Microdot Expansion Trajectories in Long-Scale-Length Plasmas on OMEGA

R. S. Craxton, S. P. Regan et al.
University of Rochester
Laboratory for Laser Energetics

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Laboratory for Laser Energetics
University of Rochester
Summary

A novel spectroscopic diagnostic is used to characterize long-scale-length plasmas on OMEGA

- The diagnostic provides trajectories and time-resolved line ratios of ablated microdots in the blowoff plasma.
- Spectroscopic results are mostly in agreement with SAGE modeling.
- There is some indication that the ablation of microdot tracer materials is delayed relative to simulations.

Subsequent papers describe the use of these plasmas to study NIF-relevant plasma instabilities.
Outline

- *SAGE* simulations of long-scale-length plasmas on OMEGA
- Spectroscopic diagnostic
- Comparison between experiments and *SAGE/FLY* modeling
  - microdot trajectory
  - line ratios of *K*-shell emission
The long-scale-length plasma design uses six OMEGA beams as overlapped interaction beams.
The corona temperature depends strongly on the interaction-beam focusing conditions.
The overlapped interaction beams see a large plasma that they heat.

(a) $t = 1$ ns, $P (62^\circ)$
(b) $t = 2$ ns, $S (48^\circ)$
(c) $t = 3$ ns, $I (23^\circ)$

$I_{max} = 9.6 \times 10^{14}$ W/cm$^2$

$R$ (mm)

$z$ (mm)

$n_c/8$

$492 \mu m$

$r_{HW}$
The overlapped interaction beams see a large plasma that they heat.
Plasma conditions are diagnosed with time-resolved *K*-shell spectroscopy of a microdot tracer layer.

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**Microdot (KCI, TiCaF₂)**

- Diameter: 200 μm
- Thickness: 0.1 μm
- Depth: 2 to 6 μm

**KCI microdot buried at 2 μm**

- s22173sscaT6
- Photon energy
- UV timing fiducial
- Time

**Spectroscopic Lines:**
- K Lyα
- K Heα
- Cl Heβ
- Cl Lyα
Experimental trajectories are close to predicted but experience a delay for greater tracer material depths.
The time history of the microdot density and temperature can be obtained from the SAGE profiles.

KCl microdot buried at 2 μm

![Graph showing electron density and temperature over time](image)
**SAGE/FLY** predictions match measured line ratios when line opacities are included.

- Normal-incidence view would avoid need for opacity correction.
Summary/Conclusions

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