HIGH ENERGY DENSITY PHYSICS RESEARCH AT THE NEVADA TERAWATT FACILITY*

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The Nevada Terawatt Facility (NTF) consists of a 1 MA, 2 Z-pinch, carrying out 350 shots a year, and a 50 TW, 350 fs, one micron glass laser. Plasma diagnostics include a multiframe laser probe, optical and x-ray imaging, particle diagnostics, and x-ray spectroscopy. More recent diagnostic developments include UV shadowgraphy and UV interferometry. The NTF generates TW x-ray bursts, megagauss magnetic fields, and magnetized laser plasmas, including astrophysical relevant plasmas.

We have carried out experiments and theory involving plasma penetration across a magnetic field. We investigated several regimes of the magnetic Rayleigh-Taylor instability, which is ubiquitous in both laboratory and astrophysical plasmas. In our experiments, measured spectra show cascading to both short and long wavelength, consistent with theory. Conical array experiments have also been undertaken at the NTF to study shear flow stabilization of MHD instabilities Several experiments have been undertaken with wire array loads. Shaped x-ray pulses on planar wire arrays have produced nearly 20 KJ of energy and nearly one TW of power. Star wire arrays have shown similar x-ray production,

Given the wire array results and other results, the Z-pinch and glass laser system at the NTF provide an opportunity to replicate conditions inside the NIF target chamber. This is because both provide harsh environments where forces, energy, debris and EMP are significant. We will show the preliminary results of solid debris collection (molten or condensing), behavior of aerogels in Z-pinches and x-ray assisted aerosol generation.

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