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Science on the Texas Petawatt Laser

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We are presently nearing the completion of the construction of a high peak power, ultrafast laser which will deliver powers well in excess of 1 petawatt (1015 W). This laser, the Texas Petawatt Laser, will be the highest power laser in the world when complete in the coming weeks. In my talk, I will report on the progress of the laser, including the technology used to access such high powers and peak irradiances. When complete, the laser will deliver 150 fs pulses with pulse energy exceeding 200 J. Using pulse shaping technology and broad band amplification on the front end, this laser will demonstrate petawatt technology in Nd:glass amplifiers at a pulse duration shorter than other Nd:glass-based petawatt facilities around the world. With this unique pulse characteristic, the Texas Petawatt will have application in a number of scientific areas. These applications include bright, ultrafast neutron generation and the study of hot dense plasmas with pressures exceeding 1 Gbar. The laser will also produce focused intensities exceeding 1021 W/cm2, intensity at which light-matter interactions take on many exotic characteristics. I will present an overview of many of these science applications with a particular eye toward describing the first campaign of experiments planned for this year.