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CW- and pulse-pumped super-continuum generators

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Outline

□ SC applications

- Metrology and optical clock
- Optical coherence tomography
- Telecom (WDM, SRS amplifiers)
- Generation of ultra-short pulses

□ Pumping schemes : our analysis

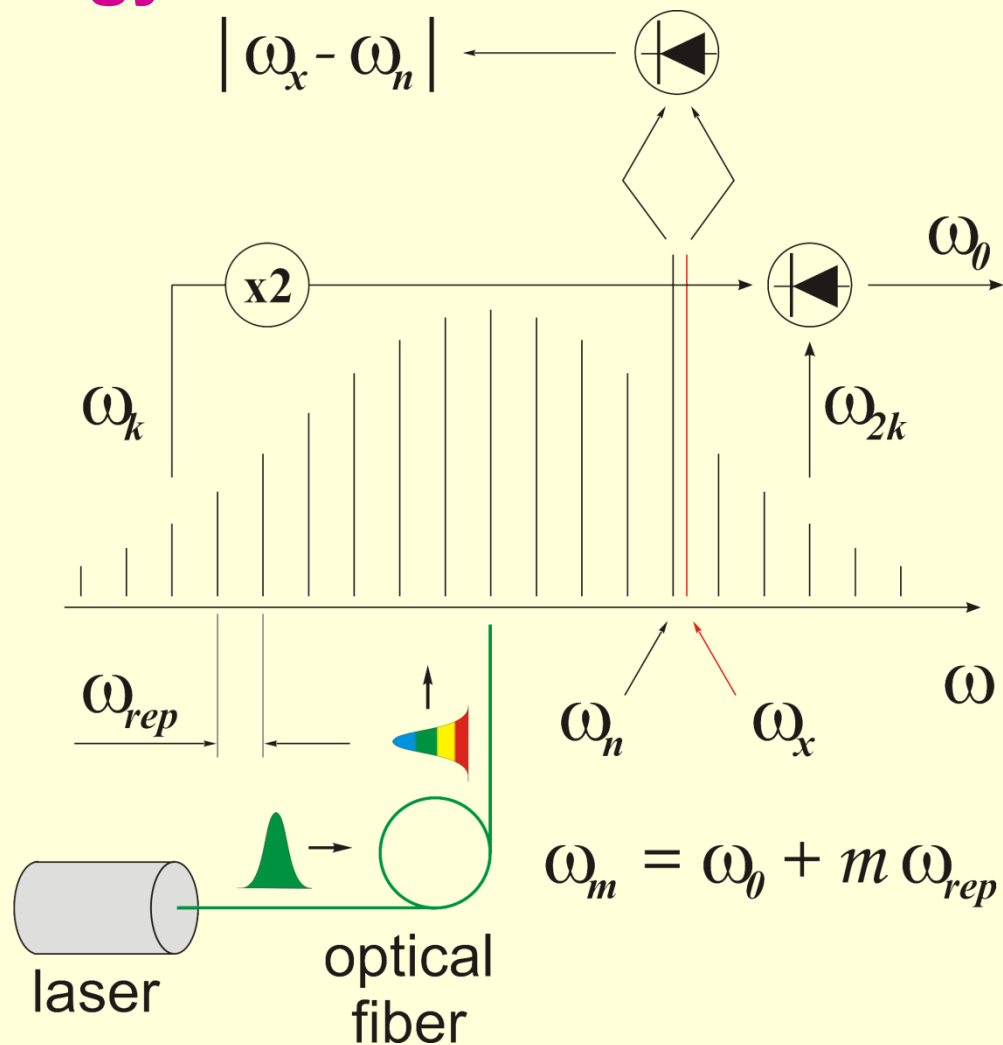
- CW pumping ($\beta_2 < 0$)
- Pumping with long pulses ($\beta_2 < 0$)
- Modulated CW pumping ($\beta_2 < 0$)
- Short-pulses pumping ($\beta_2 < 0$)
- Pumping with pulses, $\beta_2 > 0$



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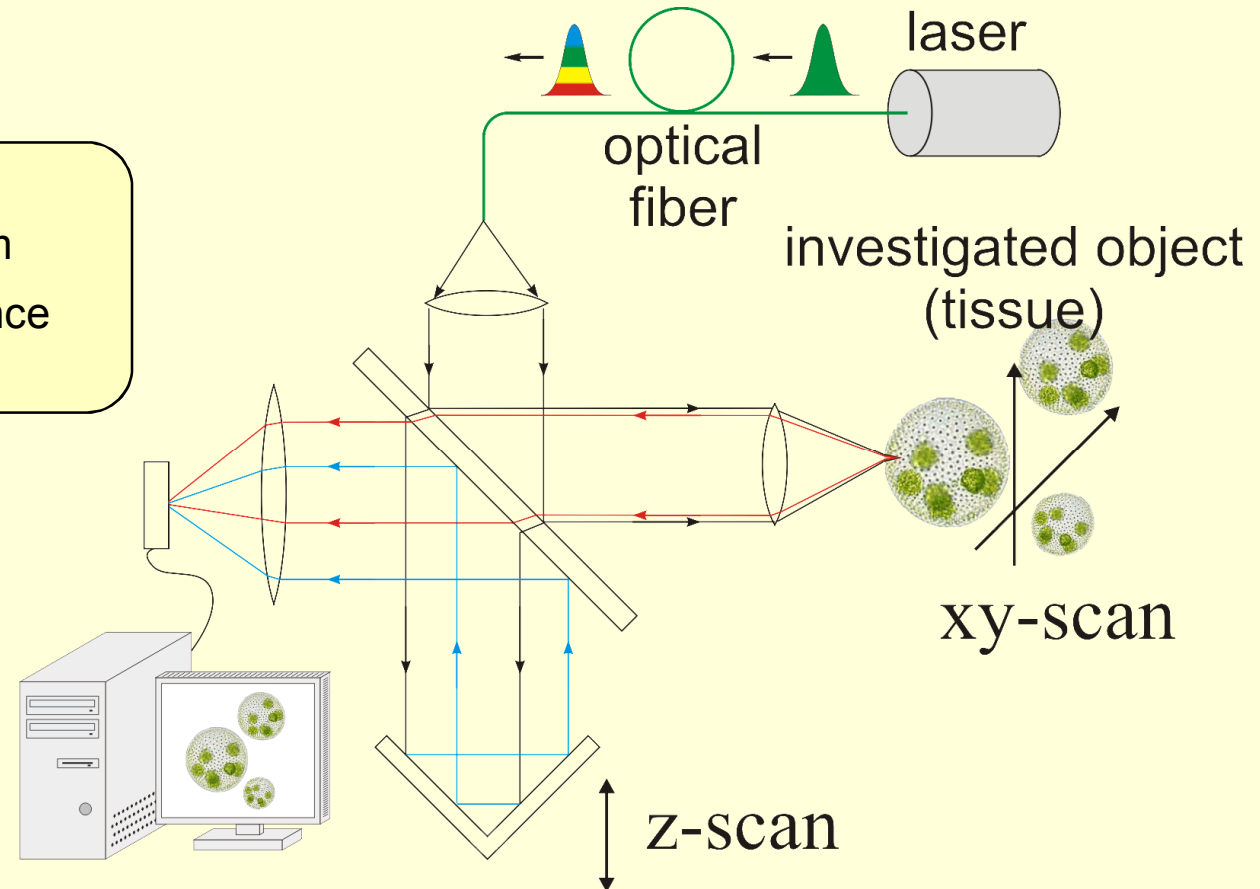
SC Applications: Metrology

- High pulse-to-pulse stability of super-continuum amplitude and phase
- Octave-spanning spectrum



SC Applications: Optical coherence tomography

- Broadband spectrum
- High spatial coherence

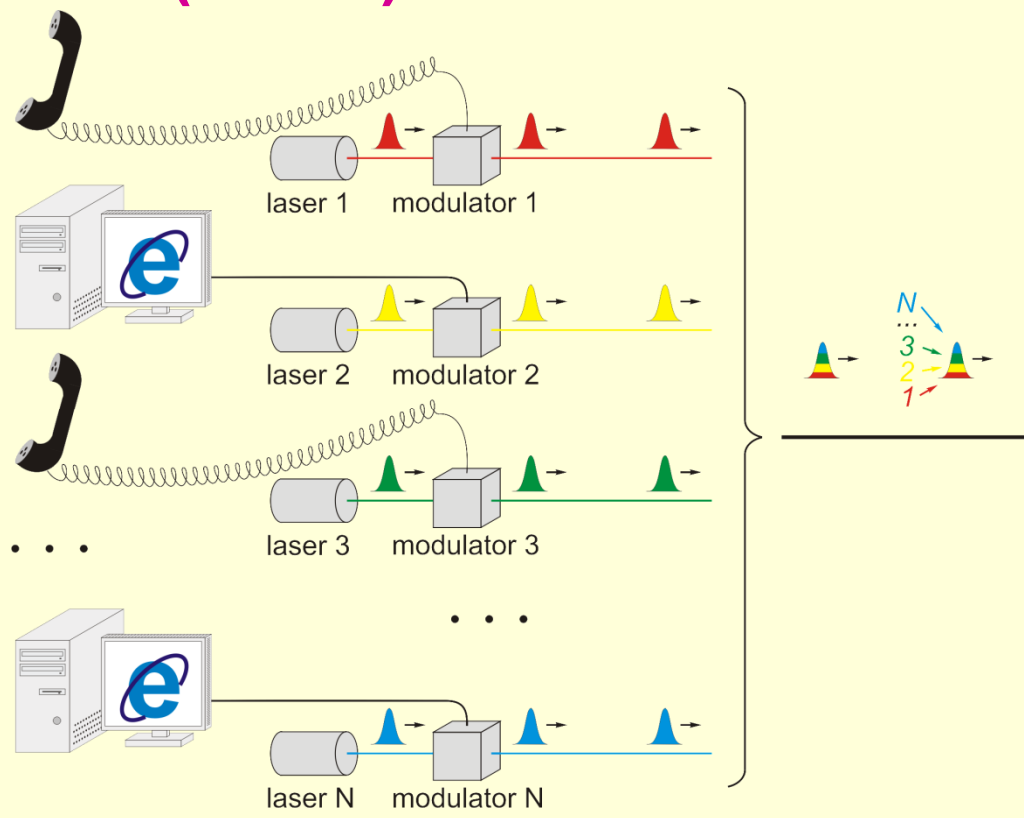




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SC Applications: Telecom (WDM)

- Regular temporal structure
- Π -shaped spectrum

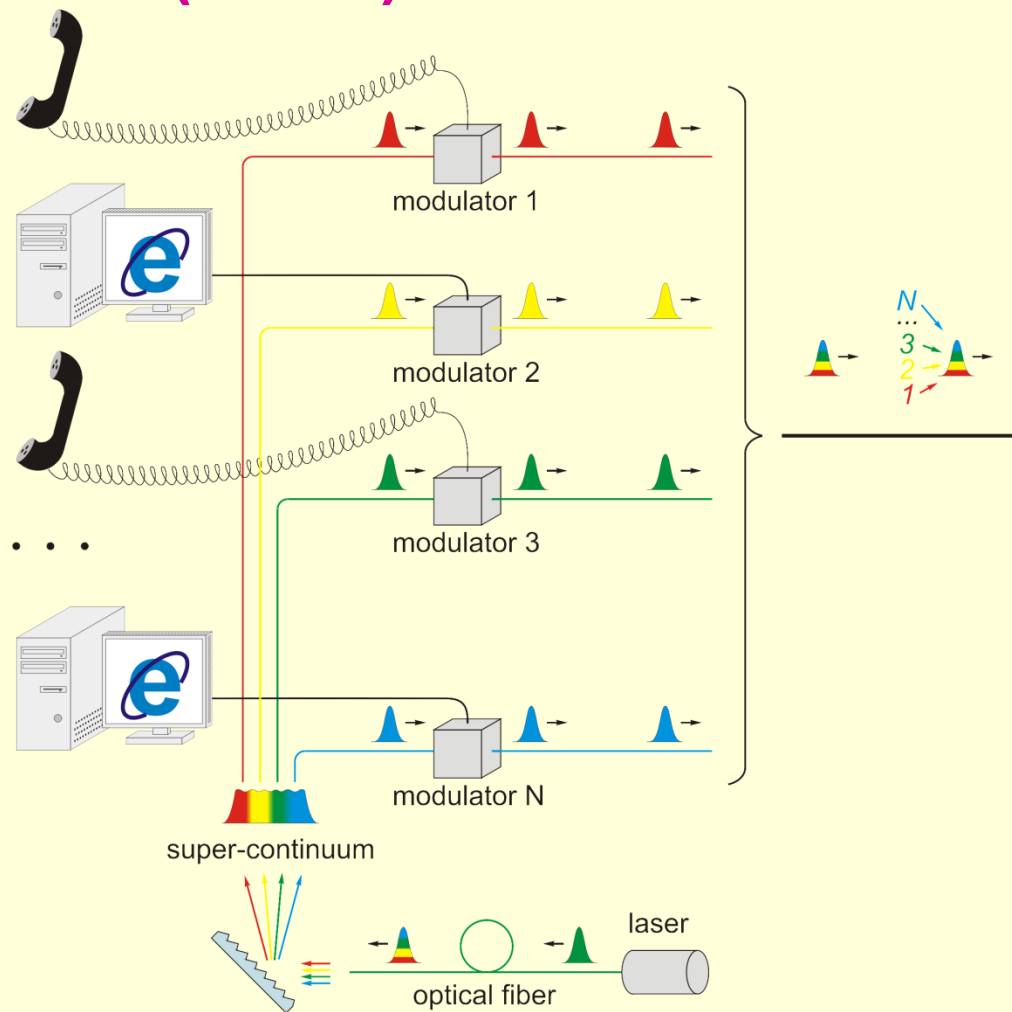




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SC Applications: Telecom (WDM)

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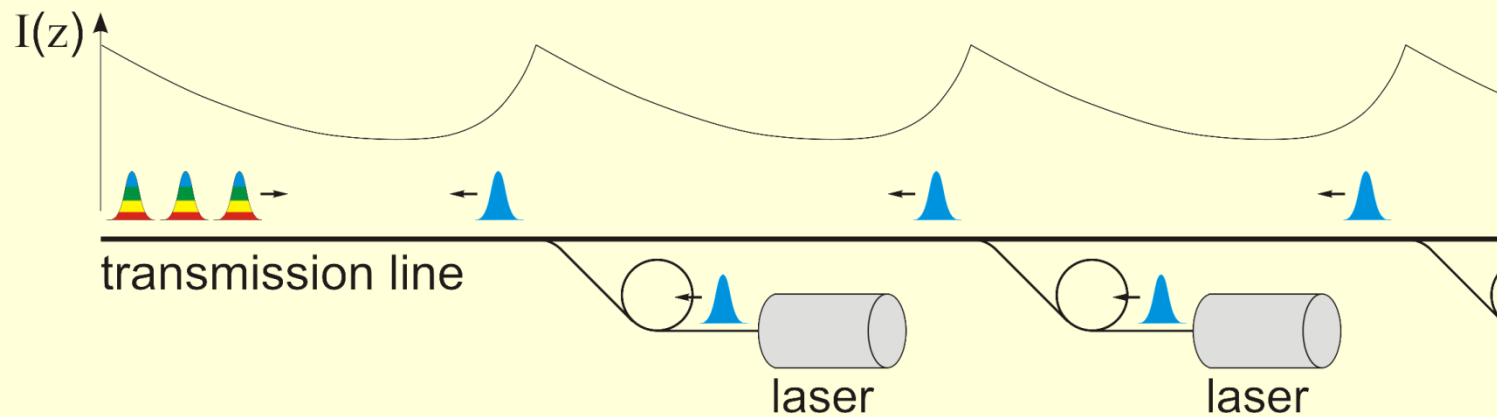




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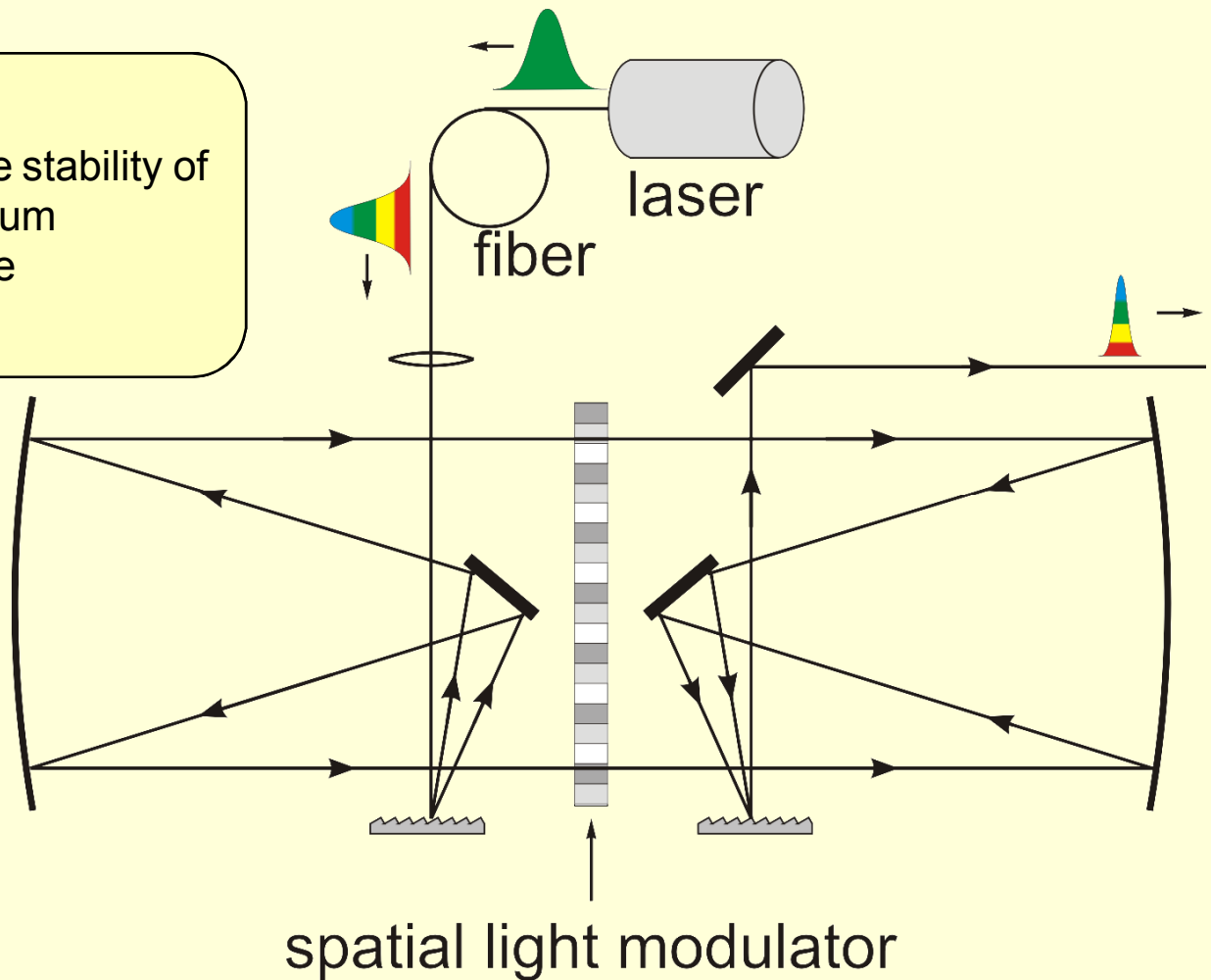
SC Applications: Telecom (SRS amplifiers)

- Special profile of spectral power



SC Applications: Generation of ultra-short pulses

- Pulse-to-pulse stability of super-continuum spectral phase





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- ✓ Generation of ultra-short pulses

➤ Pumping schemes : our analysis

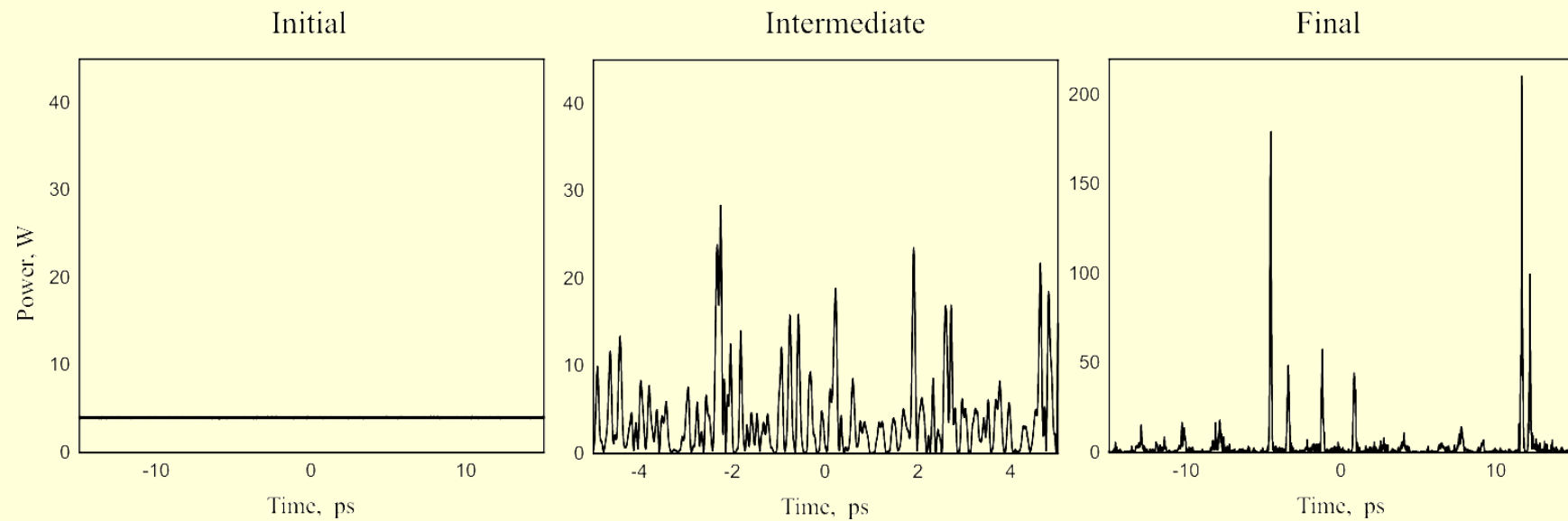
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CW pumping

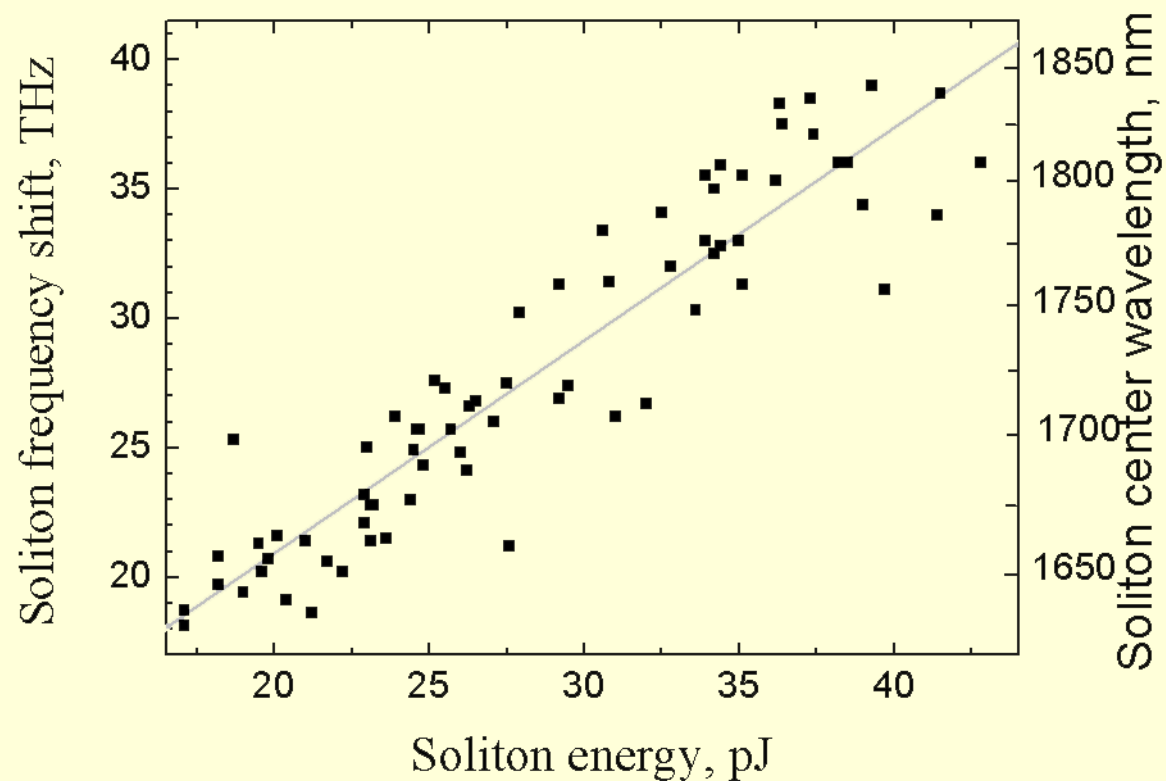
Stochastic time structure due to modulation instability





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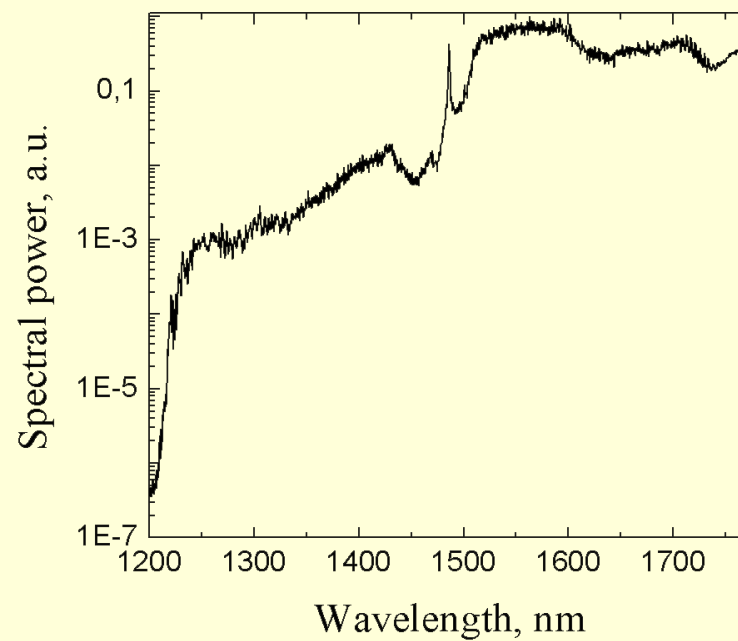
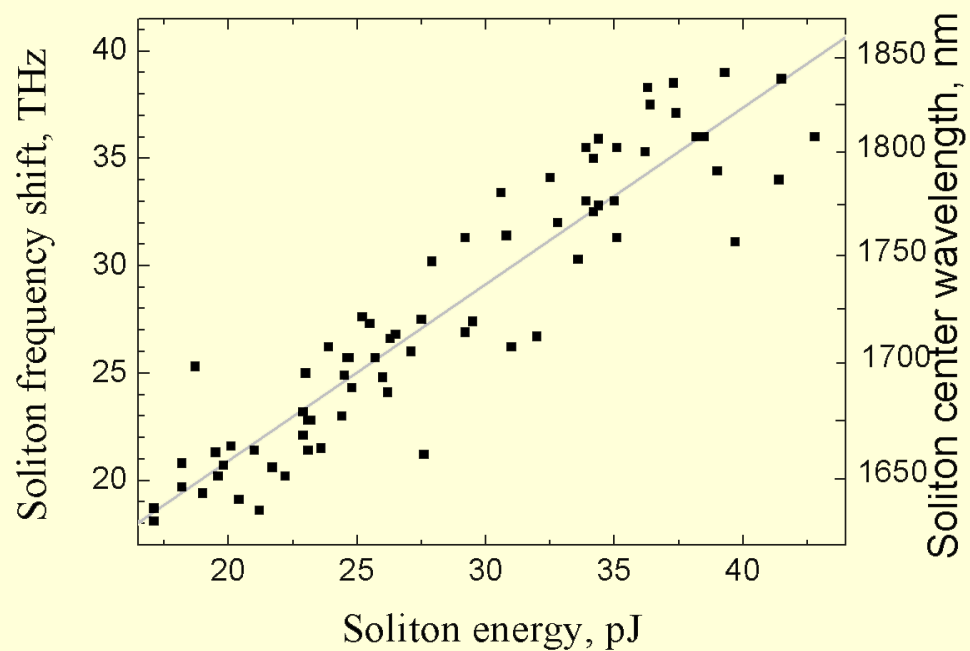
CW pumping





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CW pumping

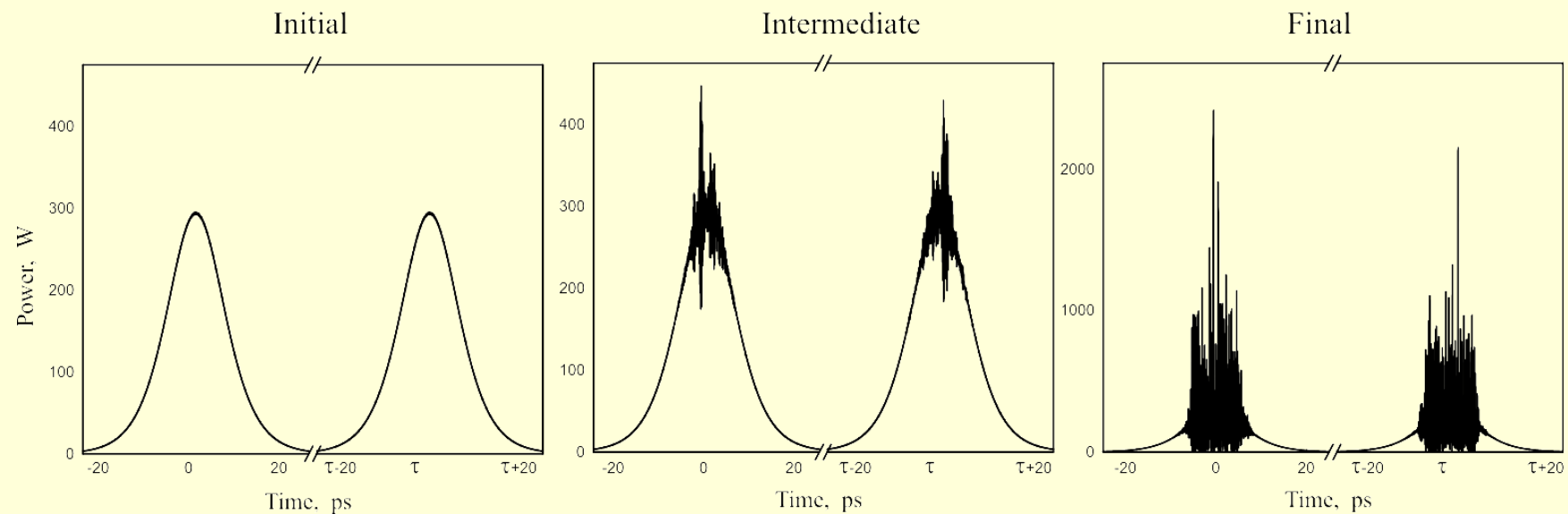




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Pumping with long pulses in anomalous dispersion regime

A regular train of wave packets with stochastic time structure inside each of them

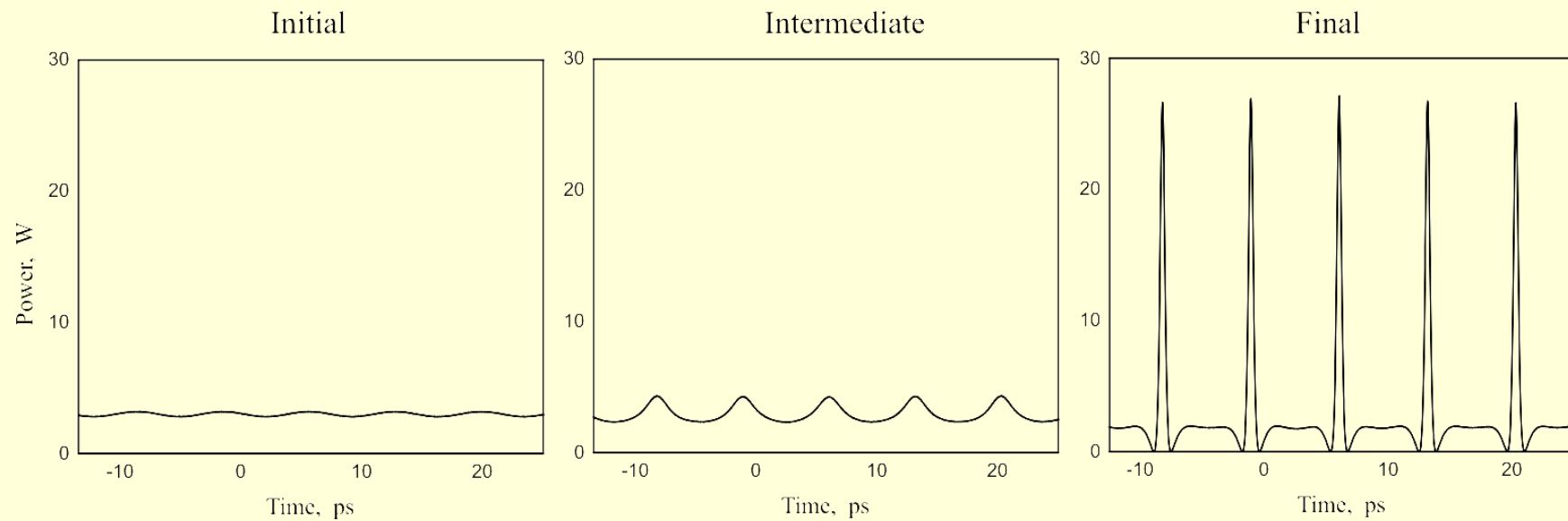




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Modulated CW pumping

Regular time structure due to induced modulation instability



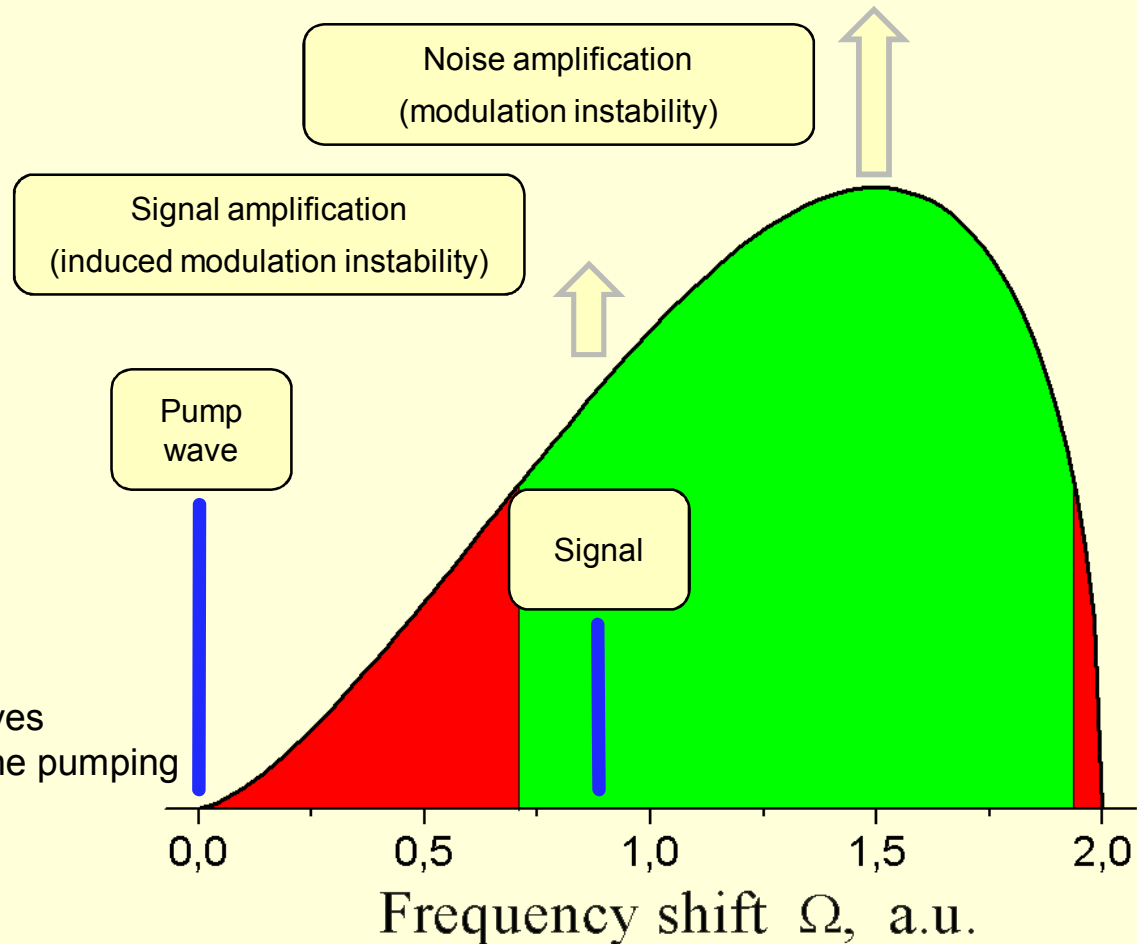


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Modulated CW pumping

$$|1 - \xi| < \sqrt{1 - \left(\frac{\ln \frac{I_0}{I_s}}{\ln \frac{I_0}{\eta I_{noise}}} \right)^2}$$

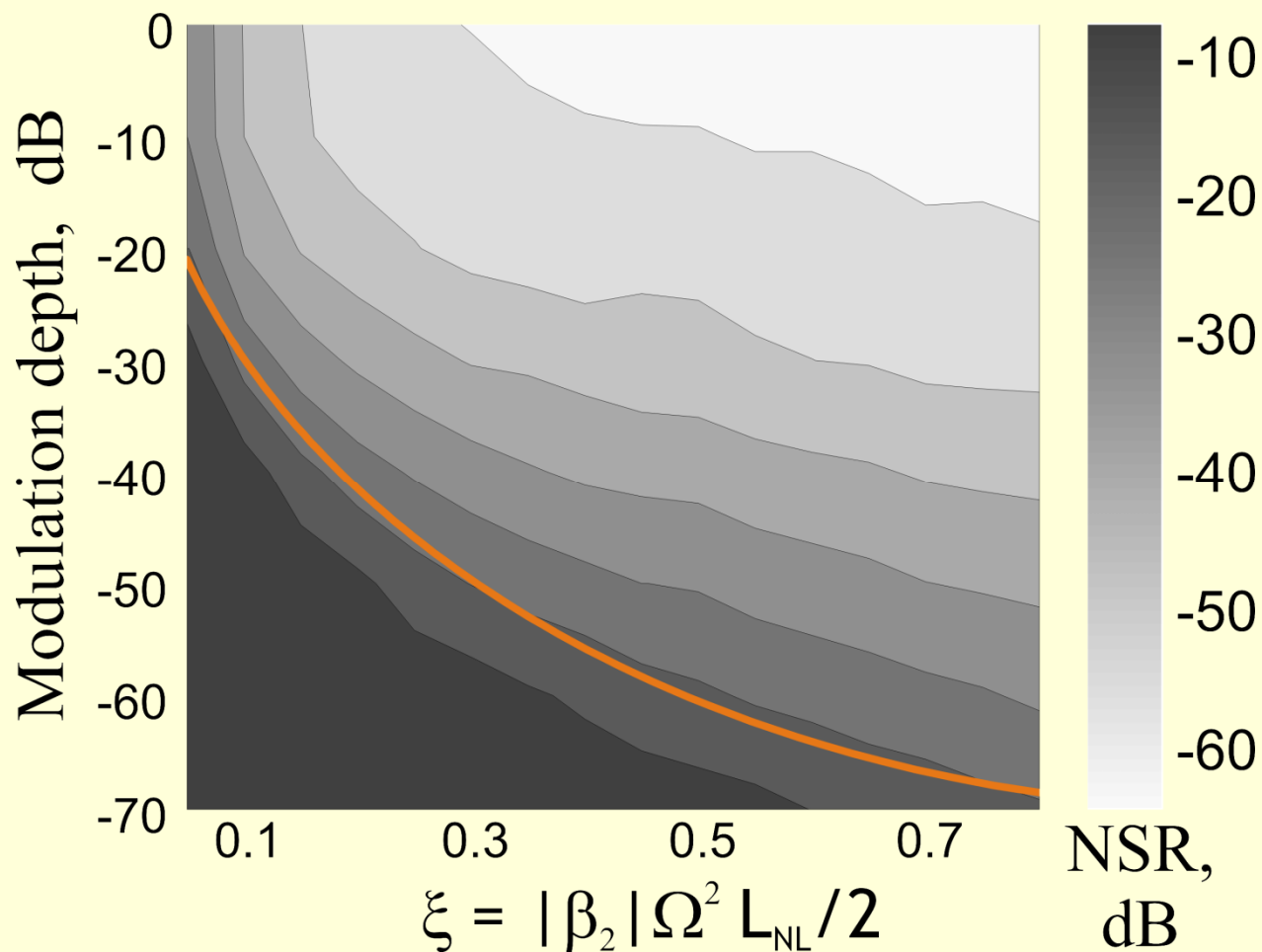
I_0, I_s – intensities of input waves
 η – noise-to-signal ratio for the pumping wave





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Modulated CW pumping

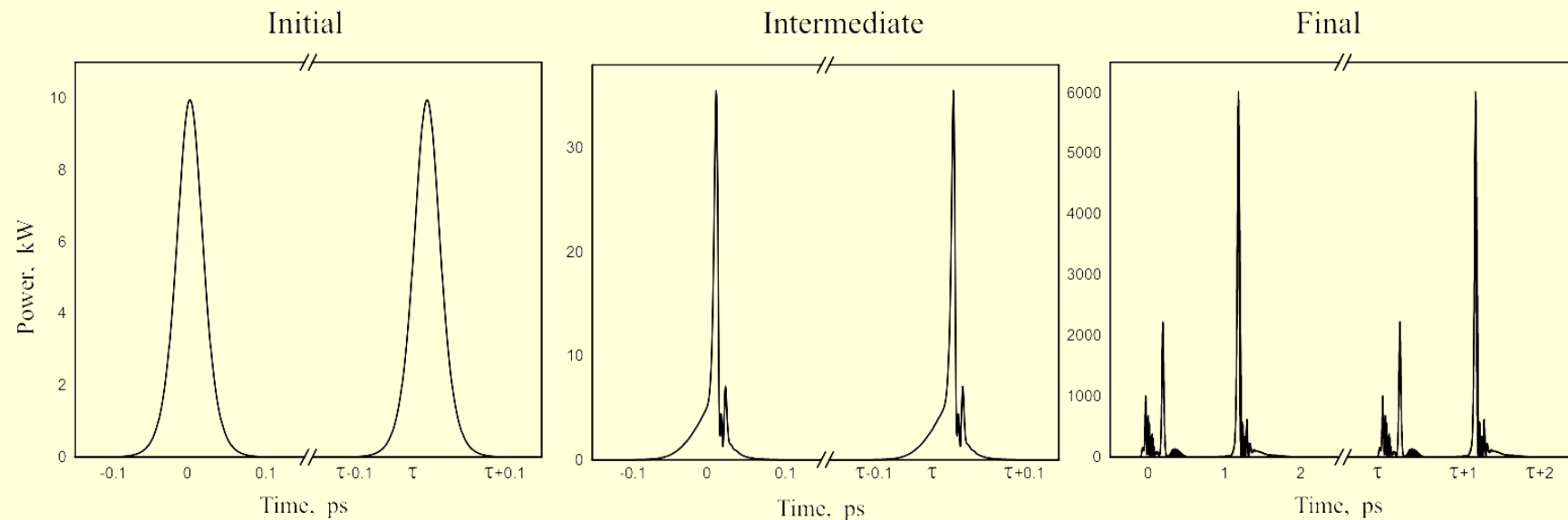




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Pumping with short pulses in anomalous dispersion regime

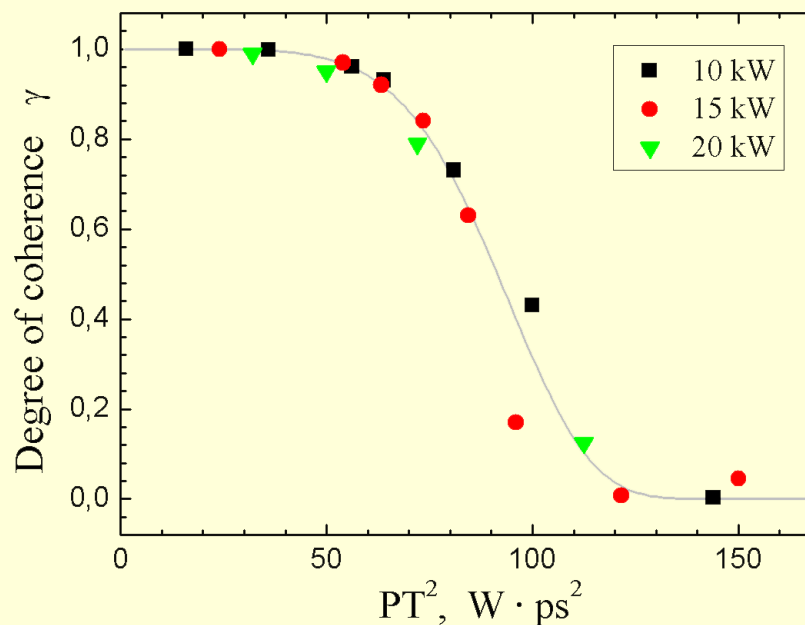
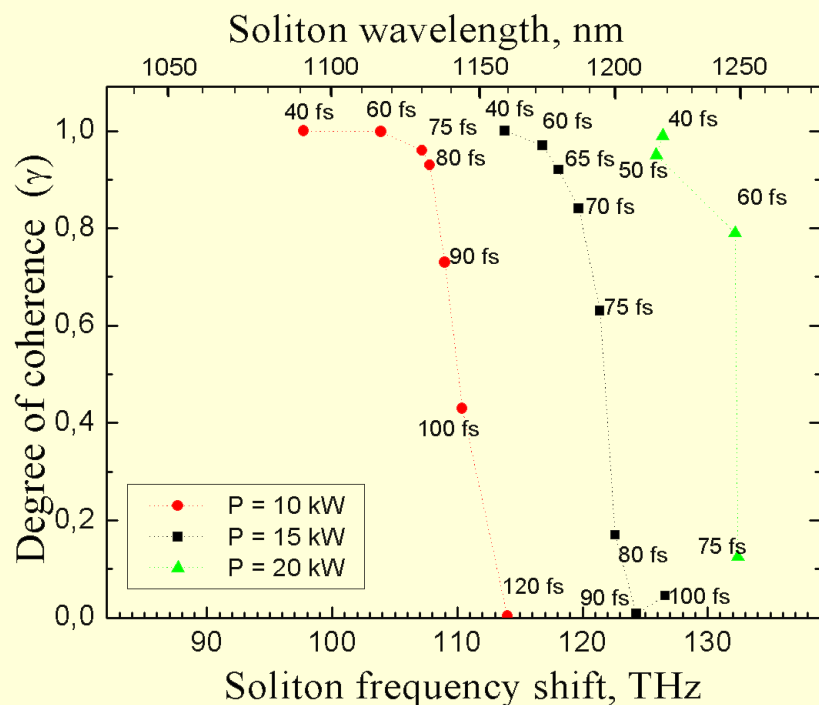
Regular train of wave packets with complex time structure
which is reproduced from pulse to pulse





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Pumping with short pulses in anomalous dispersion regime

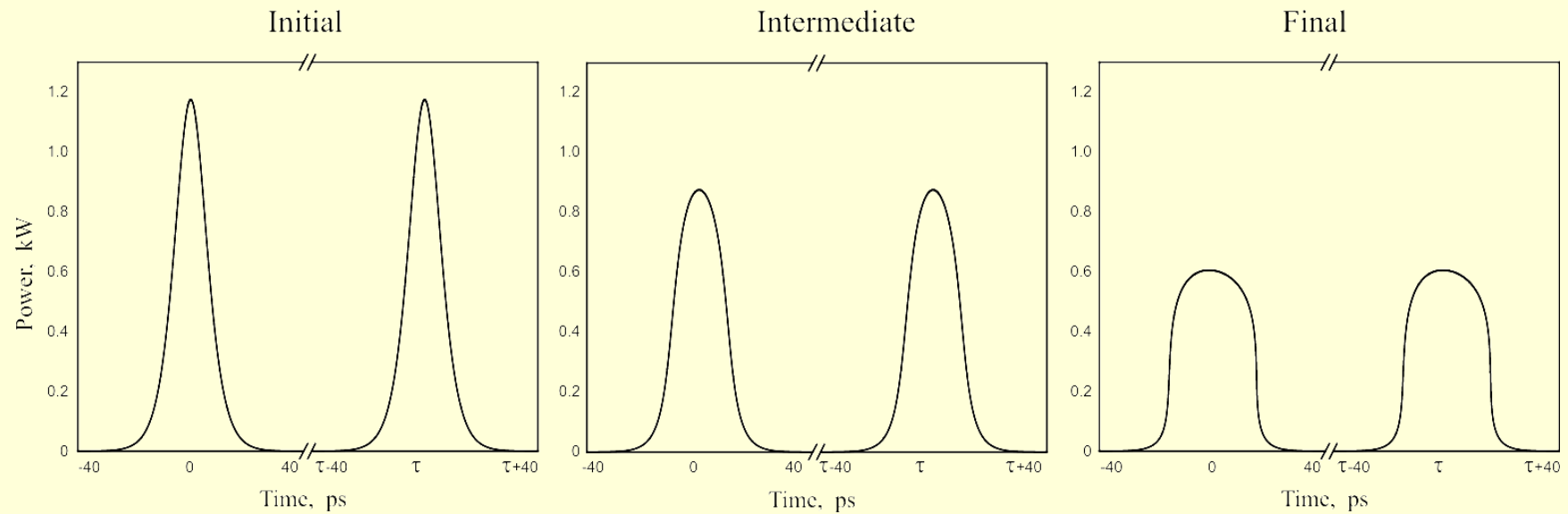




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Pulse pumping in normal dispersion regime

Regular time structure





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Conclusions

	CW pumping	Pumping with long pulses, anomalous dispersion	Modulated CW pumping	Pumping with short pulses, anomalous dispersion	Pulse pumping in normal dispersion
Optical metrology & clock	-	-	-	+	-
OCT	+	+	+	+	+
WDM	-	-	+	-	+
SRS amplifiers	+	+	+	+	+
Ultra-short pulses generation	-	-	+	+	+
Time-resolved spectroscopy	-	-	+	+	+