Thomson-Scattering Measurements of Ion-Acoustic Wave Amplitudes Driven by the Two-Plasmon-Decay Instability

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- Previous work shows that beating of electron-plasma waves drives density perturbations through the ponderomotive force*
- Time-resolved Thomson-scattering spectra at quarter critical show that the amplitude of the ion-acoustic waves follow the amplitude of the 3/2ω emission (a TPD signature)
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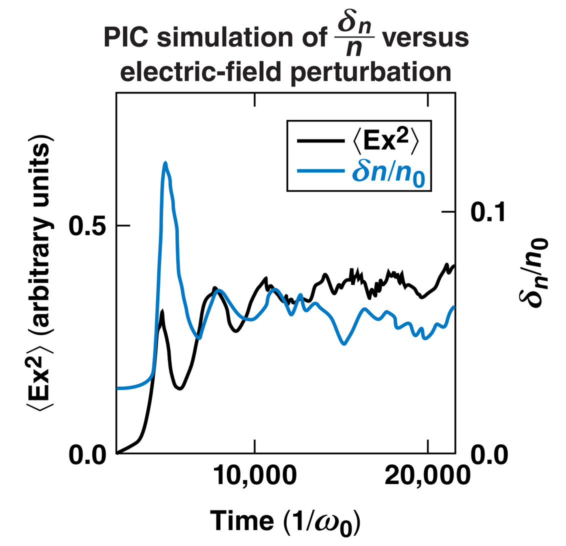
- This effect has been simulated at quarter-critical using 2-D particle-in-cell (PIC) codes*
- Previous experiments have seen indications of this effect using 10.6-μm light and 2ω TS**



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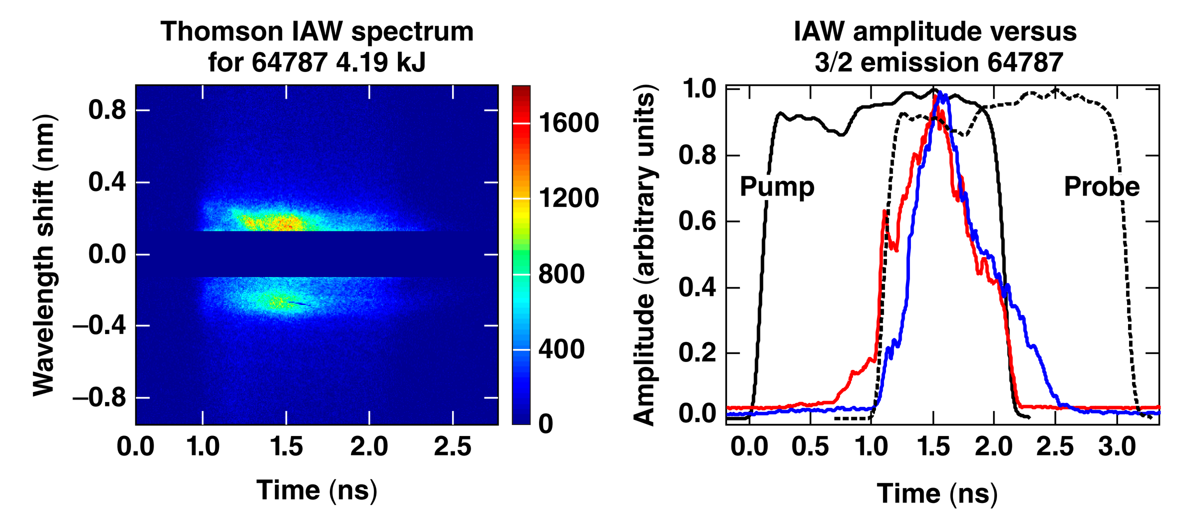

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The experimental setup involves a Thomson telescope coupled to spectrometers and streak cameras

- 2-ns OMEGA pulses with 20 beams were used to heat 90-μm (30 CH/30 Mo/30 CH) targets
- Thomson scattering was used to measure IAW amplitudes near 3ω quarter-critical
- The 1-m spectrometer output to a ROSS streak camera has 200-ps temporal and 0.03-nm spectral resolution*
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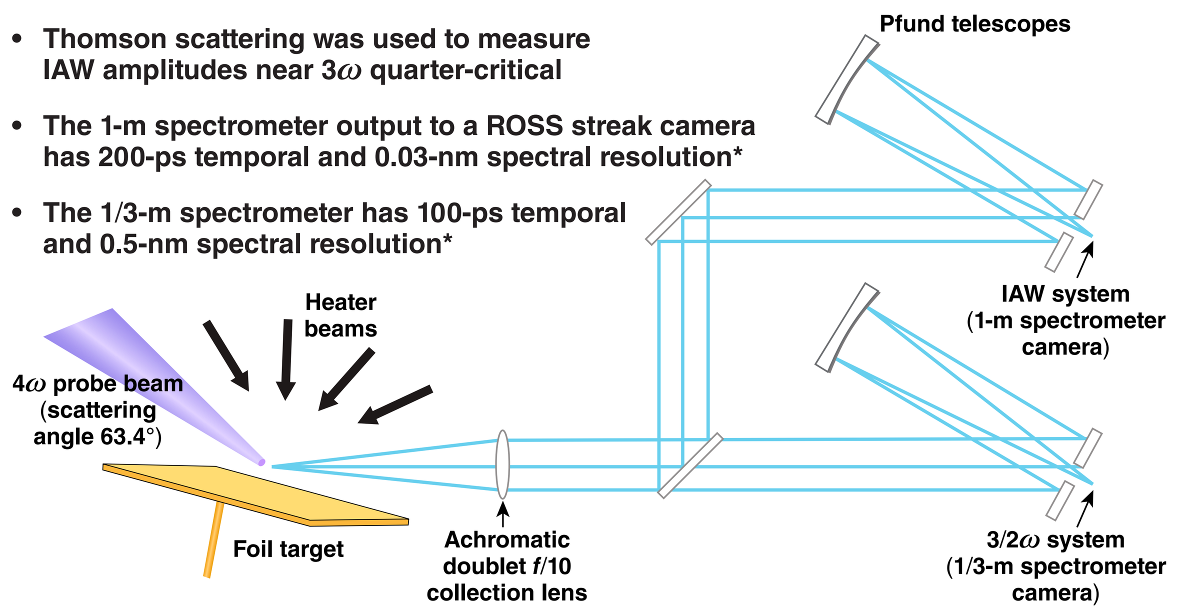

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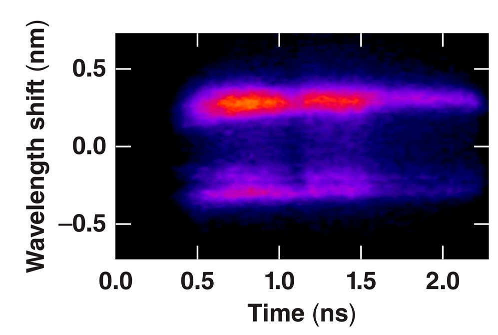

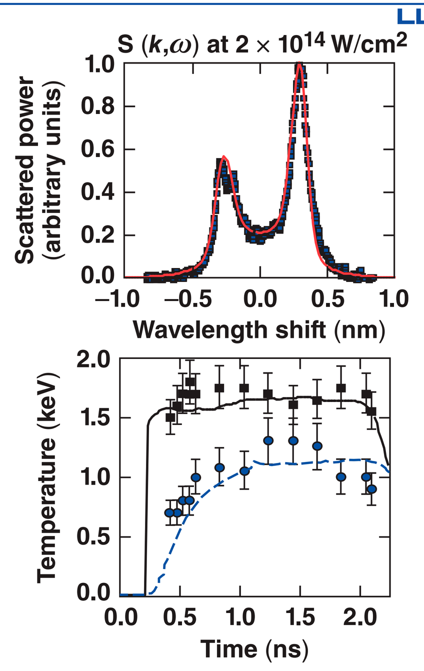

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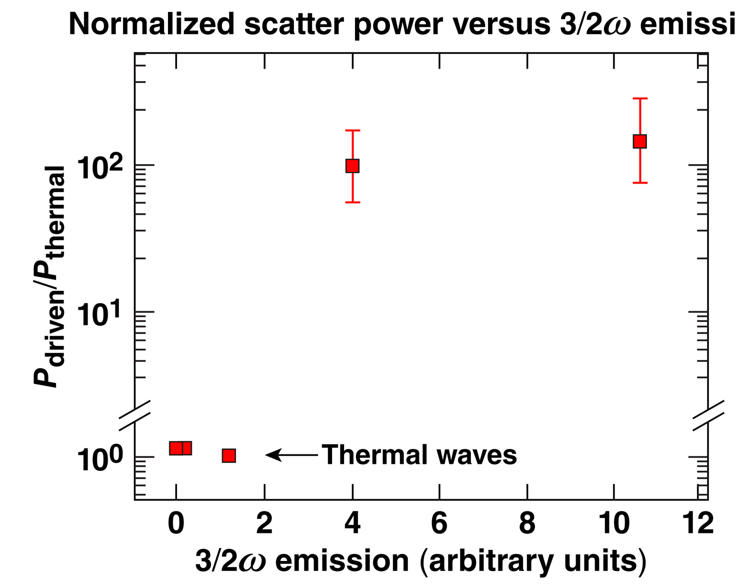
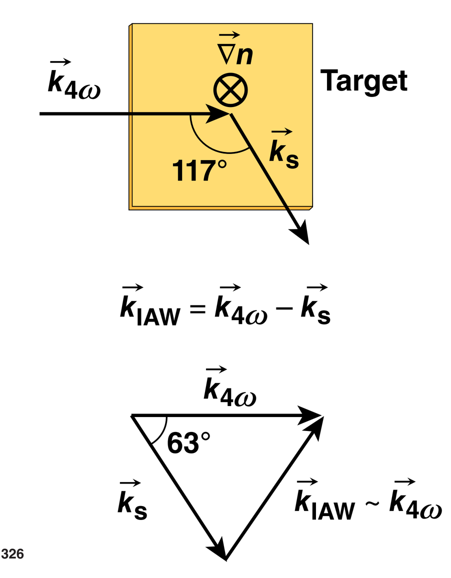


There is a clear correlation between the 3/2ω and ion-acoustic wave amplitudes.

E21325

The Thomson scattering geometry looks at ion-acoustic wave *k*-vectors near the plane of the target

The 4ω Thomson geometry is in a plane perpendicular to the primary common-wave growth vectors



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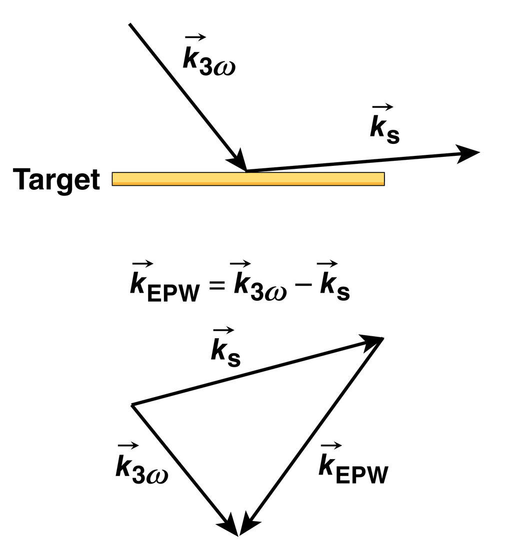

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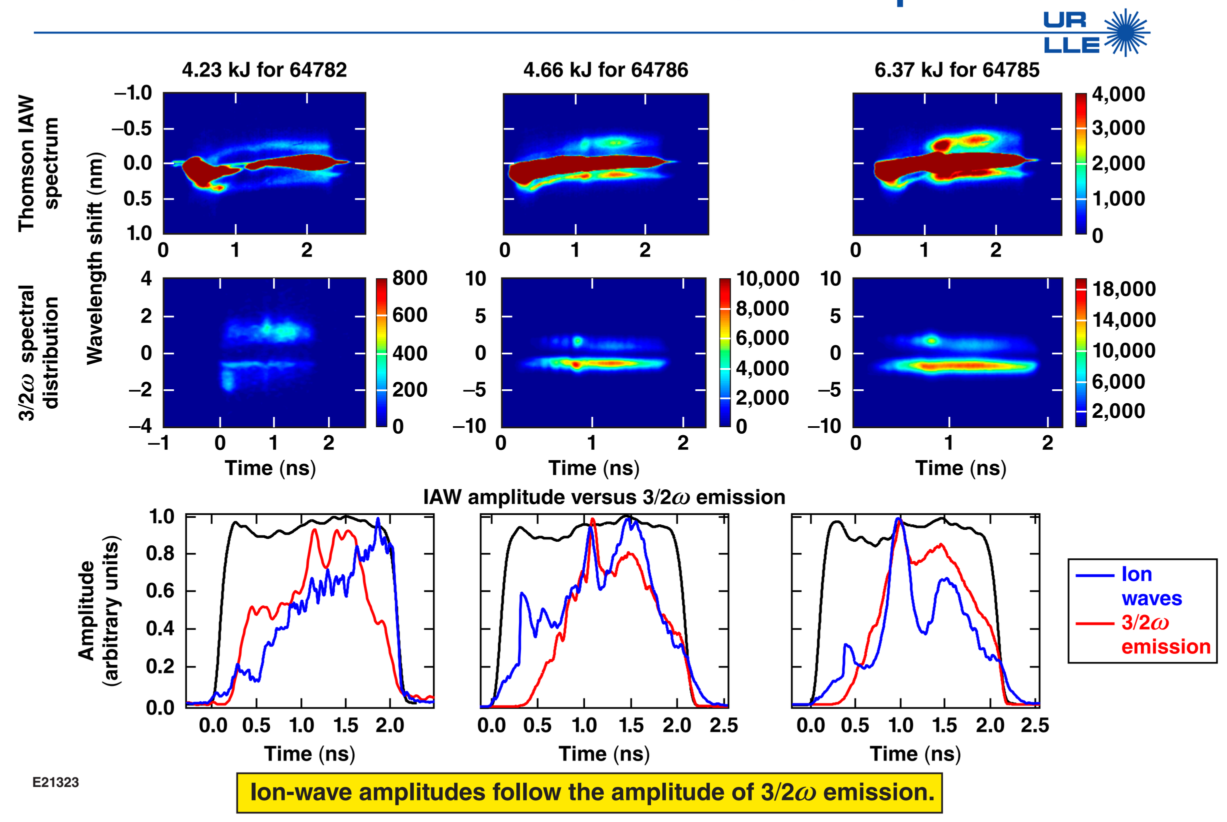
Time-resolved spectra are used to compare the temporal evolution of ion-acoustic wave and 3/2ω amplitudes



Ion-wave amplitudes follow the amplitude of 3/2ω emission.

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Ion-density perturbations are compared to *ZAK* simulations*,† and a similar growth threshold is observed

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$$P_{thermal} = \frac{1}{2} r_0^2 n_e L P_i d\Omega$$

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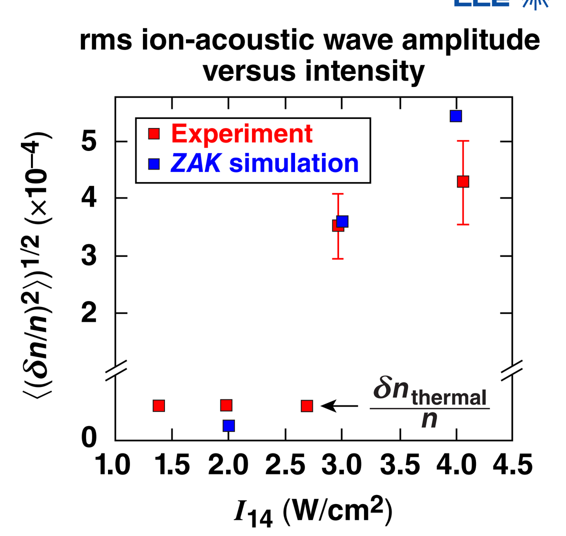

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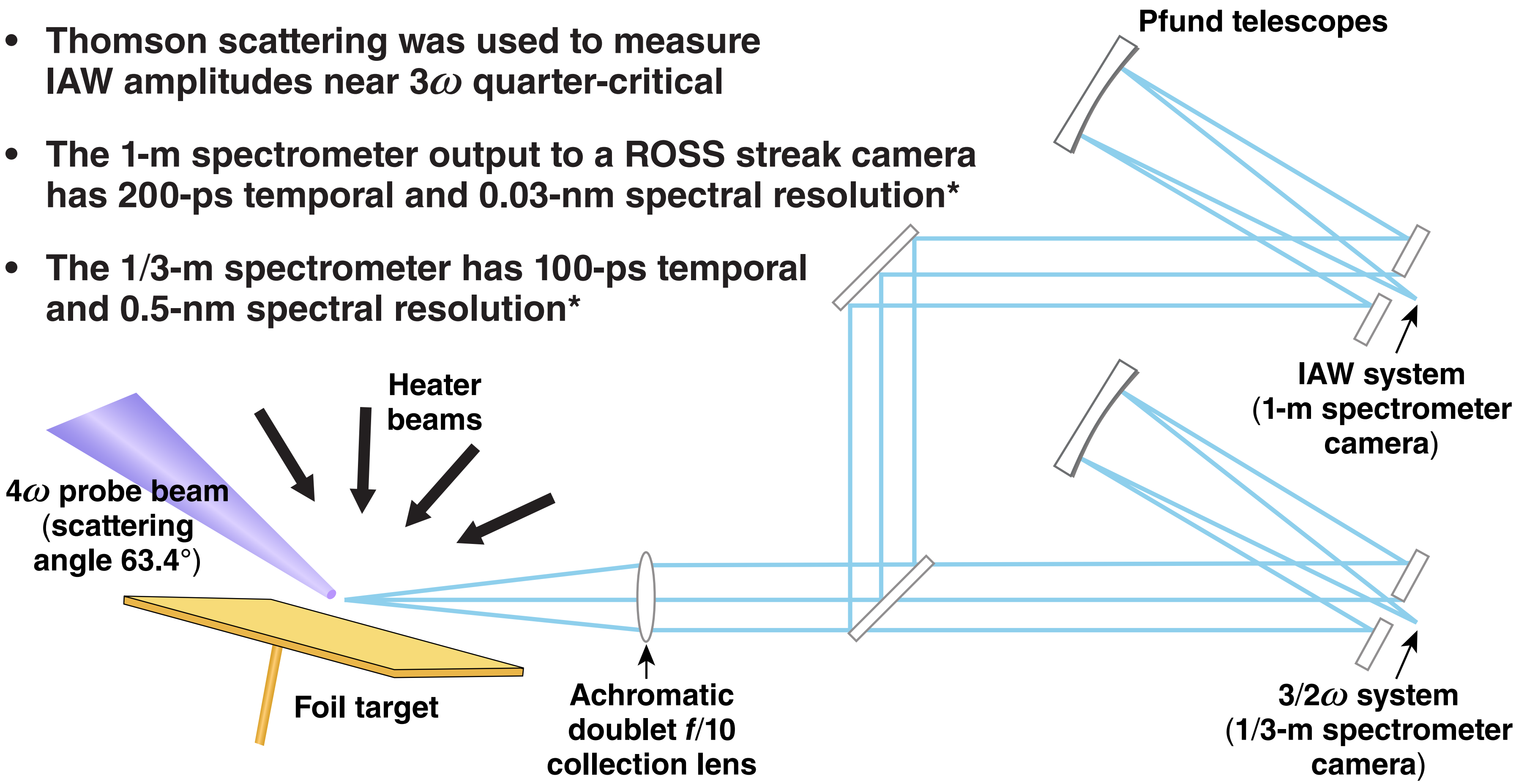

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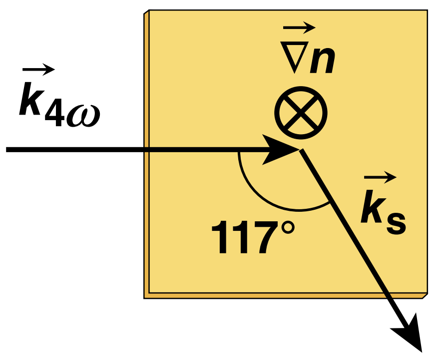
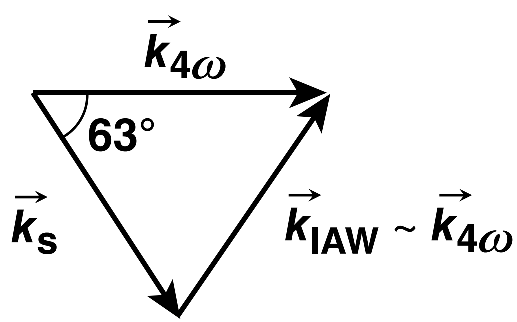


$$\vec{k}_{IAW} = \vec{k}_{4\omega} - \vec{k}_s$$



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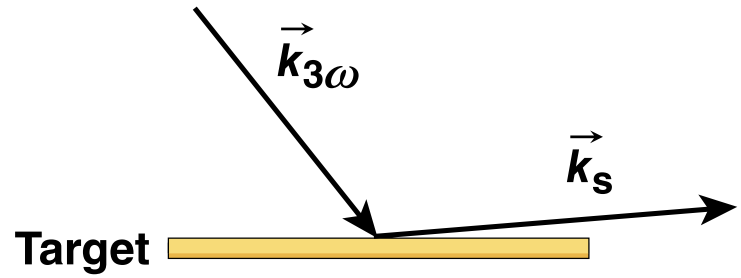

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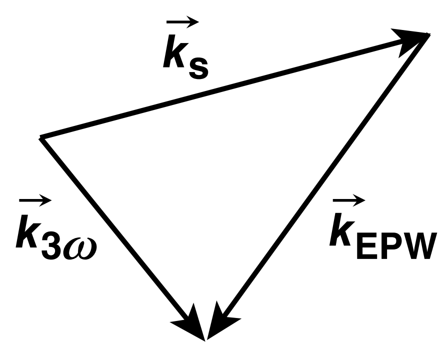

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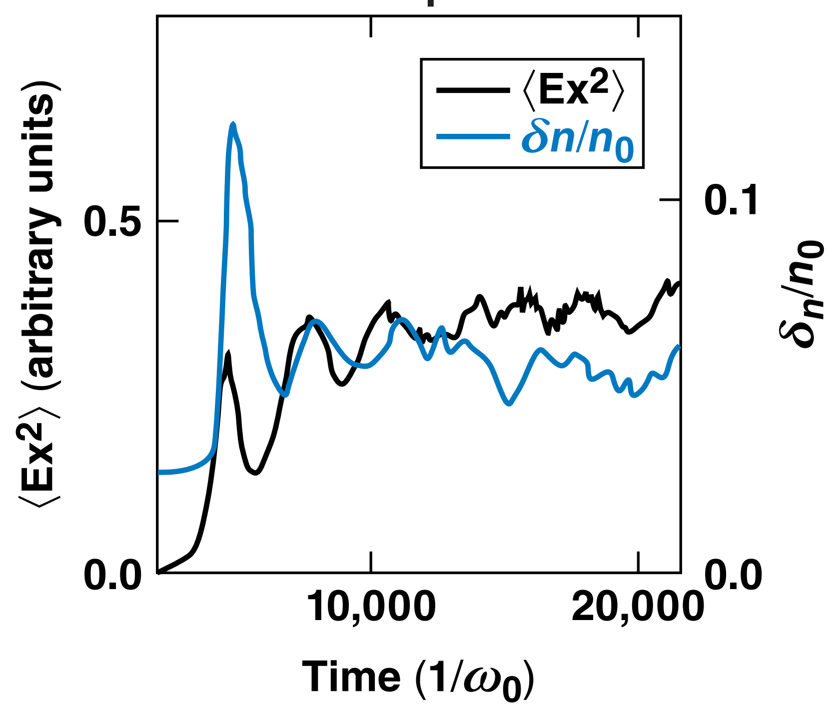
PIC simulation of $\frac{\delta n}{n}$ versus electric-field perturbation



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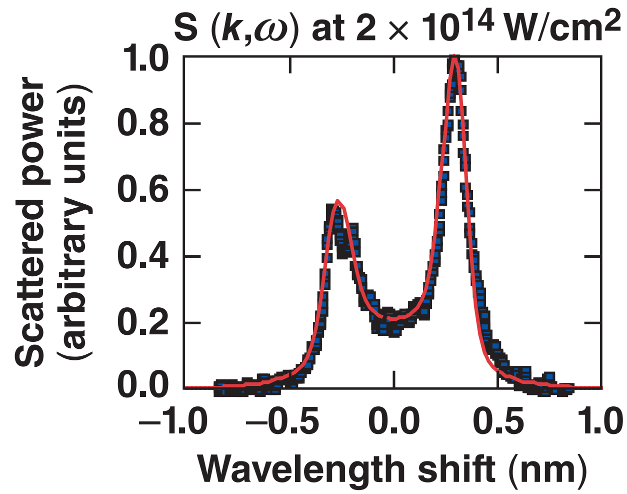

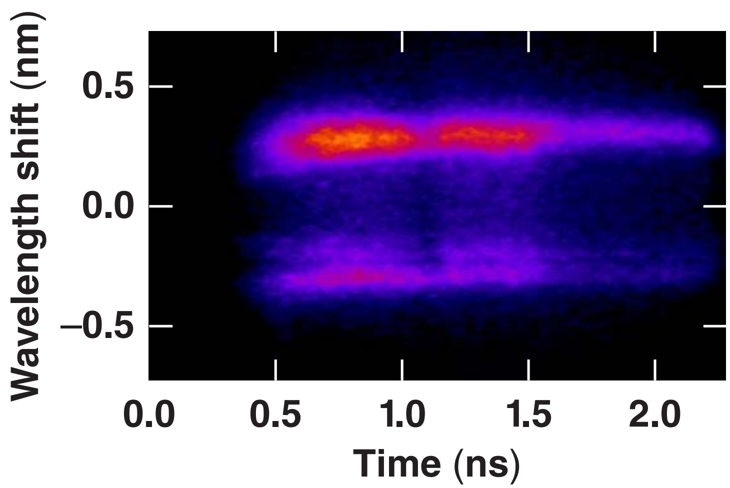

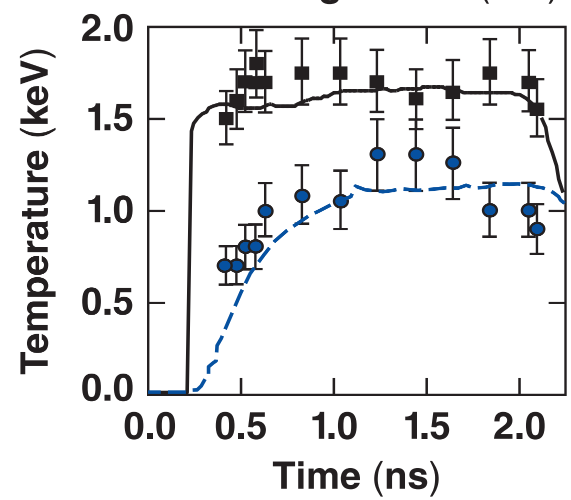

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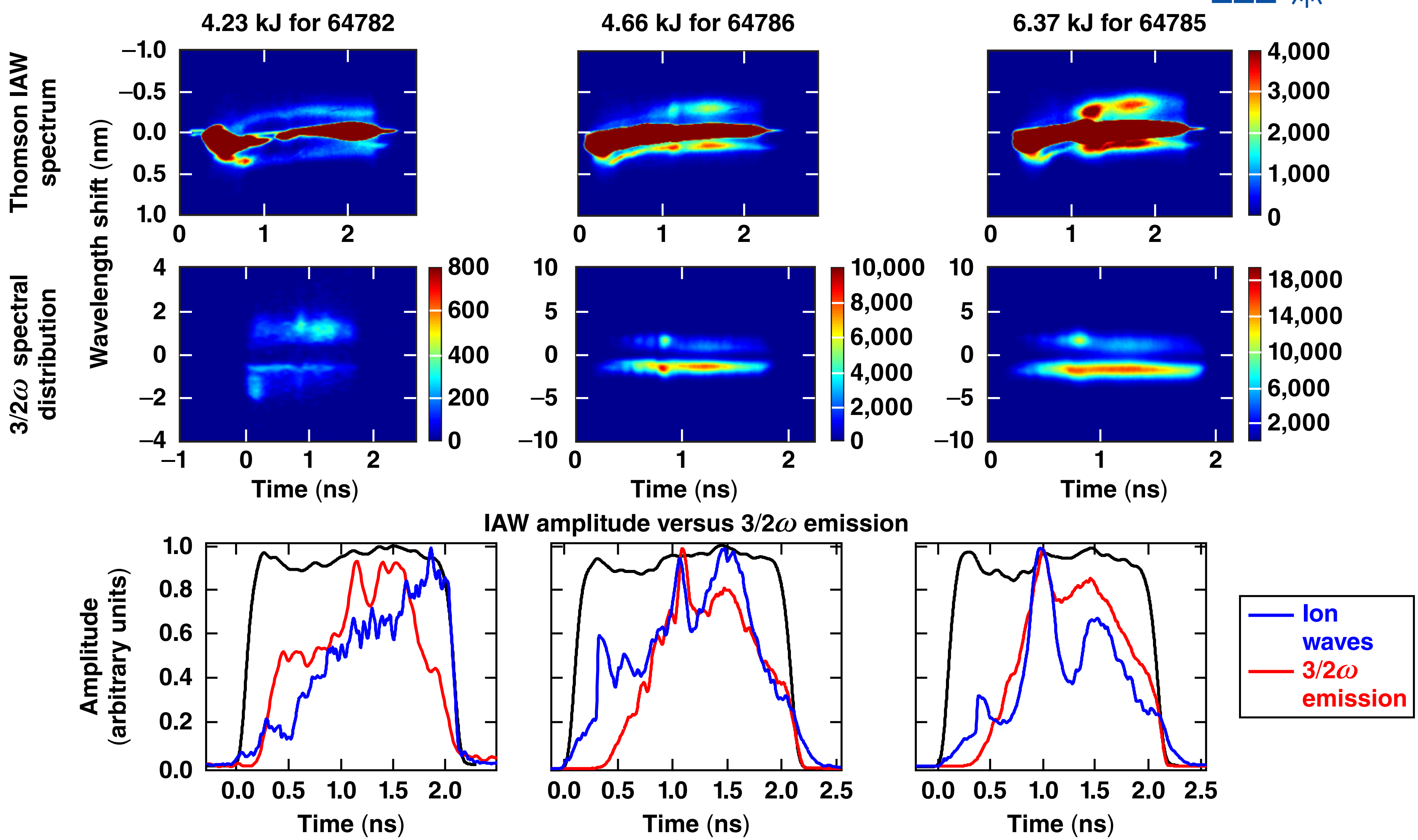

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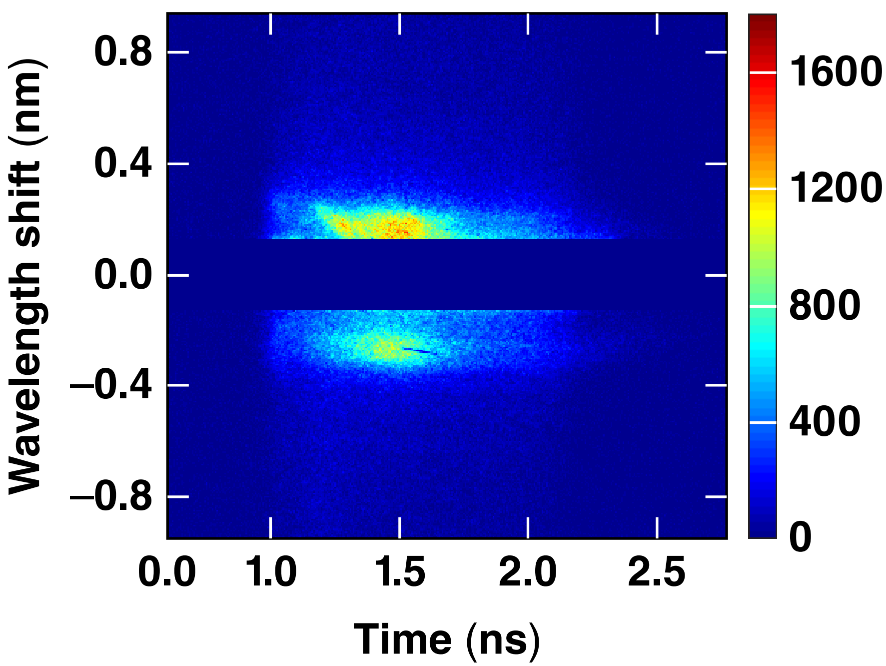
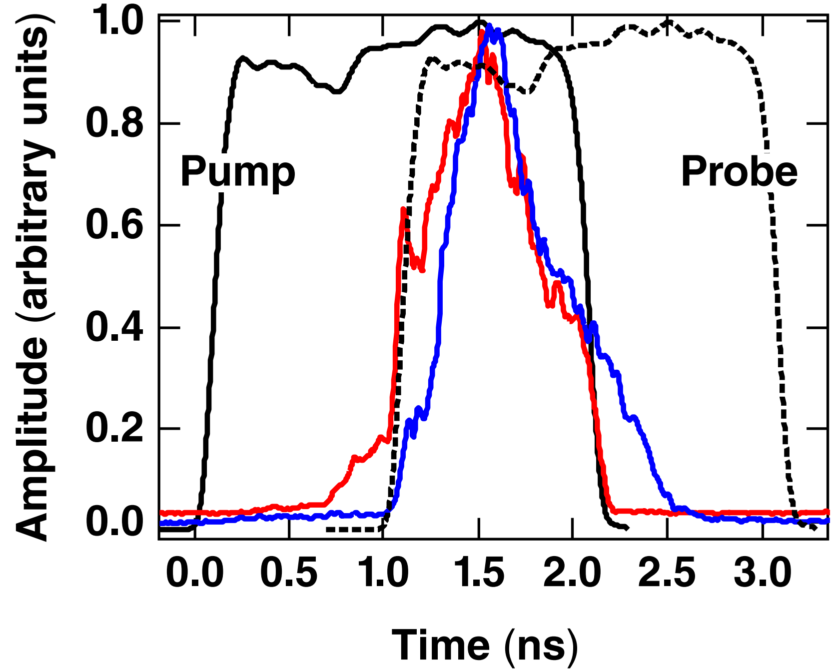
Thomson IAW spectrum
for 64787 4.19 kJ



IAW amplitude versus
3/2 emission 64787



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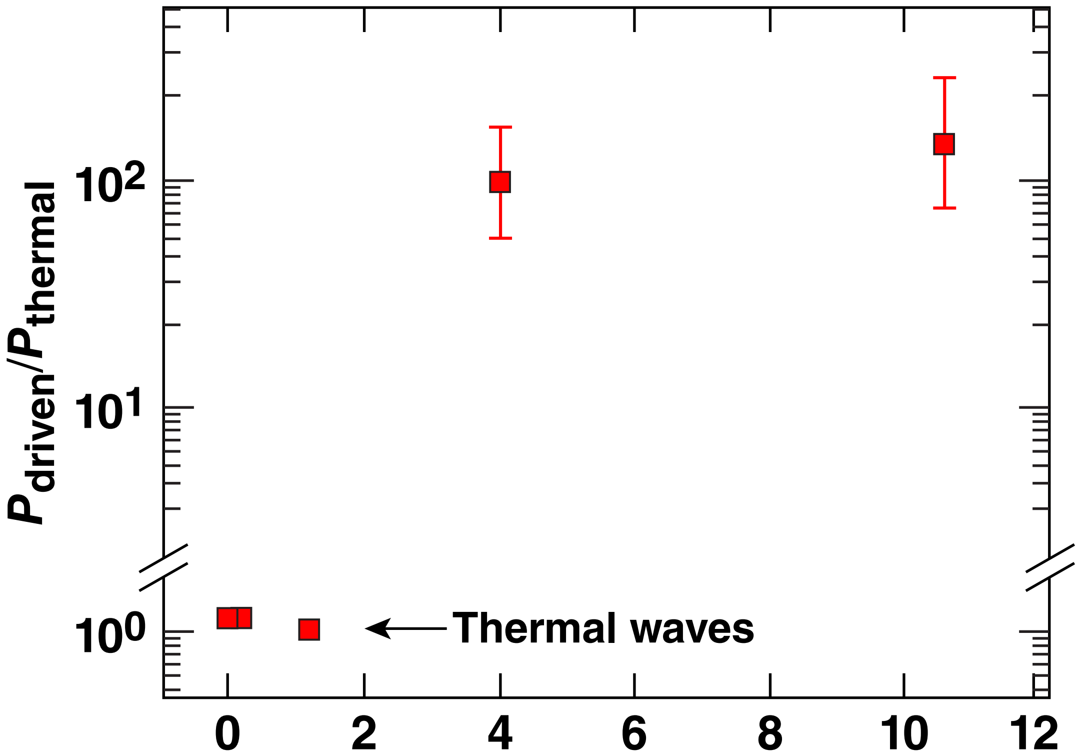
Normalized scatter power versus 3/2ω emission



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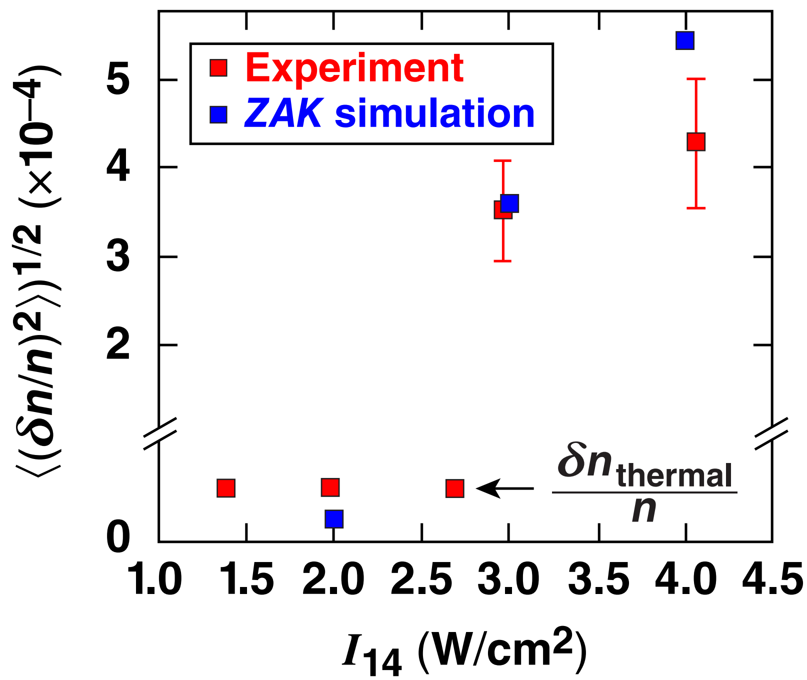
rms ion-acoustic wave amplitude versus intensity



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