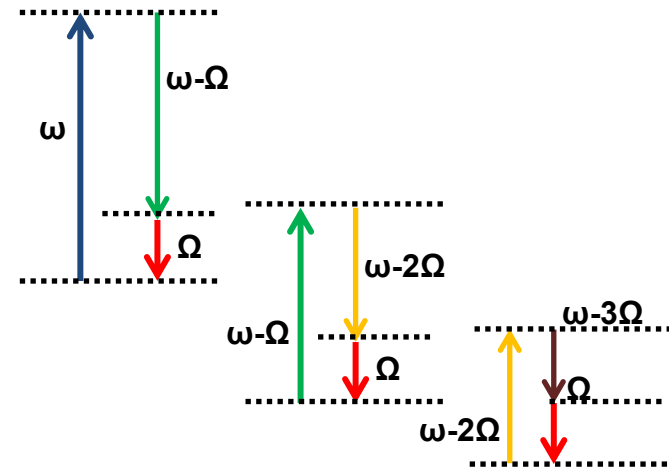
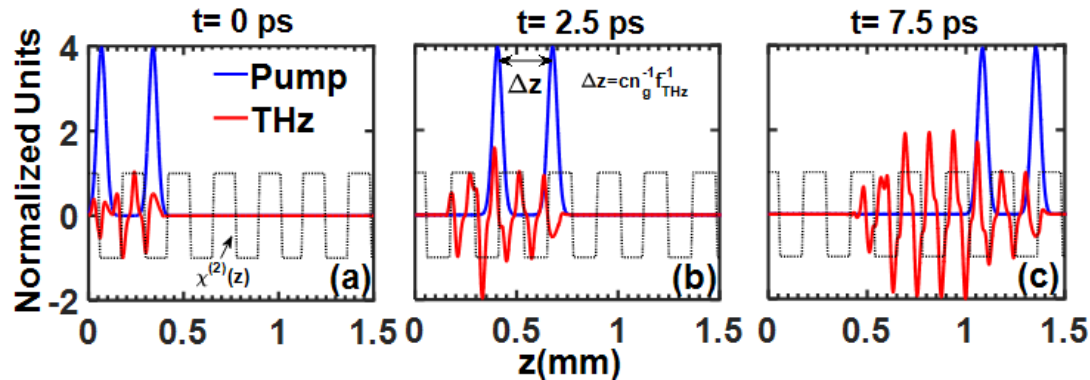


Terahertz Generation using Pulse Sequences

How to reach high conversion efficiencies ?

Circumvent Walk-off and Laser Induced Damage



Cascaded DFG⁴ :

Repeated energy down-conversions
can enable high efficiencies $\gg 1\%$

$$I_d = 2(\tau_d / 10ns)^{-1/2} \text{ GW/cm}^2$$

$$\eta \sim M \times M^{-1/2} \sim M^{1/2}$$

$$F_d = I_d \tau = 2(\tau_d / 10ns)^{1/2} \text{ J/cm}^2 \sim M^{1/2}$$

Conversion efficiency η scales as $M^{1/2}$

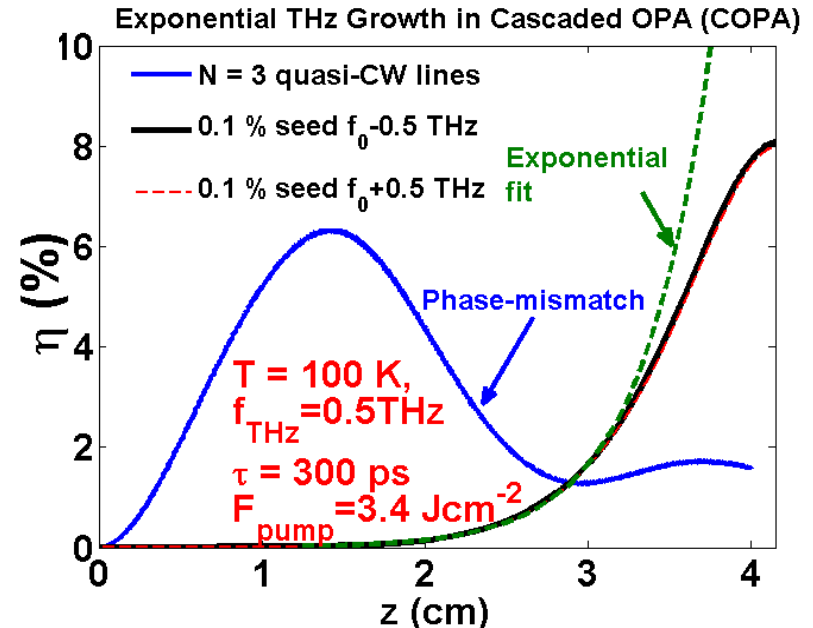
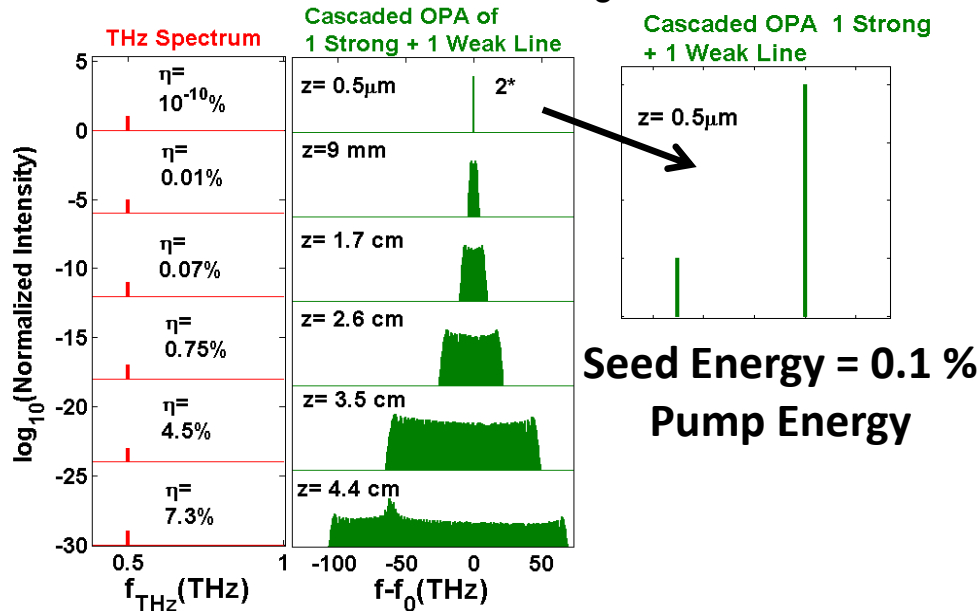
M = Number of pulses

Damage fluence increases

$\sim \text{cm}^2$ apertures required \rightarrow Demonstrated¹

Cascaded Optical Parametric Amplification

$T = 100 \text{ K}$, $\tau = 300 \text{ ps}$, $\lambda_0 = 1.03 \text{ }\mu\text{m}$



- Starting with a seed with 0.1% of pump energy -> Self-starts Cascading
- 1 J pump 300 ps \rightarrow 1 mJ 300 ps seed in a PPLN crystal at 100 K
- Exponential THz growth, $\eta \sim 10 \%$ at $T = 100 \text{ K}$, 4 cm crystals
- Strongly coupled Multi-Triplet Interaction \rightarrow Independent of seed location