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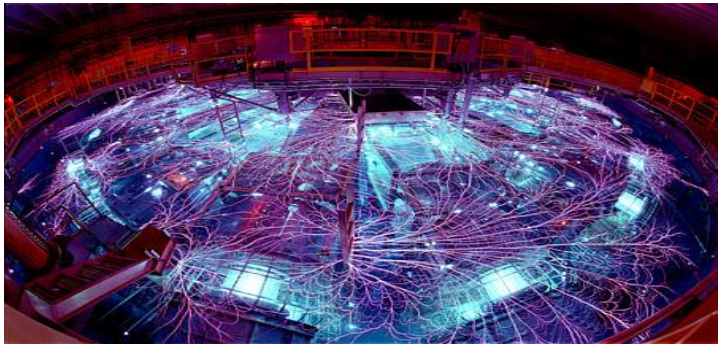

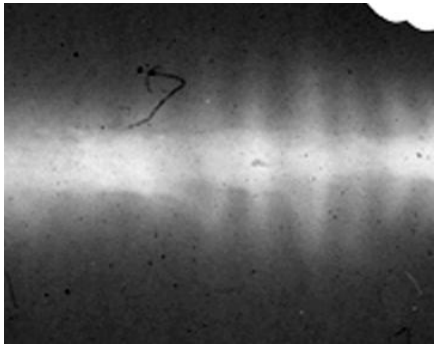

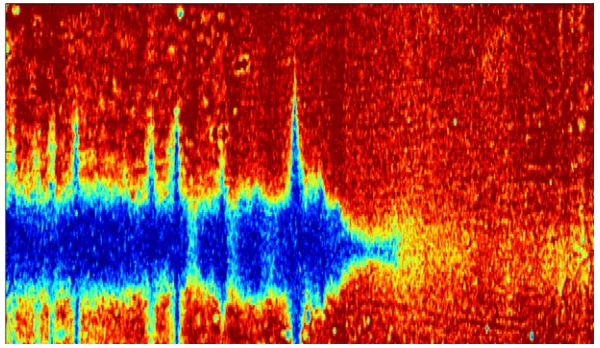

Diagnostic Prospects for X-ray Absorption Spectroscopy

Patrick Knapp

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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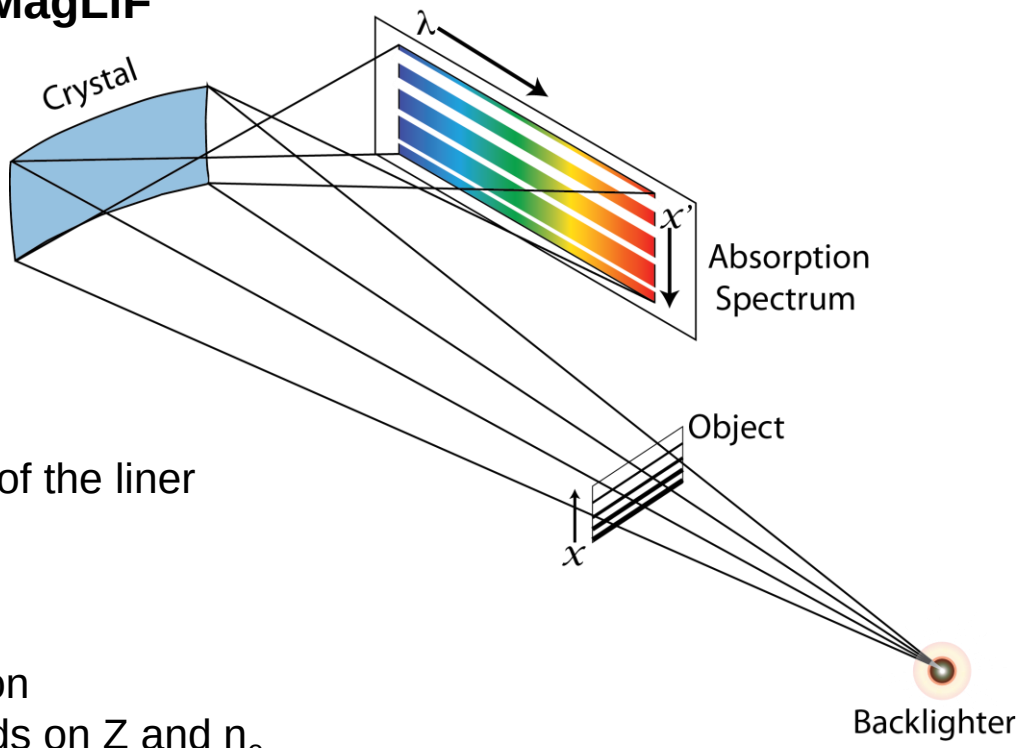
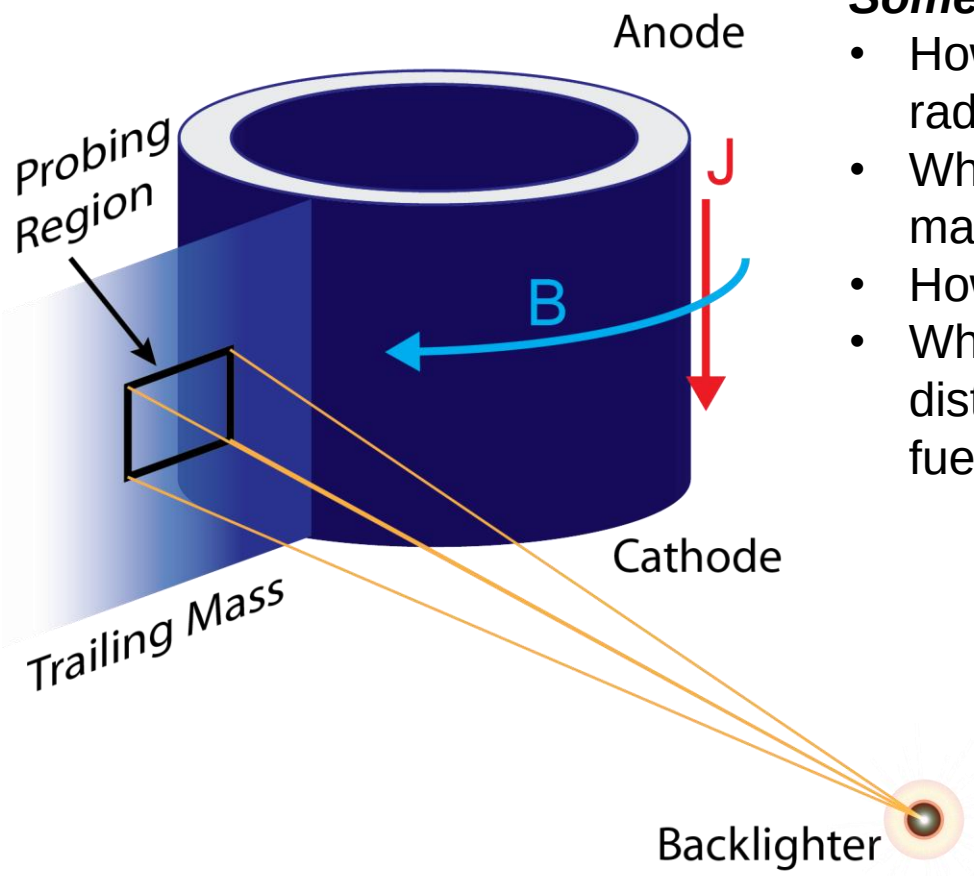
Absorption Spectroscopy Directly Measures the Line Integrated Ionization State of a Plasma

This information is well-suited to address questions in several key areas for MagLIF



- Trailing Mass
  - Density and temperature
  - Conductivity, Ohmic heating
  - How do instabilities effect Drive
- Liner Conditions
  - Shape of K-edge can tell us state of the liner
  - Density from Stark Broadening
  - Surface ablation
- Preheated Fuel Conditions and evolution
  - Inverse Brems. Absorption depends on Z and n_e
  - Bleaching wave propagation in r and z
  - Ionization equilibration dynamics

Liner Trailing Mass and Current Distribution



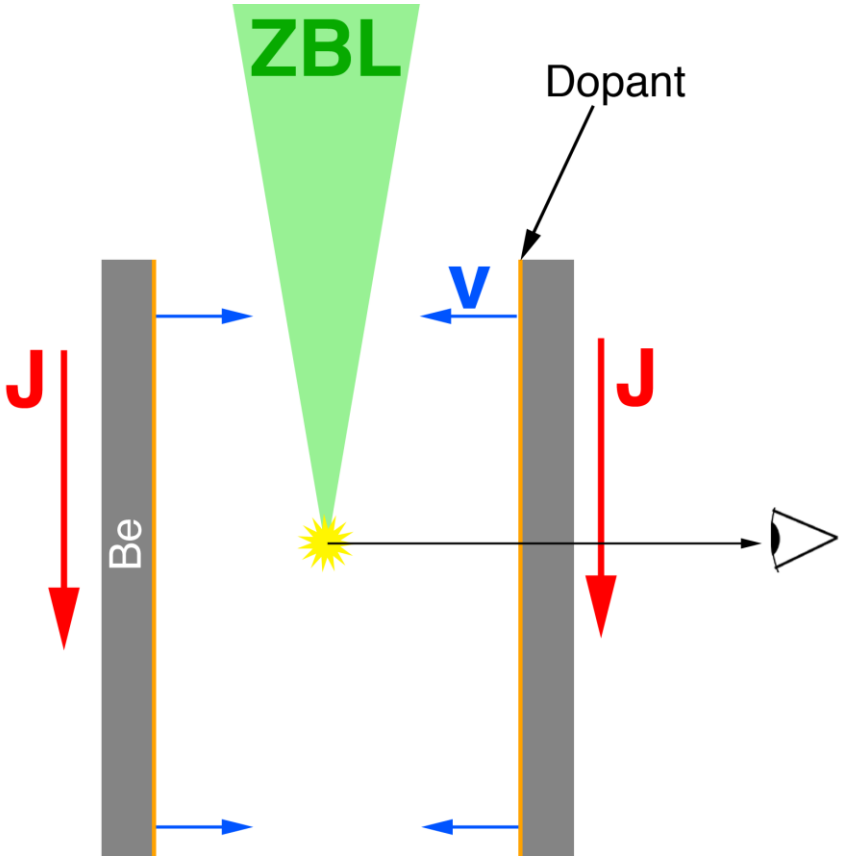
***Some* Outstanding Questions**

- How much material stays out at large radius?
- What Conditions characterize this material?
- How much current is it carrying?
- What is the impact of the current distribution on the drive as seen by the fuel?

These questions *directly* address sources of significant uncertainty in design codes

- atomic physics
- treatment of low density material

Liner Surface/Interior Conditions



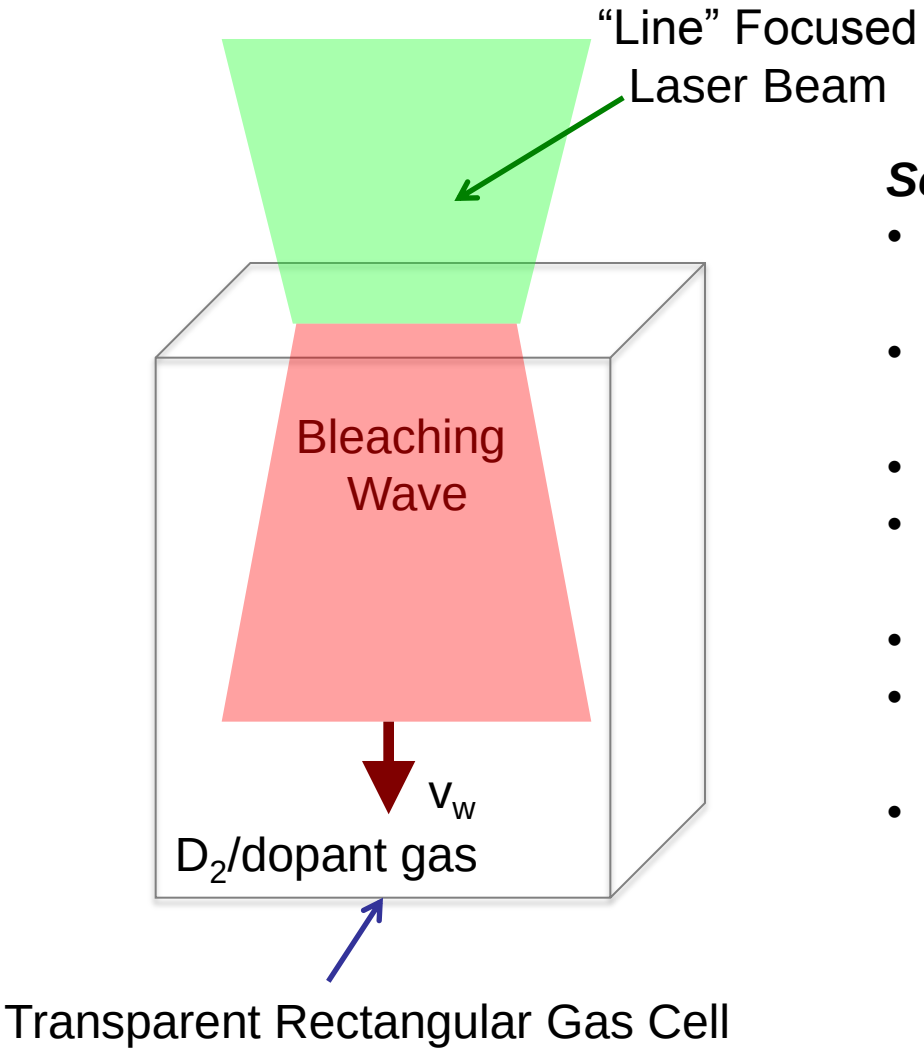
***Some* Outstanding Questions**

- What are the conditions of the liner material in contact with the fuel?
- Does the inner surface ablate?
- How do liner conditions change axially due to MRT?
- How fast is the liner inner surface moving?

What can we measure?

- Temperature and Density vs. time and space
- Instantaneous Liner surface velocity (doppler shift)
- Observe change in state
  - K-edge, NES (solid, WDM)
  - Satellite Absorption (plasma)

Preheated Fuel Dynamics and Conditions



***Some* Outstanding Questions**

- What do the T_e and ρ distributions look like OR How is the energy deposited
- How fast does the bleaching wave propagate?
- What are the ionization dynamics?
- How fast does the plasma equilibrate or redistribute
- How does B_z change these questions?
- Does the LEH window ablate and mix with the fuel?
- Does the cathode ablate and mix with the fuel?