Time-Resolved Electron-Temperature Measurements Near $n_c/4$ Reveal Temperature Islands on Imploding Targets

![Graphs and images showing temperature and wavelength shift measurements.

$T_e, \text{exp}$ and $T_e, \text{LILAC}$ are plotted against time with $I_{14} = 5.6$.

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Summary

$T_e$ measurements near $n_c/4$ point toward the existence of temperature islands on the target surface

- $T_e$ measurements near $n_c/4$ are based on a spectral feature of $\omega/2$ emission that is caused by the absolute two-plasmon-decay (TPD) instability
- Implosions close to the TPD threshold confirm $T_e$ from hydrodynamic predictions
- For standard implosions well above the TPD threshold, $T_e$ measurements in hex and pent ports exceed those taken through the focusing lenses
- These observations indicate locally driven, multibeam TPD as well as significant energy input into the TPD plasma waves and elevated temperature islands
Collaborators


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For standard (tangential) illumination of the target, multibeam-driven TPD has the lowest thresholds near the hex and pent centers.

- Multibeam-driven TPD was established in 2003*
- Multibeam-driven absolute TPD instability has been shown in Zakharov simulations** as well as analytically***

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** J. Zhang et al., this conference and to be submitted to Physics of Plasmas.
*** R. W. Short et al., this conference.
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Emission caused by the absolute TPD instability comes from its turning point and is guided by the density gradient.
Broad spectral components of $\omega/2$ emission require Thomson scattering and TPD plasmon spectra that are very broad in $k$ space.
The $\omega/2$ broadband emission is limited by the Landau cutoff to an $\sim 37^\circ$ half-cone angle

\begin{align*}
\lambda > 702 \text{ nm} & \quad I_{14} = 8.6 \\
\text{Tangential illumination} & \\
\lambda < 702 \text{ nm} & \quad I_{14} = 9.4 \\
\text{Tangential illumination} &
\end{align*}
The $\omega/2$ broadband emission is limited by the Landau cutoff to an $\sim 37^\circ$ half-cone angle.

- $\lambda < 702$ nm  \( I_{14} = 10.6 \)
  - Small-beam illumination

- $\lambda < 702$ nm  \( I_{14} = 9.4 \)
  - Tangential illumination
The electron temperatures vary in different areas of the target and exceed the \textit{LILAC} prediction by 10% to 20%.
$T_e$ variations over the target entail perturbations of the $n_c/4$ density surface

- To maintain such temperatures differences, hydrodynamic simulations require significant ($>20\%$) local energy deposition around $n_c/4$
Summary/Conclusions

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