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Development of High Fluence, High Conversion Efficiency X-Ray Sources at the National Ignition Facility[1]

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Laser heated millimeter scale targets have provided recently some of the most powerful and energetic laboratory sources of x-ray photons (E = 6 - 24 keV) with high fluence and conversion efficiency (CE). These sources have included the K-shell of stainless steel (E = 5-9 keV) from cylindrical cavities having a CE of $\sim$ 6.8 having a CE of $\sim$ 1.6a CE of $\sim$ 16The x-ray power and CE are dependent upon the peak electron temperature in the radiating plasma created from these underdense (n_e < 0.25 n_c) sources. The temperature can be limited by the available laser power and energy which can cause the fluence and the CE to be suboptimal especially for high Z K-shell sources. Cavity targets require several nanoseconds for the underdense plasma to fill the cavity but do have an increase in temperature and emission at late time from plasma stagnation on axis. In contrast the gas or foam targets heat volumetrically to an underdense source in less than a nanosecond which can be more efficient. Both the experimental and simulation details of these high fluence x-ray sources will be discussed.

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