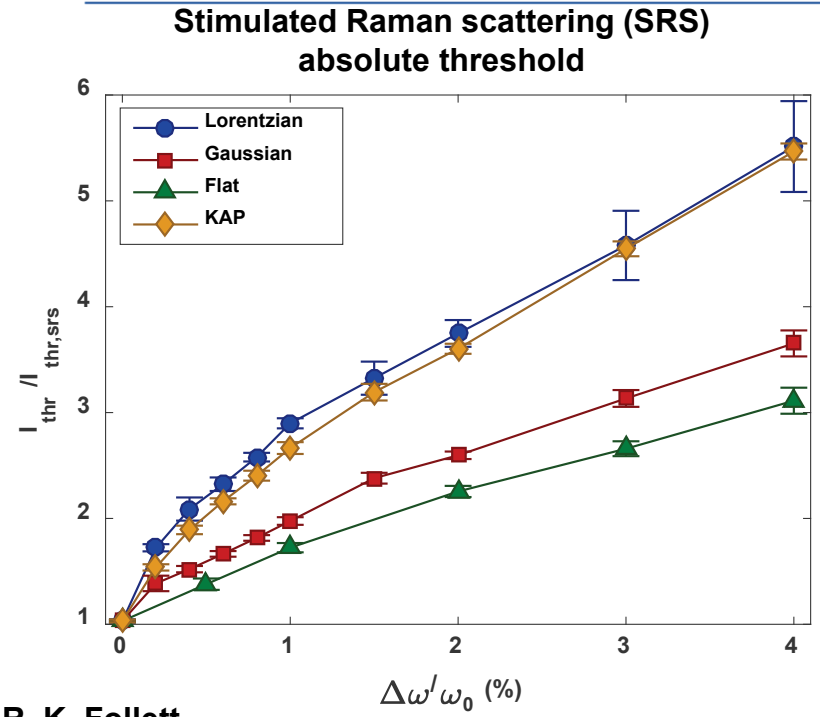
Novel Hot-Spot–Ignition Designs for Inertial Confinement Fusion with Liquid Deuterium–Tritium Spheres



- Laser-plasma instabilities limit the laser intensity that can be used in inertial confinement fusion (ICF) implosions
- The key factor in determining the effectiveness of a bandwidth scheme at suppressing instabilities is the coherence time

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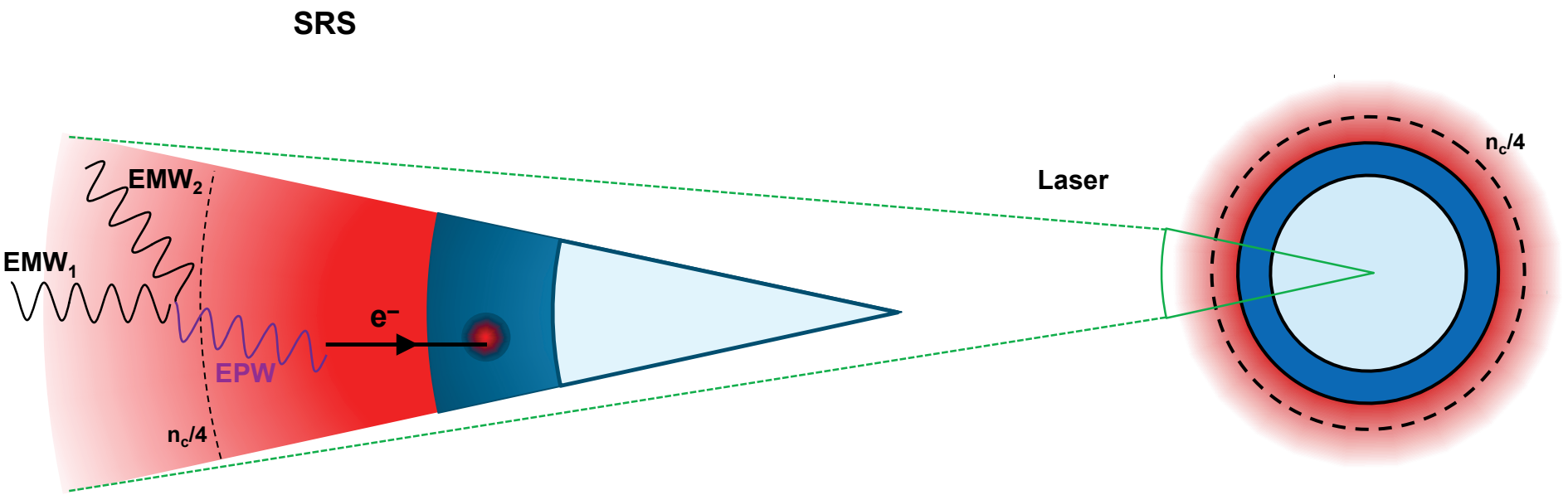
A future broadband laser based on optical parametric amplifiers is currently being developed at LLE

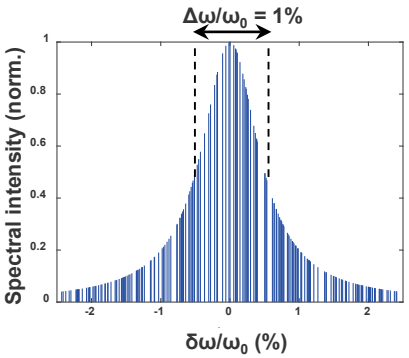
In direct-drive ICF implosions, TPD and SRS can lead to hot-electron preheat



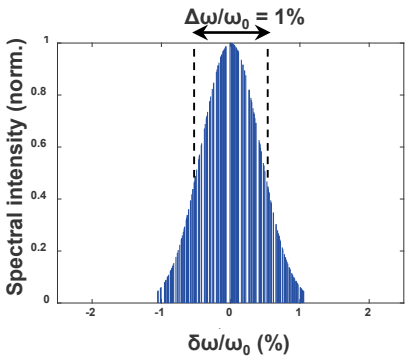
EMW: electromagnetic wave
EPW: electron plasma wave

There are many different bandwidth formats that can be used to suppress LPI

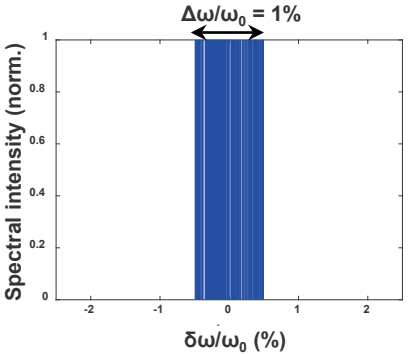
Lorentzian



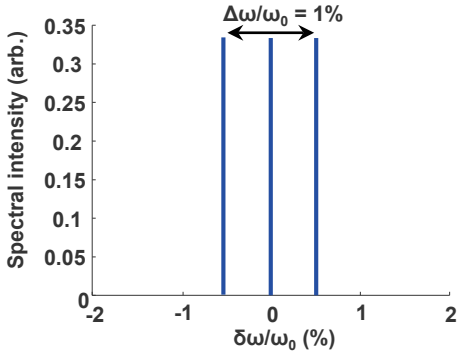
Gaussian



Flat



Discrete bandwidth



Different bandwidth formats provide varying degrees of instability mitigation

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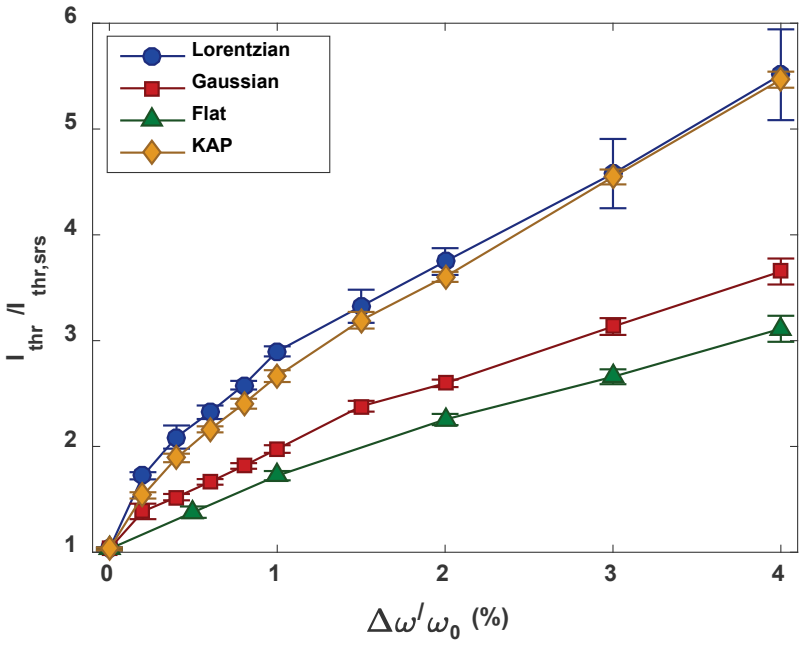
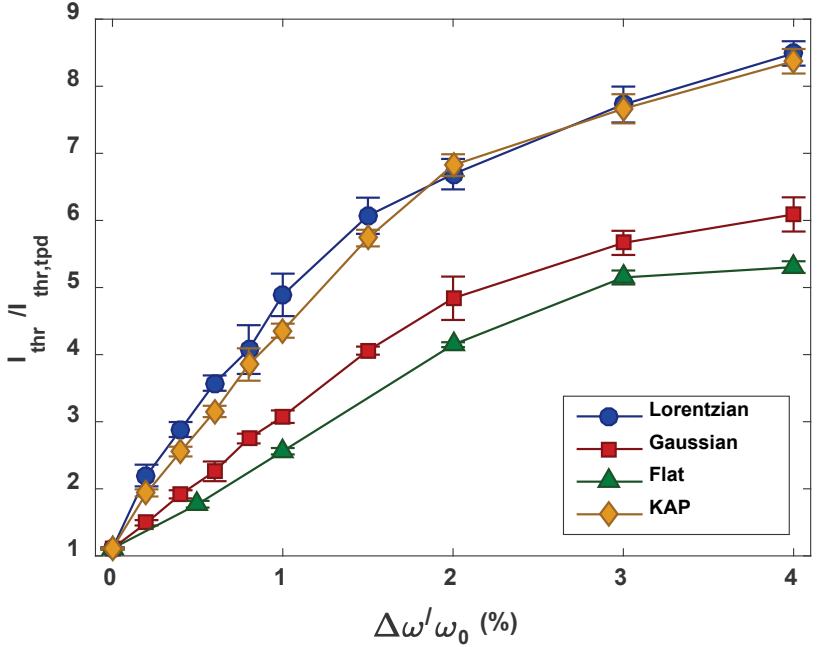
1-D SRS absolute threshold
(L_n=208 μm, T_e= 2 keV)



TPD absolute threshold
(L_n=208 μm, T_e= 2 keV)



High-bandwidth technologies developed to support short-pulse lasers are being used at LLE to build a next-generation driver for ICF

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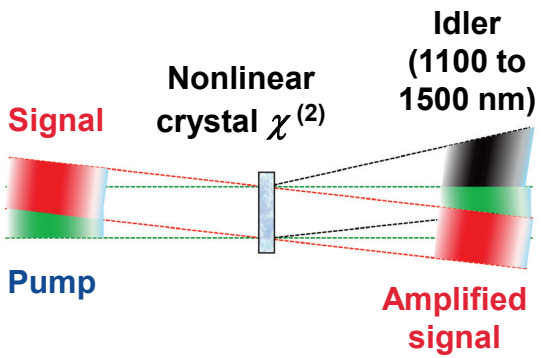
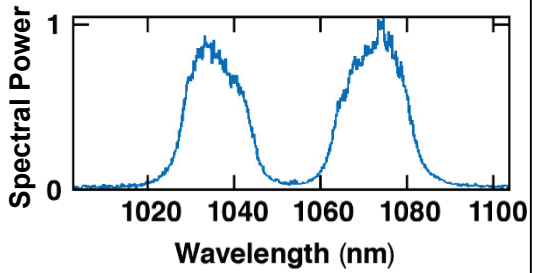
Optical Parametric Amplifiers
(developed for short-pulse lasers)



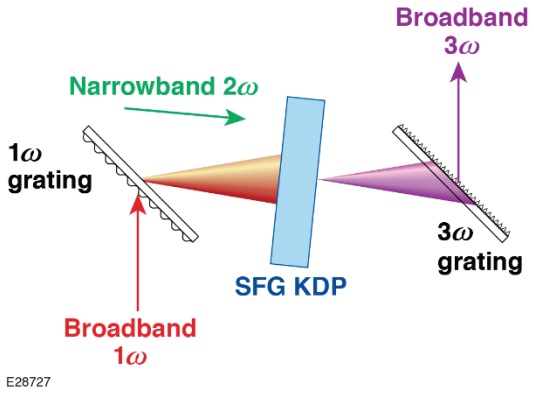
Novel co-linear OPA proposed for efficient amplification

LLE MTW Experiments
(configured with Collinear-OPA)



77% efficiency from pump to broadband ($\Delta\omega/\omega$>3%) pulse

Novel Sum-Frequency Generation (SFG)



Efficient broadband frequency conversion (1ω to 3ω) by SFG with narrowband 2ω

MTW: Multi-Terawatt