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Progress in 2012-2013 on HEDLP LAB 11-583 Eagle Nebula

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Disclaimer

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Contribution to Progress Report by Marc Pound (U Maryland) on companion HEDLP effort

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May 10, 2013

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2. Accomplishments

- What are the major goals of the project?
- What was accomplished under these goals?
- What was done?
- What was learned?

In the companion LLNL-led Eagle Nebula effort (Figure {Eagle}), experiments to characterize a multi-hohlraum "Long Duration Radiator" source at the Omega EP laser remain on schedule for June 2013. These experiments are being performed by a collaboration between HEDLP Eagle Nebula, Roberto Mancini's and Bob Heeter's photionization project, and CEA, who will field their µDMX spectrometer.

1. General Atomics and Sandia have tested manufacturing the 'hohlraums' (holes drilled in blocks of Cu), and tested a 4 mg/cc hohlraum foam fill (TPX). HYDRA radiative hydro simulations suggest the foam will eliminate glint and give a smooth drive when the hohlraums are shot at EP. The TPX process turns out to be chemically compatible with Cu (our first choice, SiO2, was not.) Two tube sizes will be used: 1.1 mm radius by 2 mm long, and 1.4 mm radius by 2.8 mm long.

2. At Omega EP we will carefully characterize the multi-hohlraum source with the µDMX spectrometer and VISAR.

3. Mancini and Heeter will field a simplified Fe photoionization target as a first try at applying the source to a physics package; their target is stood off several mm from the source, the same as an Eagle Nebula target will be.

4. HYDRA simulations suggest that the same simple multi-hohlraum experiment could be performed at NIF with the 1.4 mm diameter tube, using one quad (10 kJ), versus 3.3 kJ at EP. This NIF experiment would be relatively easy to field, featuring a robust target and a few standard diagnostics. Initial discussions with NIF are underway.

5. We have proposed further LBS shots at Omega EP in FY14 to shoot and sidelight two candidate foam targets for clumpy Eagle Nebula NIF targets.

6. We have identified a 3D LLNL code, ARES, that could be used to model the Eagle Nebula, and could also improve and simplify our modeling of the laser experiments. A key potential advantage of ARES is Automatic Mesh Refinement (AMR).

- How have the results been disseminated to communities of interest?

A summary of progress on the Eagle Nebula to date is being written and will be distributed to interested members in the community, including Mark Krumholz at UC Santa Cruz, Christopher McKee at UC Berkeley, and Caroline Kuranz at U Michigan.

- What do you plan to do during the next reporting period to accomplish the goals?

If selected, a new round of LBS shots at Omega or Omega EP will be developed to study foam target foam concepts. We will develop designs for NIF shots. We will assess the ARES code.

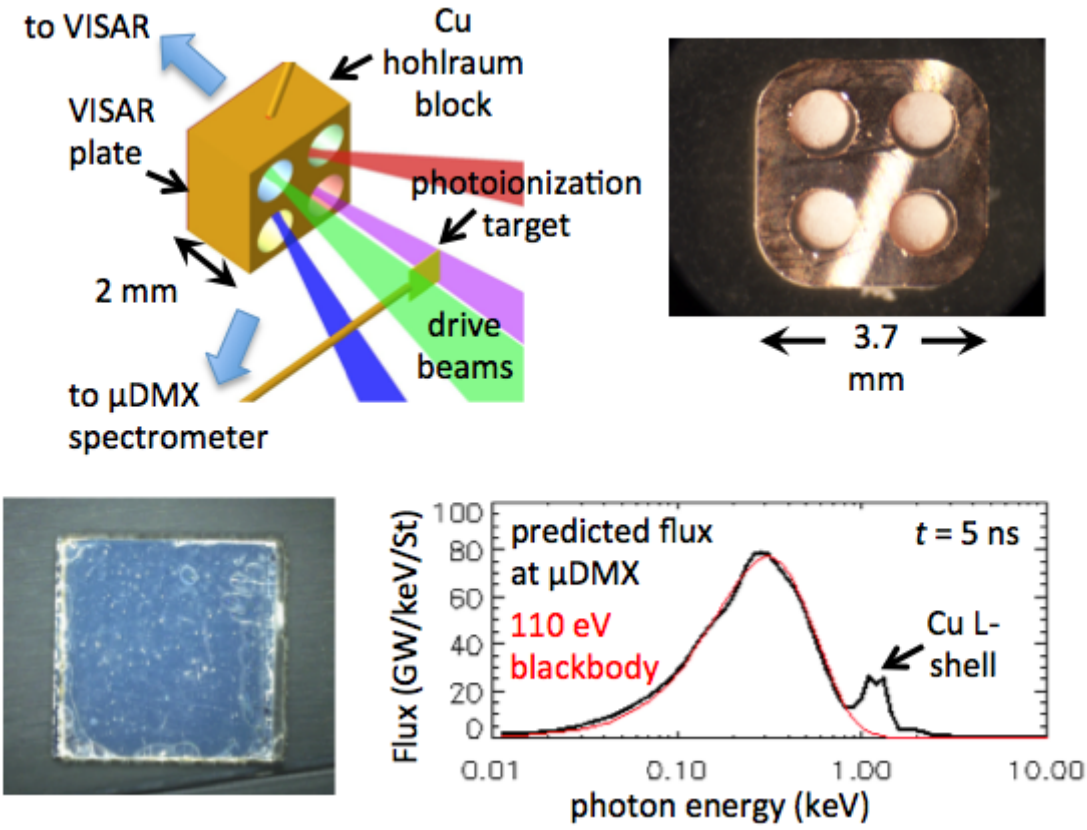

Figure {Eagle}. *LBS Long Duration Radiator experiment. Top left: VisRad design view showing (time-staggered) drive beams and major target components. VISAR plate consists of 50 μm CH covering back end of tubes, backed by quartz window. Top right: photograph of hohlraum source with 4 mg/cc TPX foam fill (white) in tubes. Bottom left: photograph of CH:Al VISAR plate. Bottom right: HYDRA prediction of spectral flux at μDMX spectrometer. Red is flux from 110 eV blackbody, for comparison*

4. Participants and other collaborating organizations

- What individuals have worked on the project?
  - ✓ Graduate Students (names, FTE's)
  - ✓ Postdocs (names, FTE's)

David Martinez, a postdoc at LLNL, is running the LBS experiments and participating in planning for NIF experiments. Martinez is participating at 25% time.

- ✓ Co-Investigators & Collaborators (names, FTE's)

Bob Heeter at LLNL and Roberto Mancini at the University of Nevada, Reno, are fielding the Fe photoionization sample in the LBS experiments. Dr. Heeter is assisting with coordination of the LBS experiments. Heeter and Mancini are separately funded collaborators. Alexis Casner, an unpaid collaborator at CEA France is fielding CEA's µDMX spectrometer at the LBS shots. Dr. Kane also works with Dr. Casner on the Science on NIF Ablative RT NIF shots, where Dr. Kane is the LLNL designer.

6. Change/Problems

- Changes in approach and reasons for change
- Actual or anticipated problems or delays and actions or plans to resolve them

Most Science on NIF shots have been delayed due to general programmatic and budget concerns. Our response has been to concentrate in the 1st year on the LBS Long Duration Radiator shots at Omega EP and on NIF planning.

Restrictions on Federal funded travel prevented Dr. Kane from presenting the Eagle Nebula work at the APS Division of Plasma Physics meeting in 2012. This conference is a standard venue for HED work.