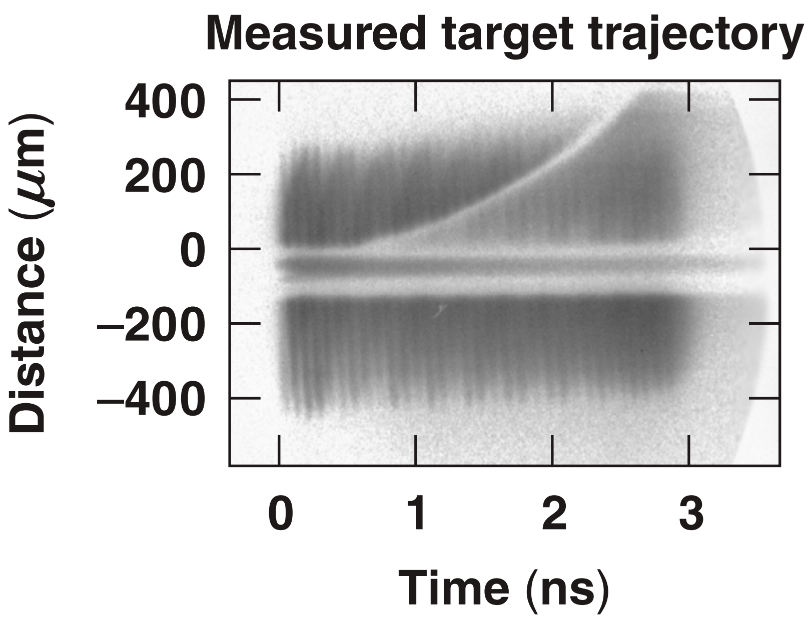
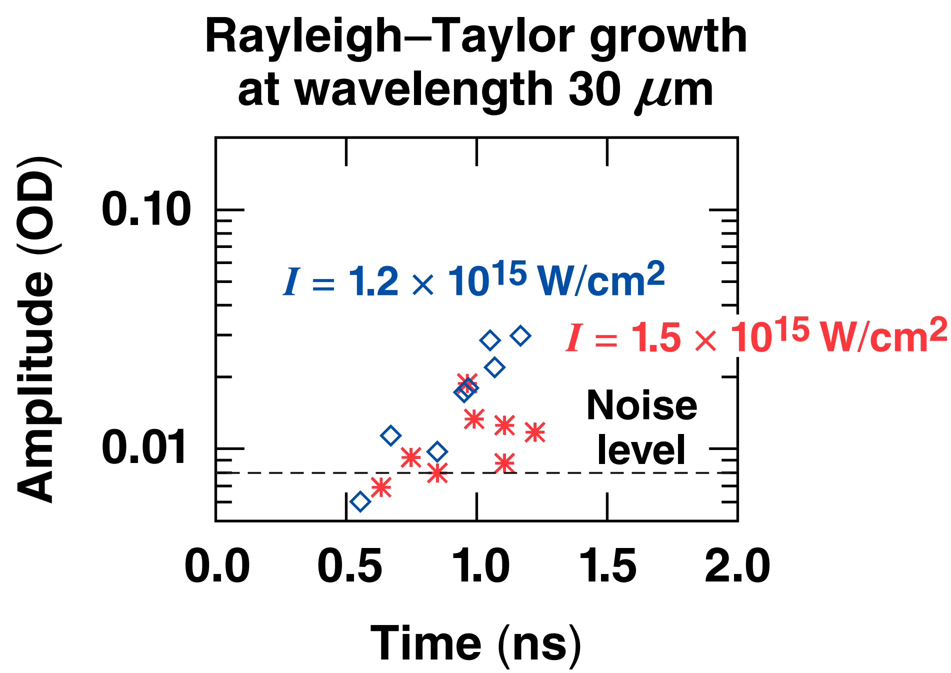
Effects of Preheating Rayleigh–Taylor Growth in Planar Plastic Targets on OMEGA





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Summary

Nonlocal electrons and hot electrons from two-plasmon-decay instability stabilize Rayleigh–Taylor growth in plastic targets

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- At high intensities up to ~10^{15} W/cm^2, time-dependent flux limiters better explain acceleration experiments, indicating a presence of nonlocal electron transport.
- Hot-electron preheat increases with drive intensity.
- Rayleigh–Taylor growth reduction correlates with higher hot-electron signals.
- RT-growth reduction at a high intensity of ~10^{15} W/cm^2 is consistent with a density reduction of ~4 to 6.

Collaborators

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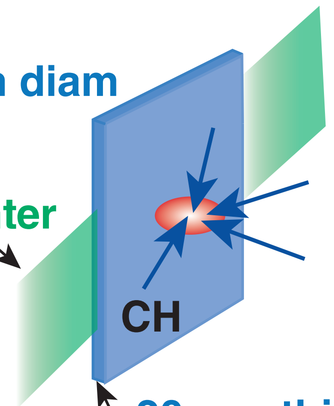
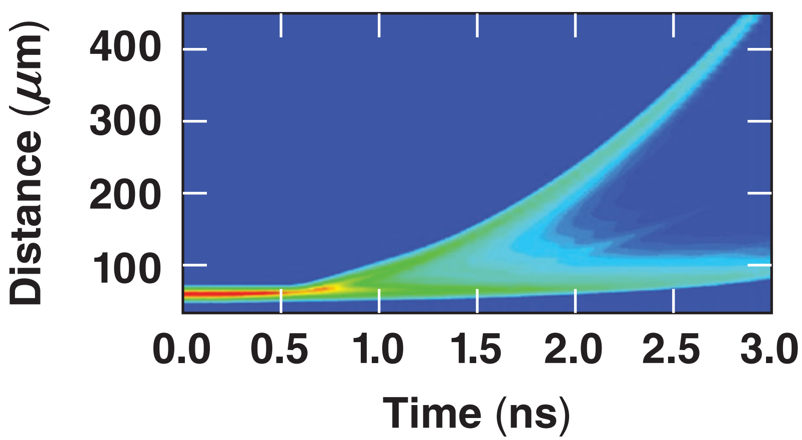
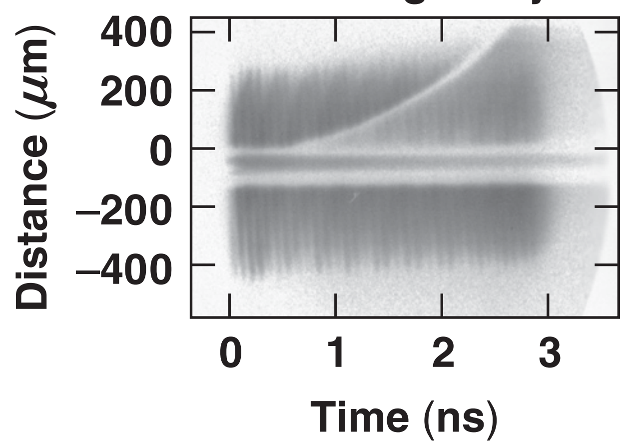
Laser coupling was studied using the acceleration of planar, 20-μm-thick plastic targets



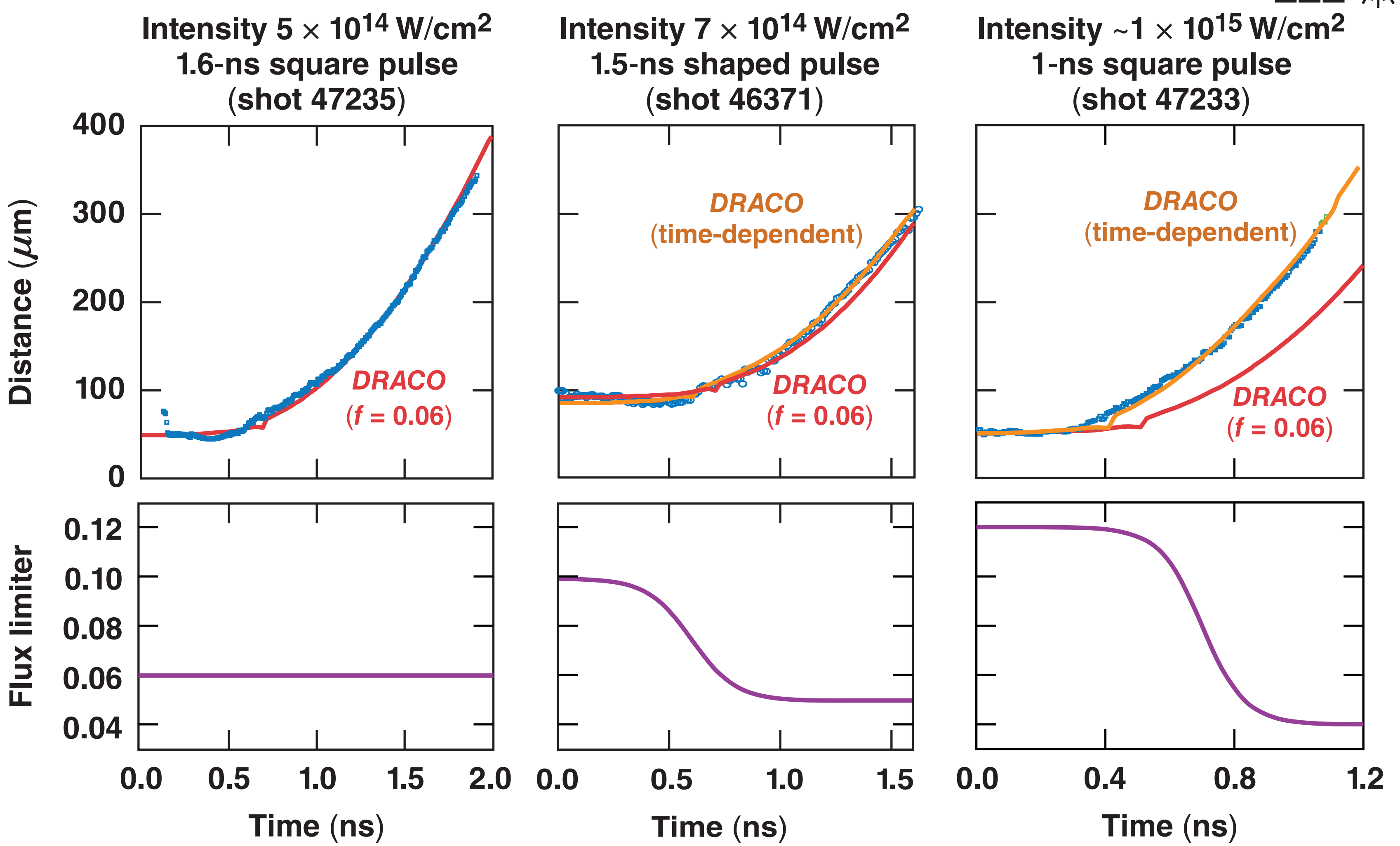




- 3-ns square drive at intensity of 2.5×10^{14} W/cm^2

TC7746b

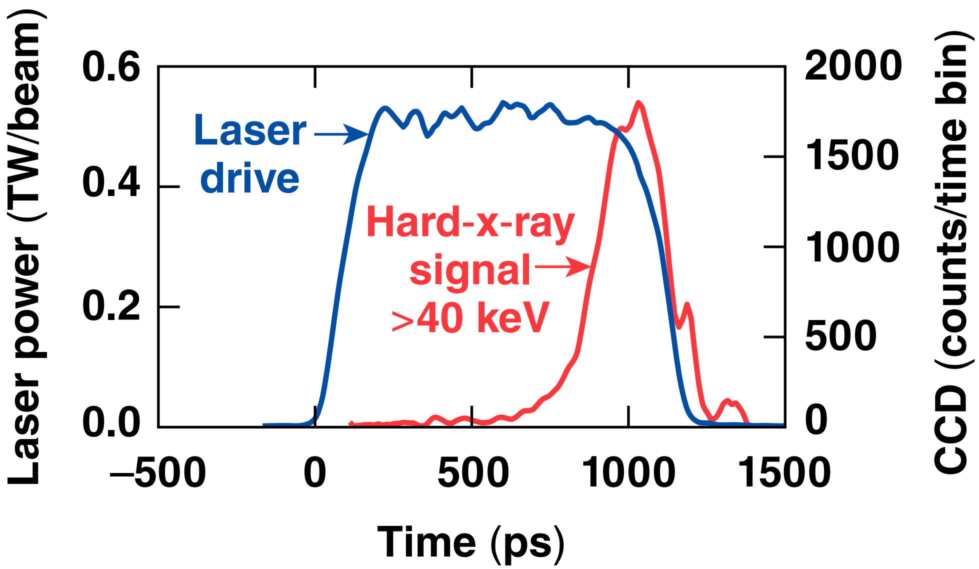
At high intensities, ~10^{15} W/cm^2, simulations with time-dependent flux limiters agree better with experiments than with a constant flux limiter of f = 0.06*

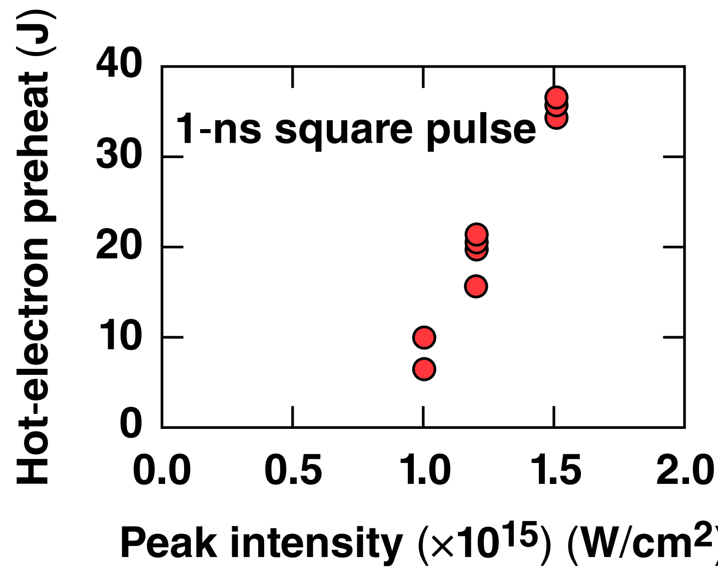


TC7751a

*V. N. Goncharov *et al.*, Phys. Plasmas 13, 012702 (2006).

In planar, plastic targets, hot electrons are produced in the last ~400 ps of a 1-ns drive





- Hot-electron temperature was measured to be in the range of ~50 to 60 keV.
- Preheat was inferred using the prescription from B. Yaakobi *et al.*, Phys. Plasmas 12, 062703 (2005).

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The 20-μm-thick CH target travels ~250 μm in experiments with both 1-ns and 1.6-ns drives

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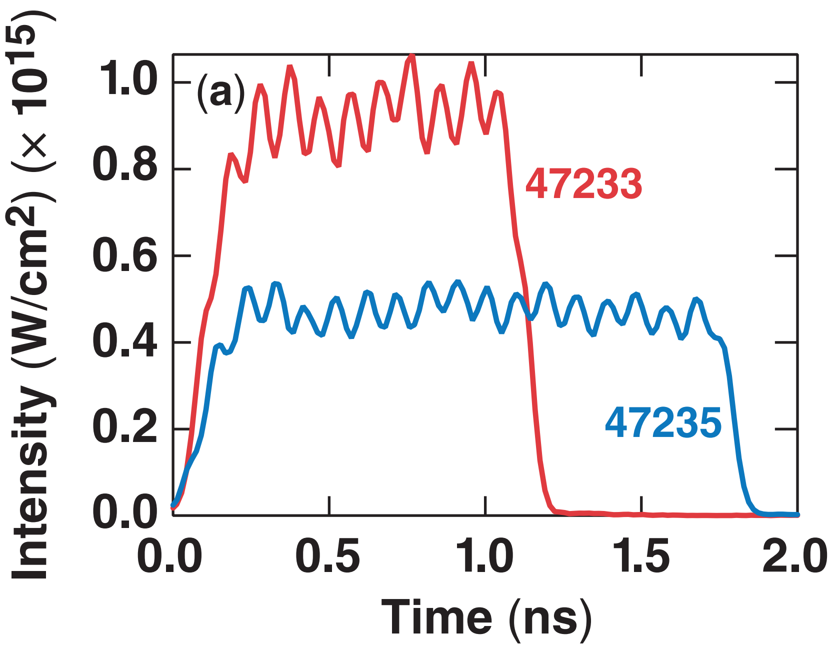

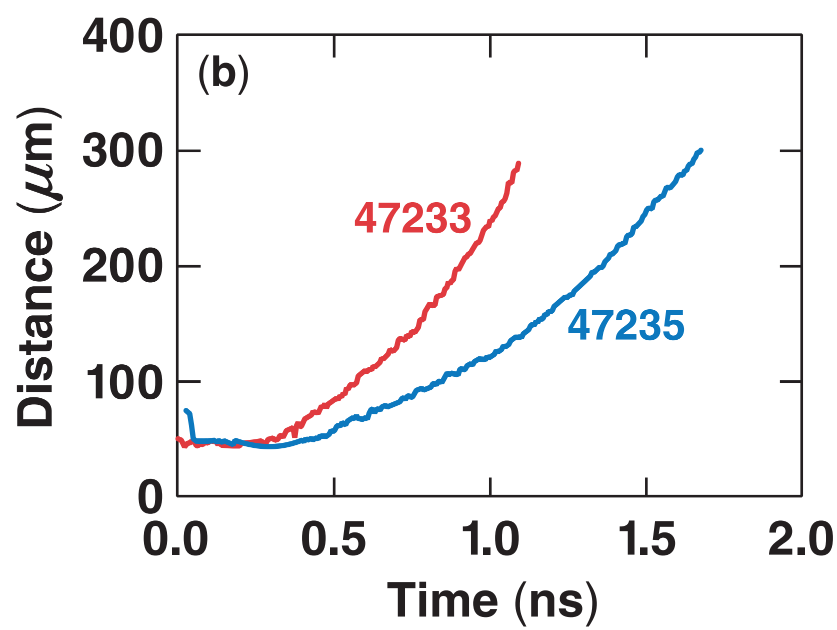

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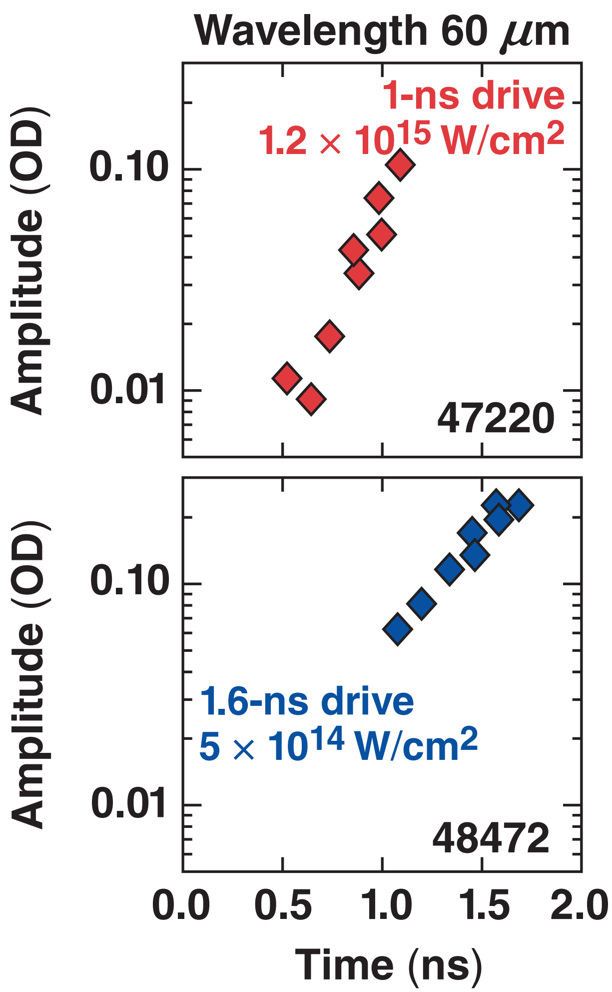
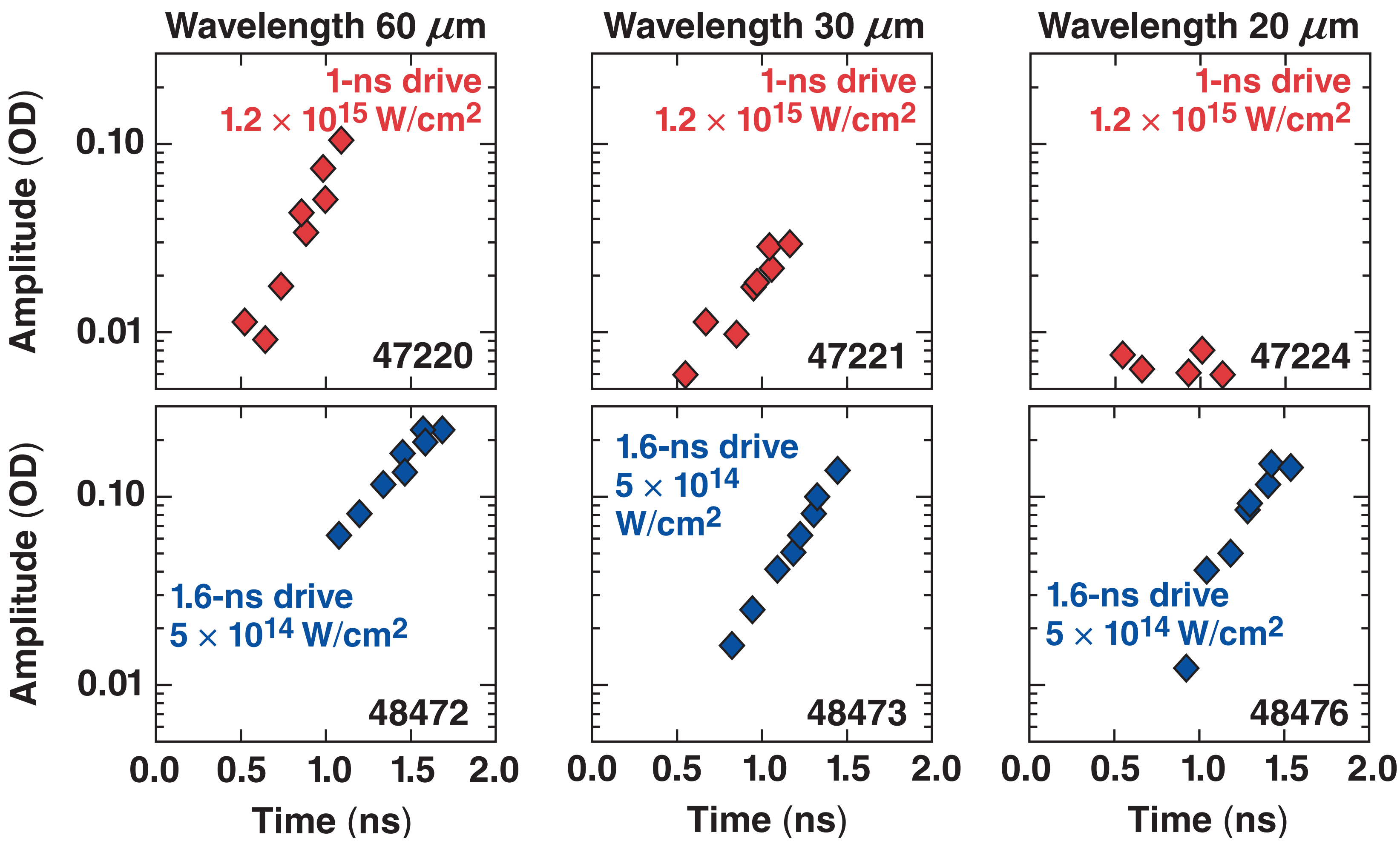
The RT growth is strongly stabilized at an intensity of 10^{15} W/cm^2 compared to 5×10^{14} W/cm^2



U656a

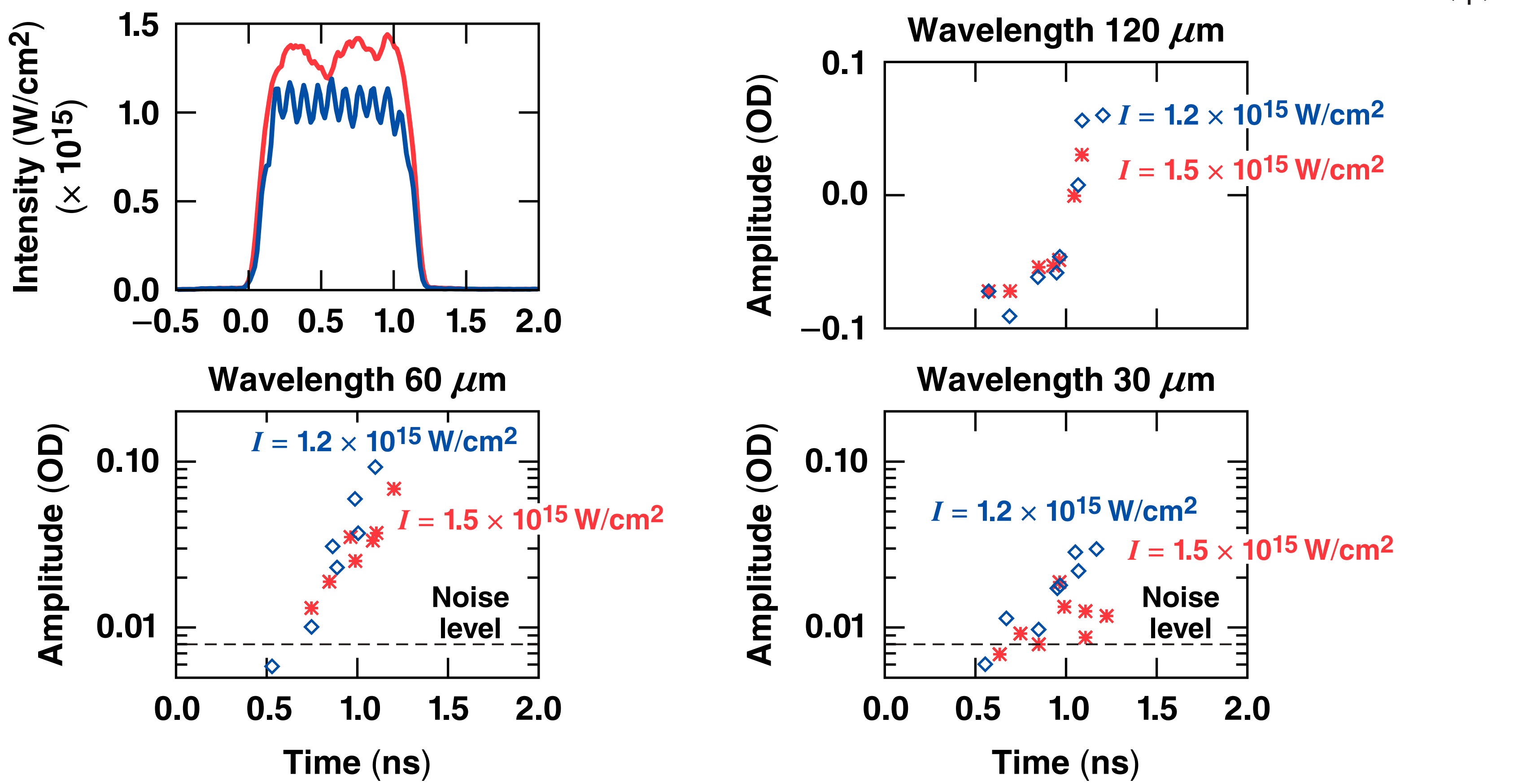
The RT growth is strongly stabilized at an intensity of 10^{15} W/cm^2 compared to 5×10^{14} W/cm^2



Modulation amplitudes are larger in 1.6-ns drives than in 1-ns drives at the same distance traveled

U656b

Reduction of RT growth at shorter wavelengths is consistent with increased preheat at higher drive intensities



- Betti–Goncharov growth rate $\gamma \simeq \sqrt{\dfrac{kg}{1+kL_m}} - 1.5\, kV_a$
- **Preheat increases V_a by ~4×, stabilizing the shorter wavelength more than the longer wavelength.**

E15961a

Future experiments will separate nonlocal and hot-electron contributions to preheat

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- Current experiments indicate that both nonlocal and hot electrons contribute to ablation-surface preheat.
- High-Z dopants significantly reduce hot-electron productions.
- Future experiments will use Si-doped targets to separate nonlocal and hot-electron contributions to total preheat
- Experiments will be done at various laser intensities and modulation wavelengths.

E16308

Summary/Conclusions

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