L-shell radiator) placed at the larger distance and half-empty middle aluminum (Al) plane (to create K-shell Al plasma that will influence radiation from outer planes) are highlighted in Figure 1. They represent an excellent set of data to advance the subdisciplines of radiation physics (how the mixture of two plasmas radiate), plasma physics (why a hot precursor was formed that was never observed before in PWAs), and laboratory astrophysics (how plasma flow is affected by the initial internal magnetic field and what is the nature of observed standing shocks).

The study of a new compact hohlraum configuration with PWA sources, unique for university-scale generators, continues on Zebra. Magnetically insulated double PWA sources in cages showed well-synchronized implosions and x-ray bursts. A numerical simulation capability using VisRaD (from PRISM company) code established at UNR allowed the study of hohlraum coupling physics and the possibility of its design optimization. The radiation temperature $T_R$ of the hohlraum central cavity with re-emission target was measured using cross-calibrated filtered EUV Si-diodes. Experimental $T_R$ (from 42 eV to 55 eV) was in favorable agreement with $T_R = 38$ eV from the simulation. The first results of theoretically optimizing a new compact hohlraum indicated $T_R$ increased by 1.15 times and x-ray power flux increased by 1.7 times.

Though selected topics mentioned above constitute two important directions of our studies, during the last year our research on Z-pinch physics was broader and included more topics that were developed and presented at four conferences and a symposium.