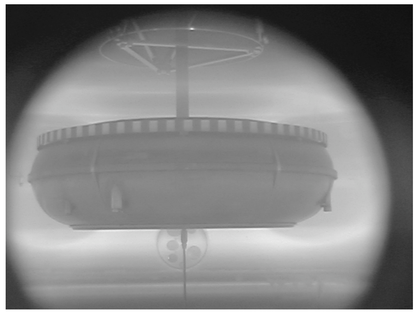

Visible and x-ray imaging of a laboratory dipole plasma

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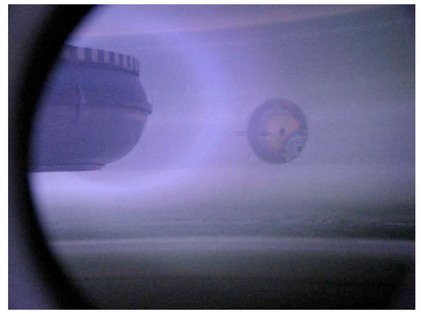
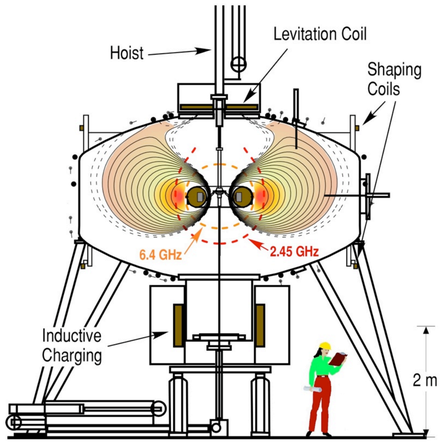


Synopsis

We characterize the constituents of the plasma and use this information to explain why the color images of the plasma are not always pink. Most of the plasma pressure is carried by the fast electrons. We compare the pressure contours to the x-ray images.

The Levitated Dipole Experiment

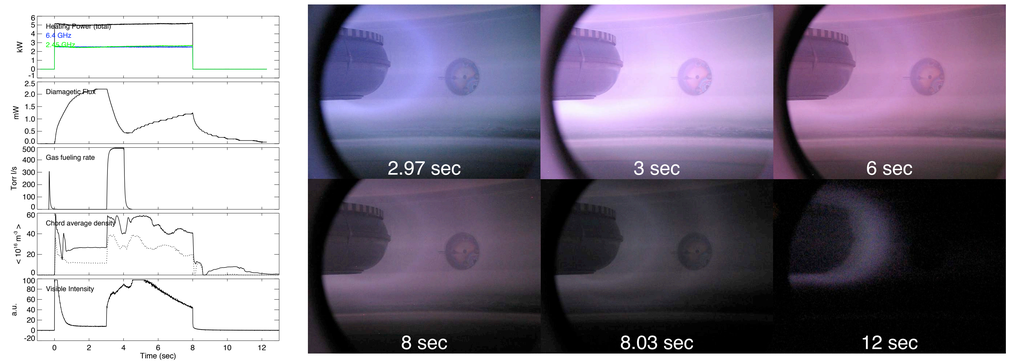


- Internal superconducting coil is supported by three thin supports.
- The levitation coil may be operated while the floating coil is supported to give a "levitated" magnetic geometry.
- Deuterium plasmas are created by multi-frequency electron cyclotron heating (ECRH).

Methods

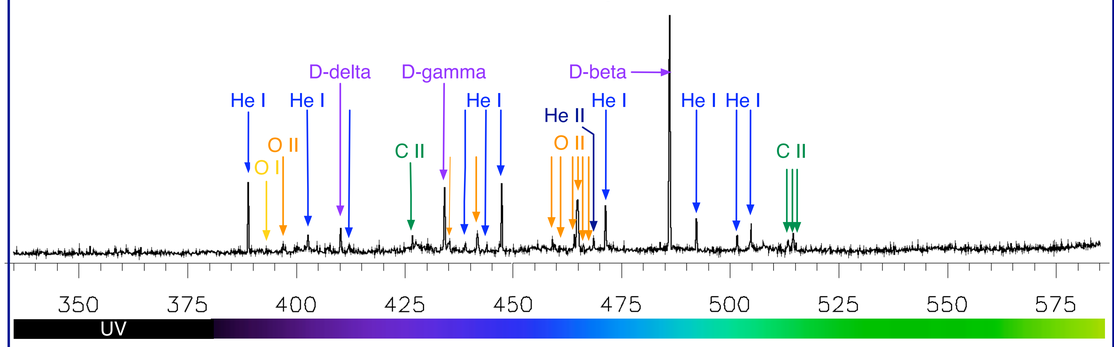
- Three video cameras record the plasma from different viewpoints.
- A single channel spectrometer with a range of 330-580 nm and resolution of 0.1 nm is used to measure the composition of the plasma. Time resolution is 0.11 sec for the data considered here.
- 4-channel interferometer
- Flux loops, B-poloidal pick-up coils, and Mirnov coils are used for magnetic reconstruction.
- X-ray camera[1] measures intensity of x-rays with energies > 40 keV.

Plasma Shot with a Large Gas Puff



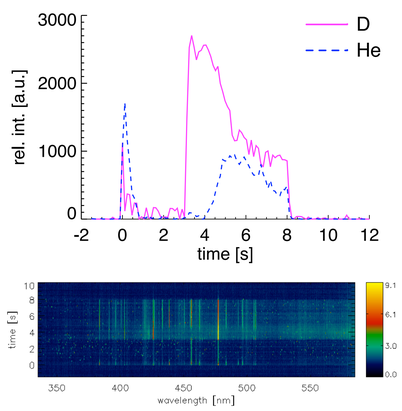
In this discharge, a large gas puff occurs at 3 seconds. These images characterize the evolution of the video data before, during, and after the deuterium is puffed, as well as just before and after the heating is turned off, and during the afterglow.

What's in the plasma?



This spectrum is an average of spectra collected during 11 plasma discharges.

He Impurity Causes Plasmas to Appear Blue at Times

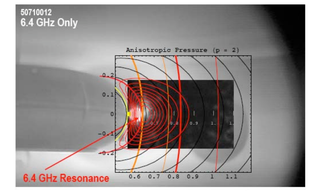


The color of the plasma changes over time. Deuterium plasmas are generally pink. The plasmas in LDX are sometimes blue or purple because of a helium impurity. The plot shows the relative intensities of helium and deuterium between 330 and 580 nm. The helium is introduced to the vacuum vessel during glow discharge cleaning.

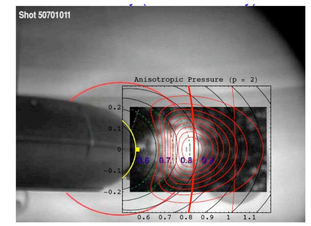
Time evolution of the spectrum.

X-Ray Images

Plasma heated by 6.4 GHz only



Plasma heated by 2.45 GHz only



Images of x-ray intensity measured by an x-ray camera [1] are shown to scale over visible images of the plasma. Anisotropic pressure contours are overlaid in red. The resonance locations, magnetic field lines, and mod B surfaces are also shown. The best fit is found for $P_\perp/P_\parallel = 5$

Conclusions

- Position and number of bright rings of light in the visible images of the plasma change in time.
- Helium is the dominant impurity in the plasma. Oxygen and carbon are also observed.
- X-ray images confirm that the plasma is highly anisotropic.
- The anisotropy is caused by electron cyclotron heating and by the supports on the "floating coil".

[1] S. von Goeler et al., RSI, **65** (1994) 1621
[2] NIST Atomic Spectra Database http://physics.nist.gov/PhysRevData

Electronic copies of this poster will be available at http://www.psfc.mit.edu/ldx/