Parabolic mirrors concentrate sunlight to power lasers

September 12 2011

Legend tells of Greek engineer and inventor Archimedes using parabolic mirrors to create "heat rays" to burn the ships attacking Syracuse. Though the underpinnings of that claim are speculative at best, a modern-day team of researchers at the Scientific and Production Association in Uzbekistan has proposed a more scientifically sound method of harnessing parabolic mirrors to drive solar-powered lasers.

Small scale analogs of giant reflector telescopes, these proposed ceramic lasers would convert an impressive 35 percent of the Sun's energy into a laser light, providing a considerable increase in the maximum power produced by current-day solar pumped lasers, which typically achieve only a 1-2 percent efficiency.

As outlined in the AIP's *Journal of Renewable and Sustainable Energy*, the new solar lasers would concentrate light with a small parabolic mirror 1 meter in diameter that has a focal spot approximately 2-3 centimeters in diameter. The concentrated light would then strike a two-layer ceramic disk known as a Neodymium and Chromium co-doped YAG (yttrium aluminum garnet) laser material.

One side of the disk would have a highly reflective coating; the other side would be anti-reflecting. When sunlight penetrates through the ceramic material, it excites the electrons in the material, causing them to emit laser light of a specific wavelength (1.06 micrometers). To control the searing heat produced by the concentrated sunlight, the ceramic disk would be mounted atop a heat sink through which water would be

pumped.

The laser light would then travel to a prime focus and be reflected back to the ceramic surface before exiting the solar collector at an oblique angle. It's this "double pass" path that produces the gain in efficiency, enabling a greater fraction of sunlight to be converted into laser light. Potentially, parabolic reflector lasers could be harnessed for the large-scale synthesis of nanoparticles and nanostructures.

More information: "Transformation of concentrated sunlight into laser radiation on small parabolic mirrors" by Shermakhamat Payziyev et al. is accepted for publication in the *Journal of Renewable and Sustainable Energy.*

Provided by American Institute of Physics