

Successful “temporal” seeding of the regenerative amplifier cavity results in a cavity Q-switch pulse envelope segmenting into shorter pulses, each having the width of the input seed, and having a uniform temporal separation corresponding to the cavity round-trip time of ≈ 10 ns. The pulse energy is allowed to build on successive passes in the regenerative amplifier cavity until a maximum is reached, (when cavity gains and losses are equal), after which the pulse is electro-optically switched out on the next round trip.

The overall gain of the amplifier is ≈ 82 dB (or a factor of 1.26 million). After directing the amplified output through a LBO frequency doubling crys-

tal, ≈ 2.1 W of 532-nm output (>1 mJ) was measured. This corresponds to a nonlinear conversion efficiency of $>60\%$. Furthermore, by pulse pumping this system, a single pulse per laser shot can be created for the SLR (satellite laser ranging) measurement, and this can be ejected into the instrument. This is operated at the precise frequency needed by the measurement, as opposed to commercial short-pulsed, mode-locked systems that need to operate in a continuous fashion, or CW (continuous wave), and create pulses at many MHz. Therefore, this design does not need to “throw away” or dump 99% of the laser energy to produce what is required; this system can be far smaller, more efficient,

cheaper, and readily deployed in the field when packaged efficiently.

Finally, by producing custom diode seed pulses electronically, two major advantages over commercial systems are realized: First, this pulse shape is customizable and not affected by the cavity length or gain of the amplifier cavity, and second, it can produce adjustable (selectable) pulse widths by simply adding multiple seed diodes and coupling each into commercial, low-cost fiber-optic combiners.

This work was done by Barry Coyle of Goddard Space Flight Center and Demetrios Poullos of American University. Further information is contained in a TSP (see page 1). GSC-16550-1

X-Ray Diffractive Optics

Goddard Space Flight Center, Greenbelt, Maryland

X-ray optics were fabricated with the capability of imaging solar x-ray sources with better than 0.1 arcsecond angular resolution, over an order of magnitude finer than is currently possible.

Such images would provide a new window into the little-understood energy release and particle acceleration regions in solar flares. They constitute one of the most promising ways to probe these regions in the solar atmosphere with the sensitivity and angular resolution

needed to better understand the physical processes involved.

A circular slit structure with widths as fine as 0.85 micron etched in a silicon wafer 8 microns thick forms a phase zone plate version of a Fresnel lens capable of focusing ≈ 6 keV x-rays. The focal length of the 3-cm diameter lenses is 100 m, and the angular resolution capability is better than 0.1 arcsecond. Such phase zone plates were fabricated in Goddard’s Detector Development Lab. (DDL) and

tested at the Goddard 600-m x-ray test facility. The test data verified that the desired angular resolution and throughput efficiency were achieved.

This work was done by Brian Dennis and Mary Li of Goddard Space Flight Center and Gerald Skinner of the University of Maryland. For further information, contact the Goddard Innovative Partnerships Office at (301) 286-5810. GSC-16418-1