

# 2010 R&D 100 Award Winner

## HIGH-SPEED IMAGER FOR FAST, TRANSIENT EVENTS AT NIF

The grating-actuated transient optical recorder (GATOR) is an instrument designed to capture and record fleeting, sequential images of x rays and other radiation emitted from the miniature "stars" created in the National Ignition Facility's (NIF's) laser target chamber. The instrument can provide the necessary time resolution in picoseconds to record ignition events, enabling scientists to better understand the physical processes occurring in these experiments.

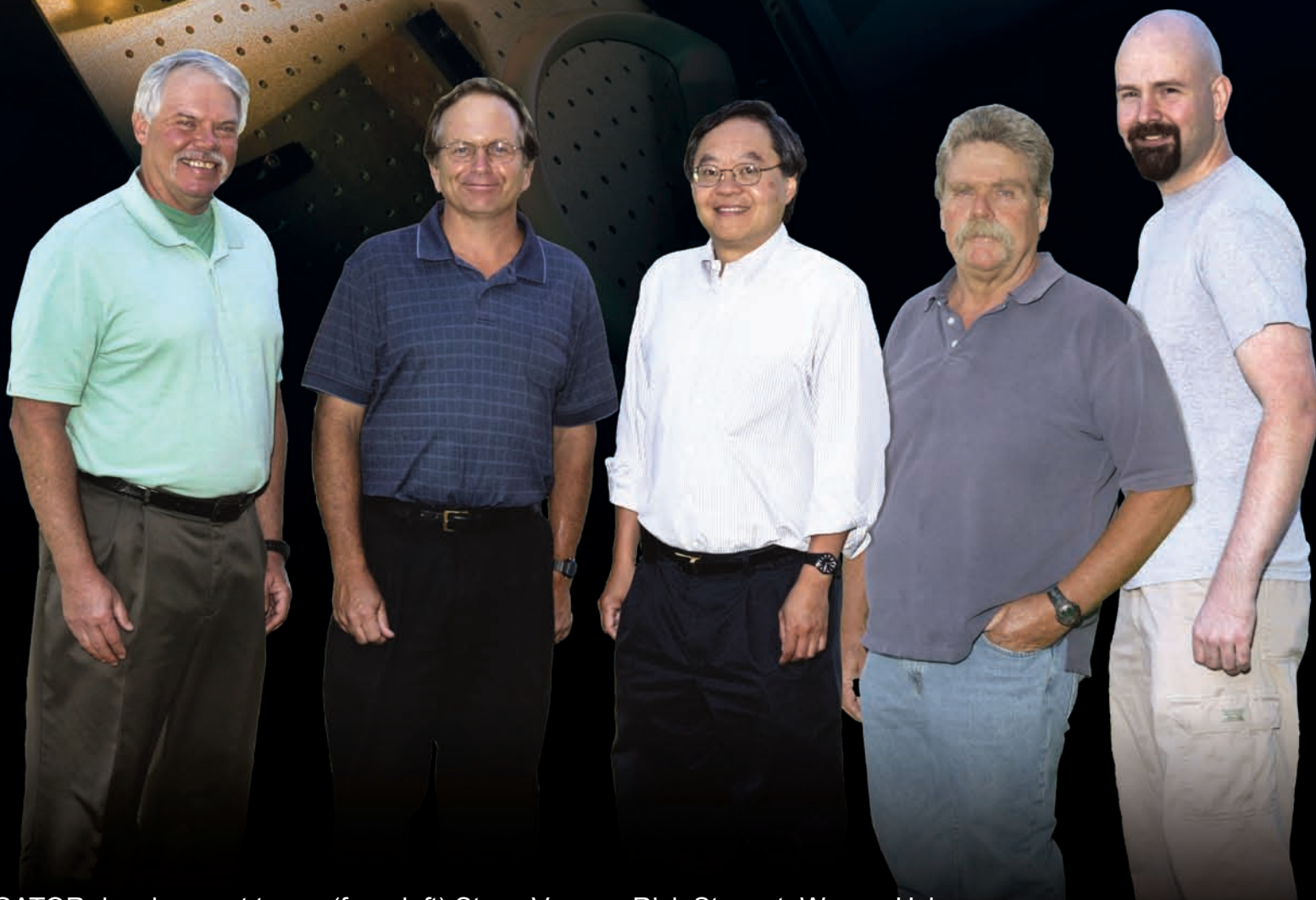
### A New Concept to Record Ignition

An entirely new concept for high-speed imaging, GATOR encodes two-dimensional x-ray or optical images onto coherent light. Because the radiation conversion process is done optically, GATOR does not use charged particles and thus does not suffer from the fundamental space-charge limitations of commercial electro-optical systems, which can restrict a system's speed, spatial resolution, and dynamic range. In addition, because GATOR can convert x rays and other types of radiation to coherent optical radiation, which can be transported and recorded remotely, the instrument can operate in an environment with radiation levels that would almost certainly disable or destroy conventional detectors installed near an igniting capsule.

### Future Applications

A flexible system, GATOR can be adopted for any application in which very fast, high-power energy sources are used or created, including high-power lasers, free-electron x-ray lasers, and high-energy-density objects. GATOR will allow detailed measurements to be taken of the ignition conditions involved in studying the high-energy-density physics of thermonuclear burn, advancing scientific understanding of stars and furthering stockpile stewardship.

The grating-actuated transient optical recorder (GATOR) is designed to acquire sequential images of x rays or optical light in a trillionth of a second or faster during experiments on the National Ignition Facility.



The GATOR development team: (from left) Steve Vernon, Rick Stewart, Warren Hsing, Mark Lowry, and Paul Steele. (Not shown: Susan Haynes.)