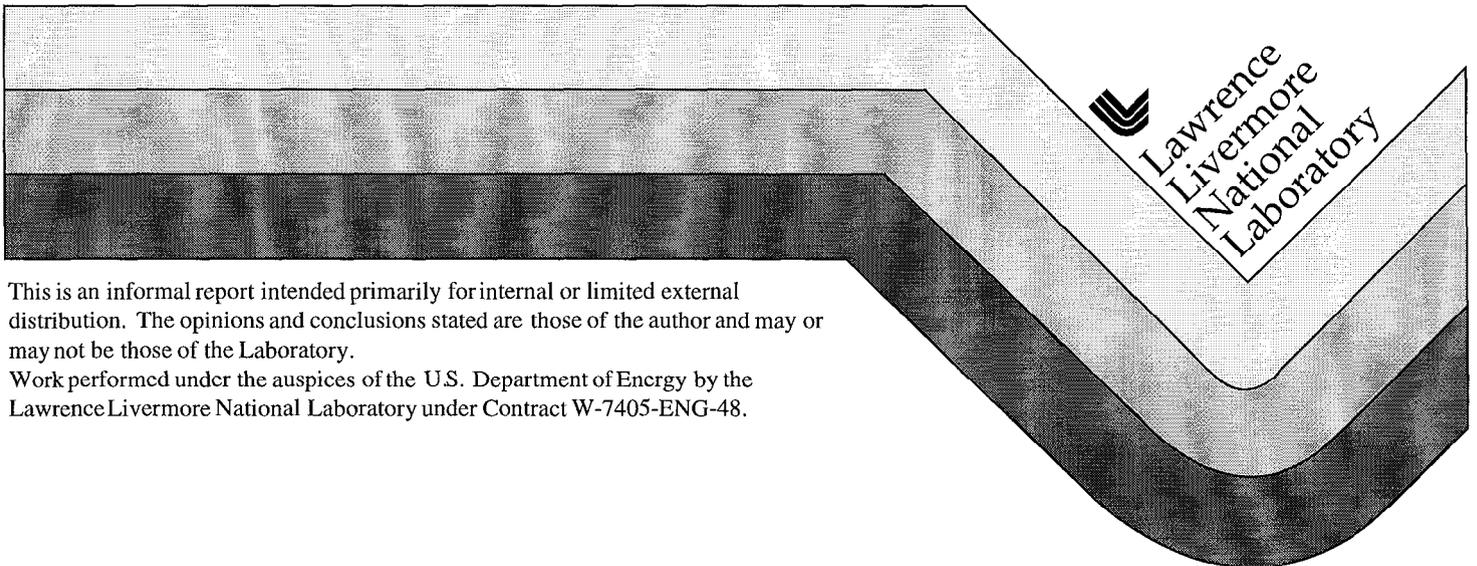


Extreme States of Matter on Nova

B. A. Remington

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Final Report: 98-ERI-009
Extreme States of Matter on Nova
Bruce A. Remington, Principal Investigator

This is the final report for the LDRD 98-ERI-009 involving Lasers, and MRI to develop dynamic diffraction experiments to diagnose shocked solid-state lattices on intense lasers such as the Nova and Trident lasers. This was in collaboration with the UC San Diego, Univ. of Oxford, and LANL. During this period, we have developed successful dynamic diffraction experiments on (111) and (400) Silicon lattices, both on the Nova laser and on the Trident laser. We also developed simultaneous transmission Bragg diffraction measurements off orthogonal lattice planes, to look for evidence of the transition to 3D. No evidence for lateral lattice adjustment was observed for (400) Si, which is a theoretical puzzle still under active investigation.

These experiments have received high visibility, with several publications, and 16 conference presentations, several of which were invited talks. Copies of the papers are attached, and the full publication list resulting from this LDRD work is given below.

In anticipation of the closing of the Nova laser, we have successfully proposed transferring these dynamic diffraction experiments to the Omega laser at the Univ. of Rochester under the NLUF Program and will continue using the Trident laser at LANL.

The goal of this endeavor was to technically assess whether dynamic diffraction could be developed into a robust diagnostic of solid-state lattices under shock loading. Successful observation of shock compressed lattices in the direction of shock propagation in Si have been observed. Development of a diagnostic to observe the transition to 3D is on-going, with this work continuing on the Omega and Trident lasers.

PUBLICATIONS:

“Transient x-ray diffraction used to diagnose shock compressed Si crystals on the Nova laser,” D.H. Kalantar, E.A. Chandler, J.D. Colvin, R. Lee, B.A. Remington, S.V. Weber, L.G. Wiley, B.H. Failor, A. Hauer, J.S. Wark, A. Loveridge, M.A. Meyers, and G. Ravichandran, *Rev. Sci. Instrum.* **70**, 629 (Jan. 1999).

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