

CW-pumped, Repetitively Q-switched Operation of a Ti:Sapphire Laser

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OUTLINE

Theoretical background

Laser design

Performance data



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OOPS!

Not the first report of CW-pumped, Q-switched operation

Scheps and Myers reported results at ASSL'93 of cw Ti:sapphire laser operating with a chopper in the cavity

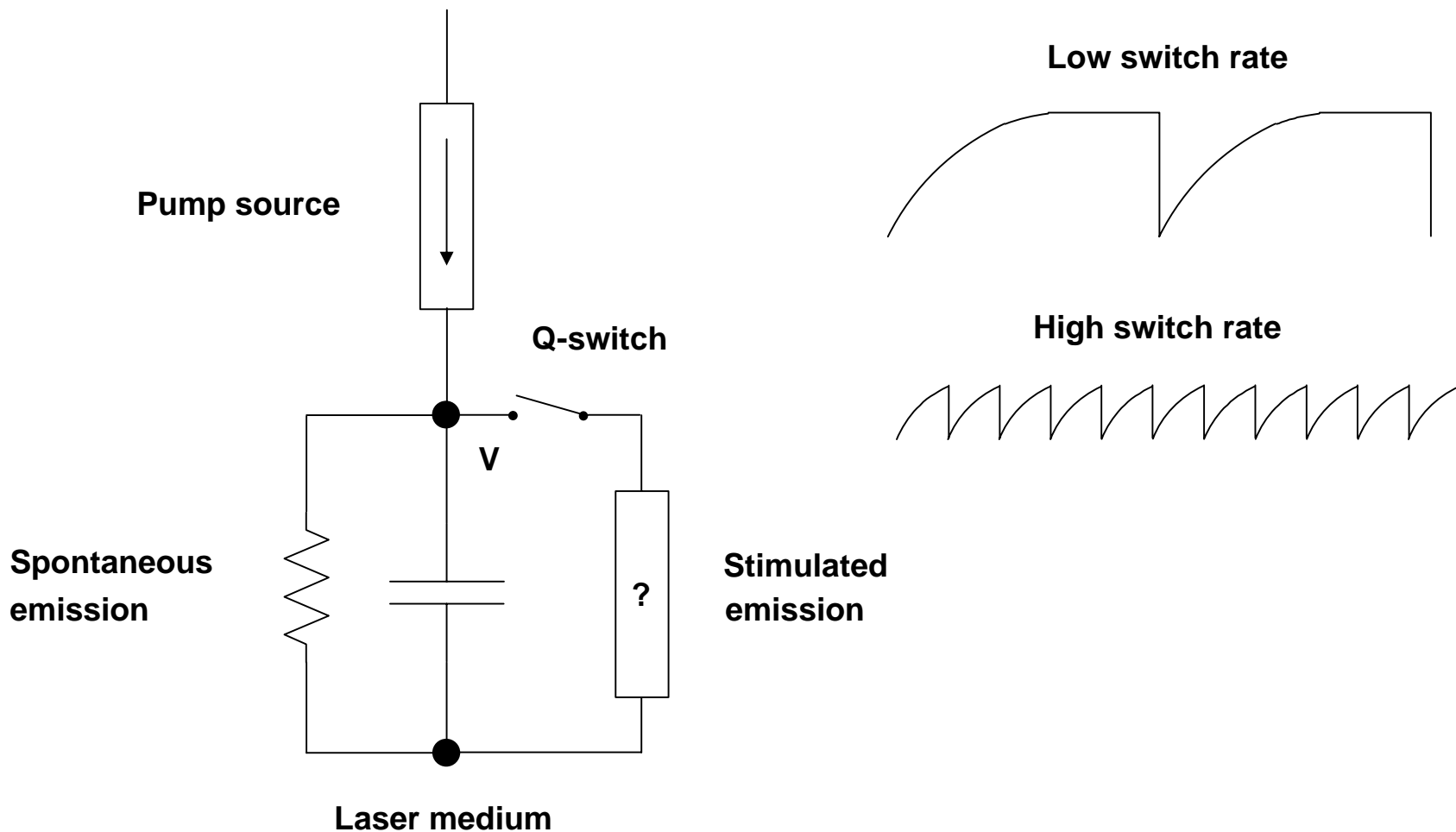
- **Chopper operated at 2.9 kHz**
- **Laser output was an initial spike followed by relaxation oscillations and quasi-cw operation**

Paper to be published in April '94 IEEE JQE



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ELECTRICAL ANALOG OF REPETITIVELY Q-SWITCHED LASER





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TYPICAL CW Ti:SAPPHIRE LASER PARAMETERS

Upper-state lifetime - 3.2 μ s

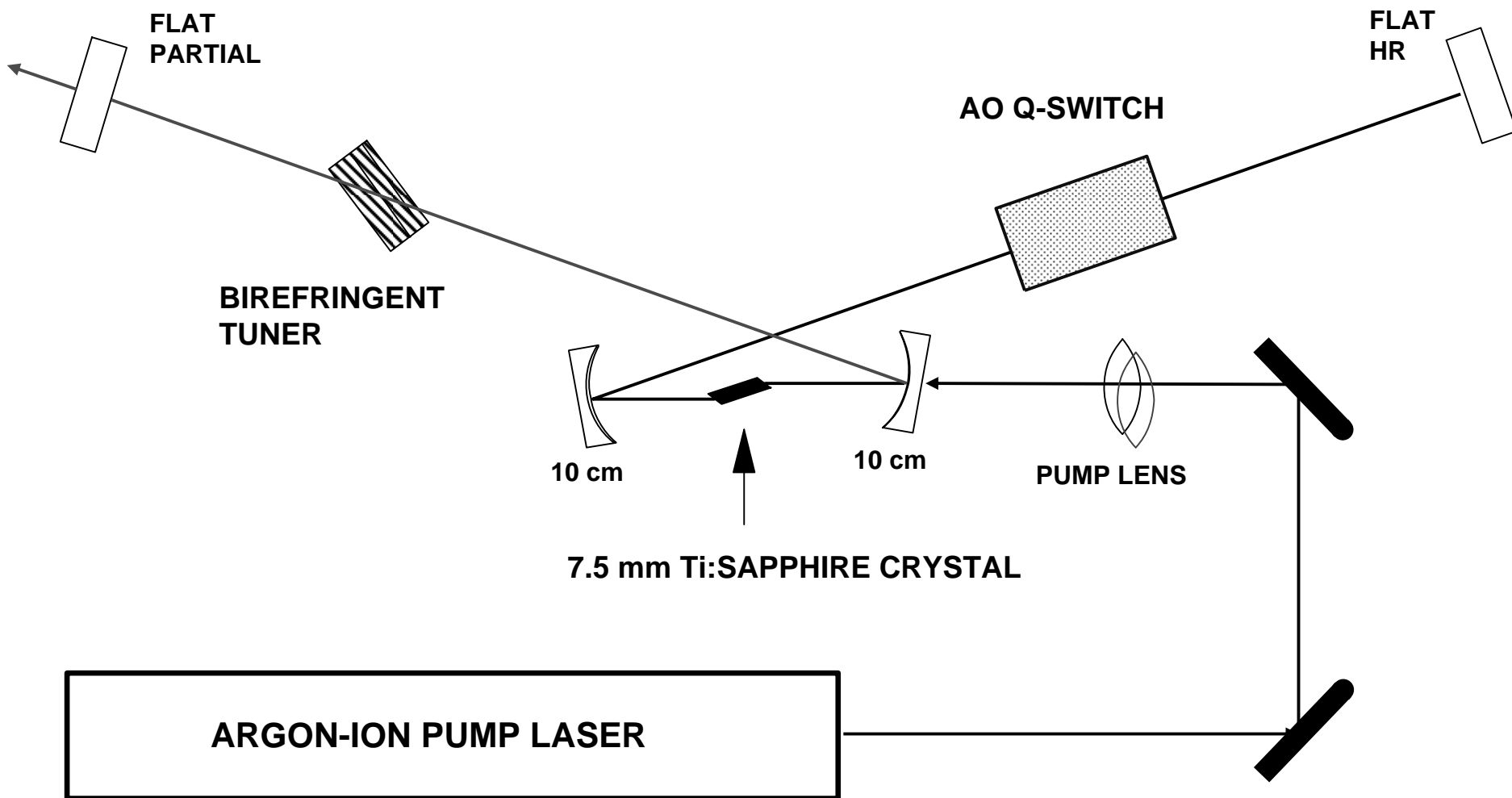
Cavity lifetimes

- **72 cm, T = 2% -> 240 ns**
- **72 cm, T = 25% -> 19 ns**



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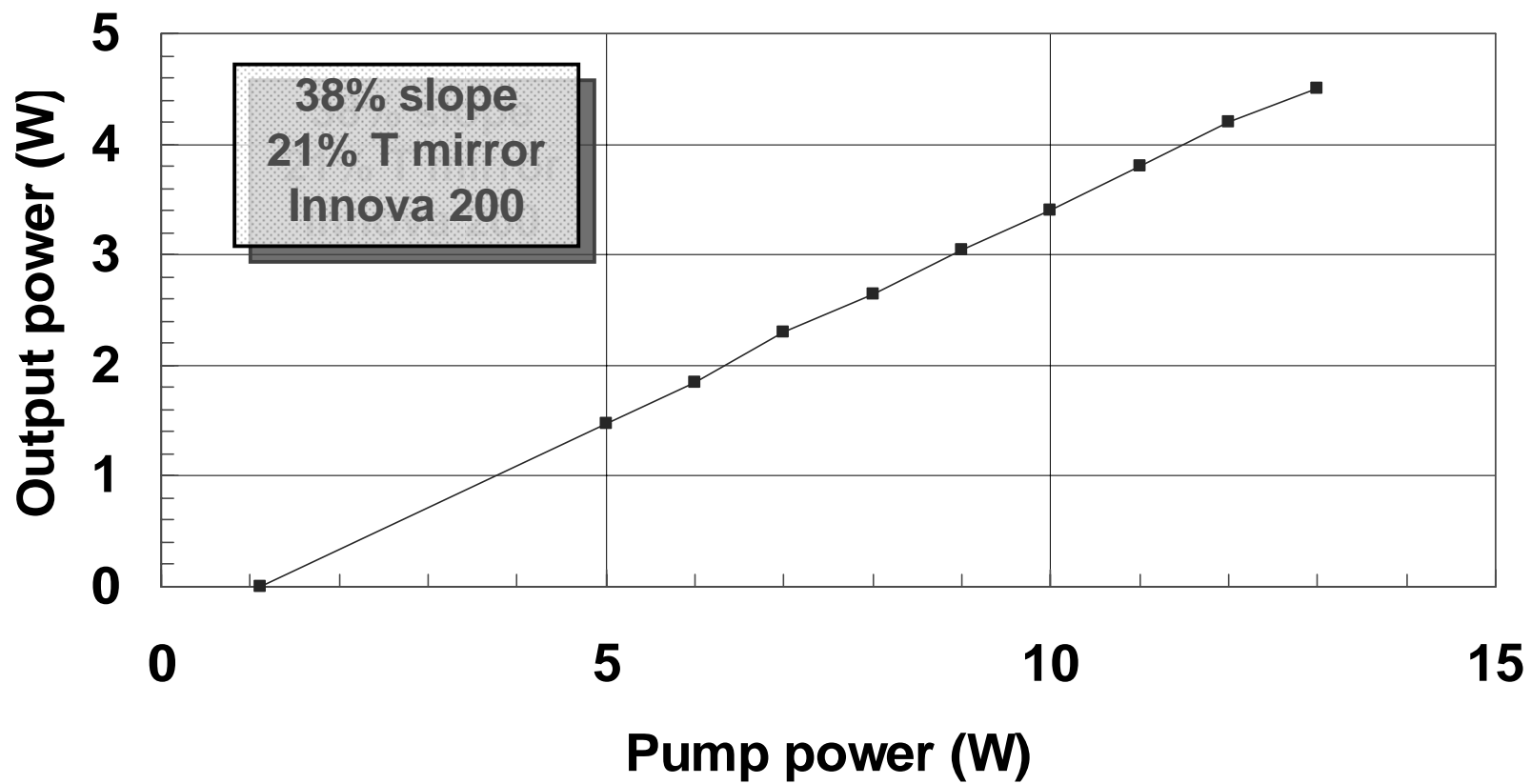
LASER CONFIGURATION





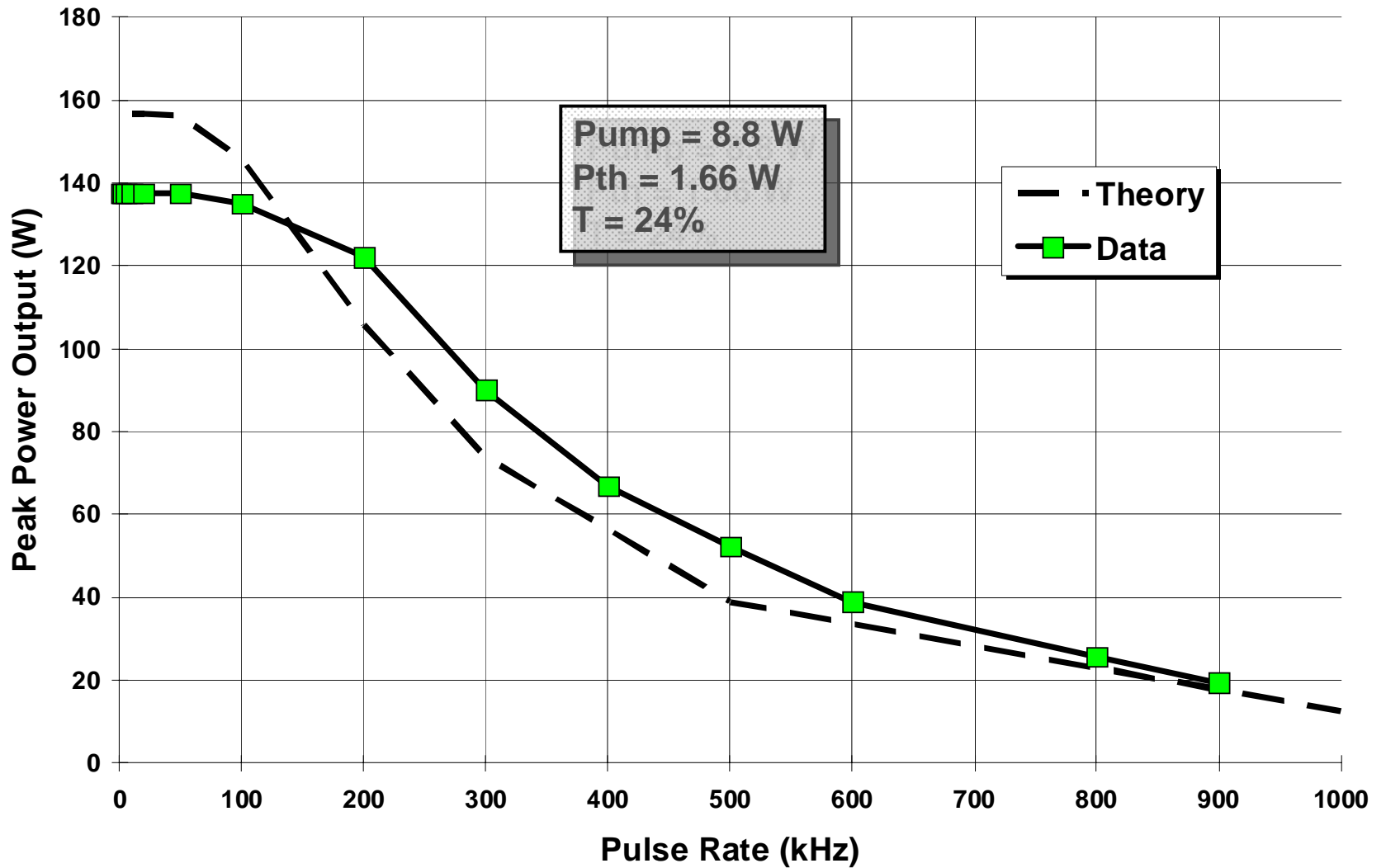
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CW INPUT-OUTPUT DATA



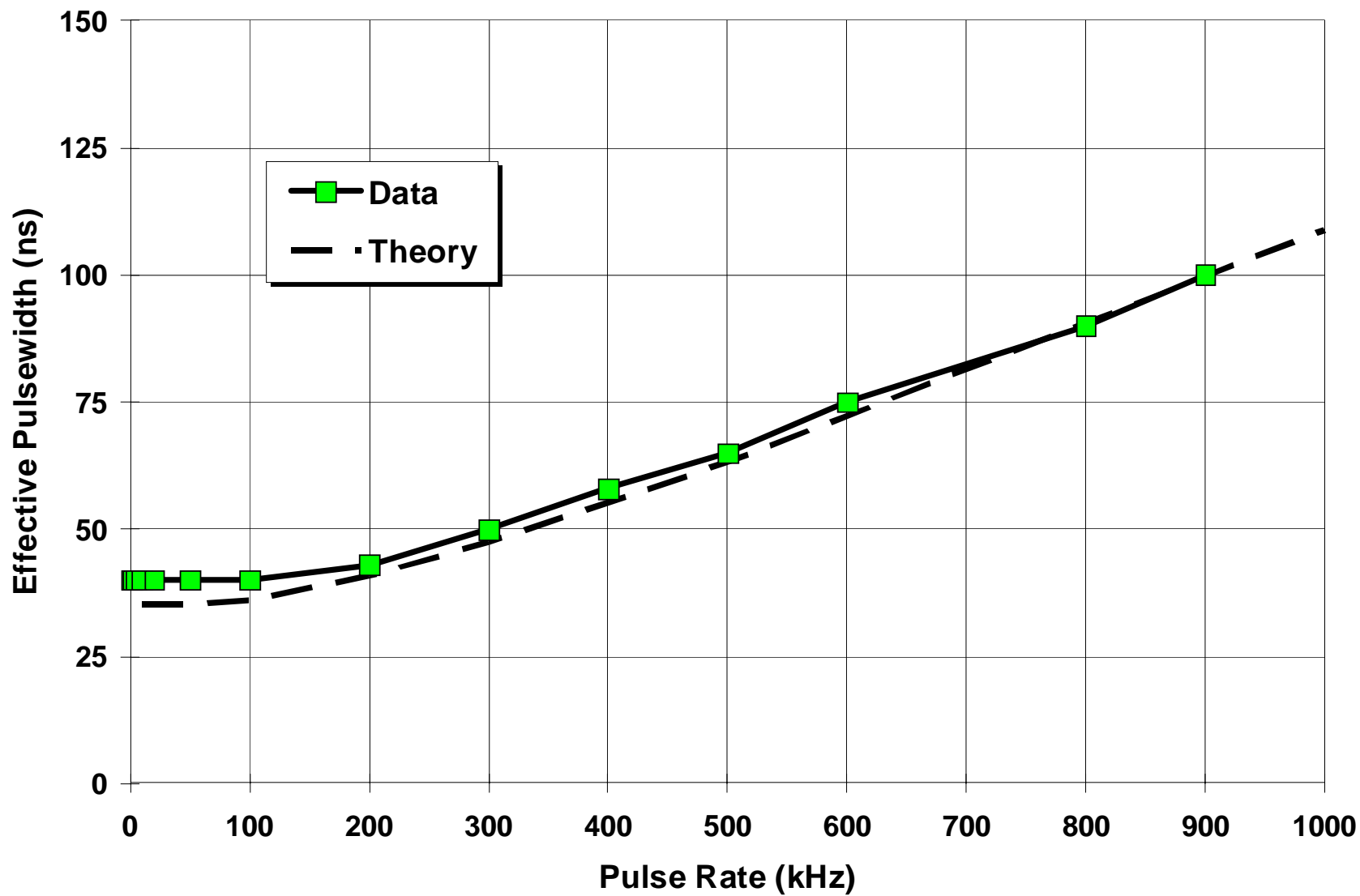


PEAK POWER vs. PULSE RATE





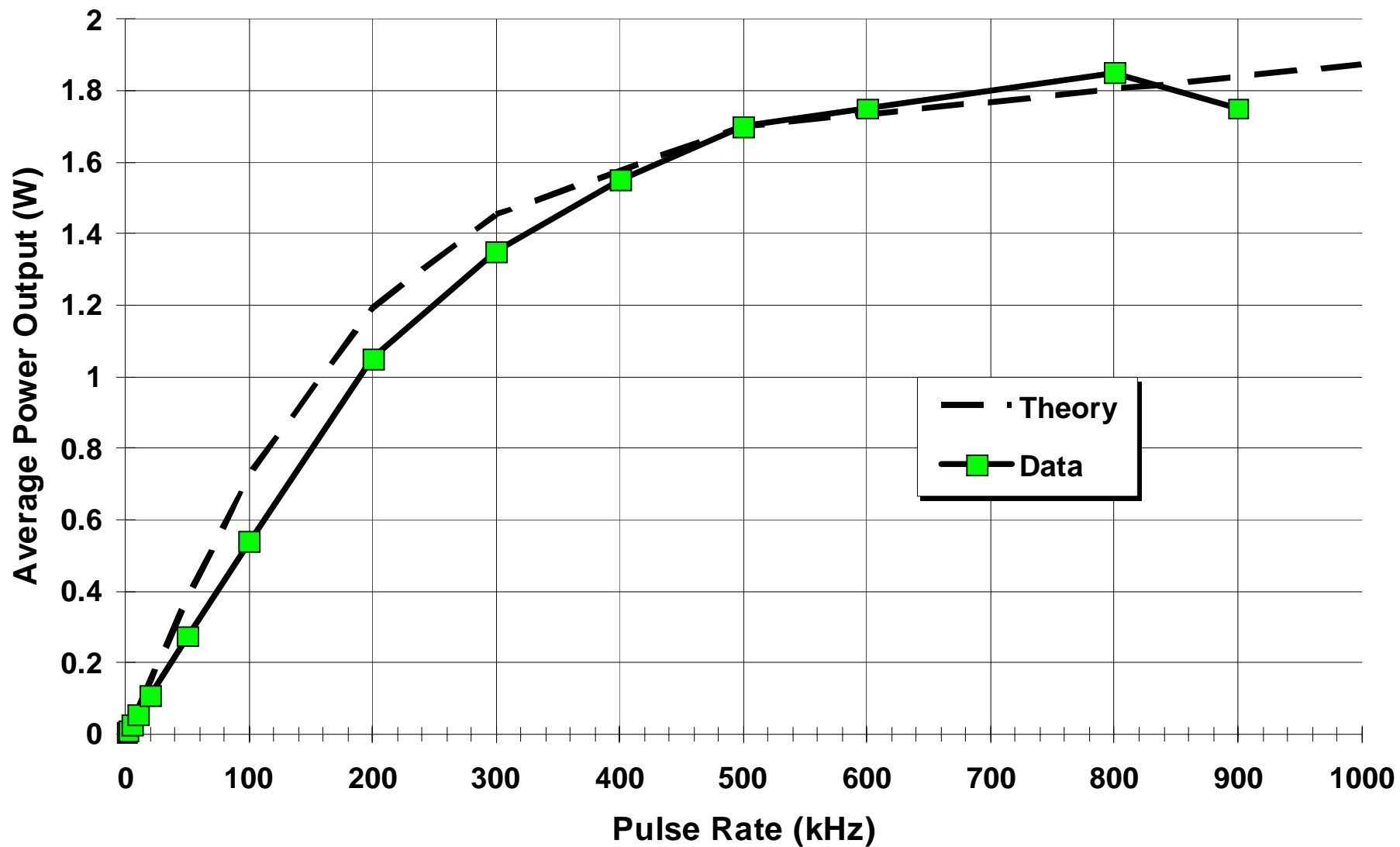
PULSEWIDTH vs. PULSE RATE





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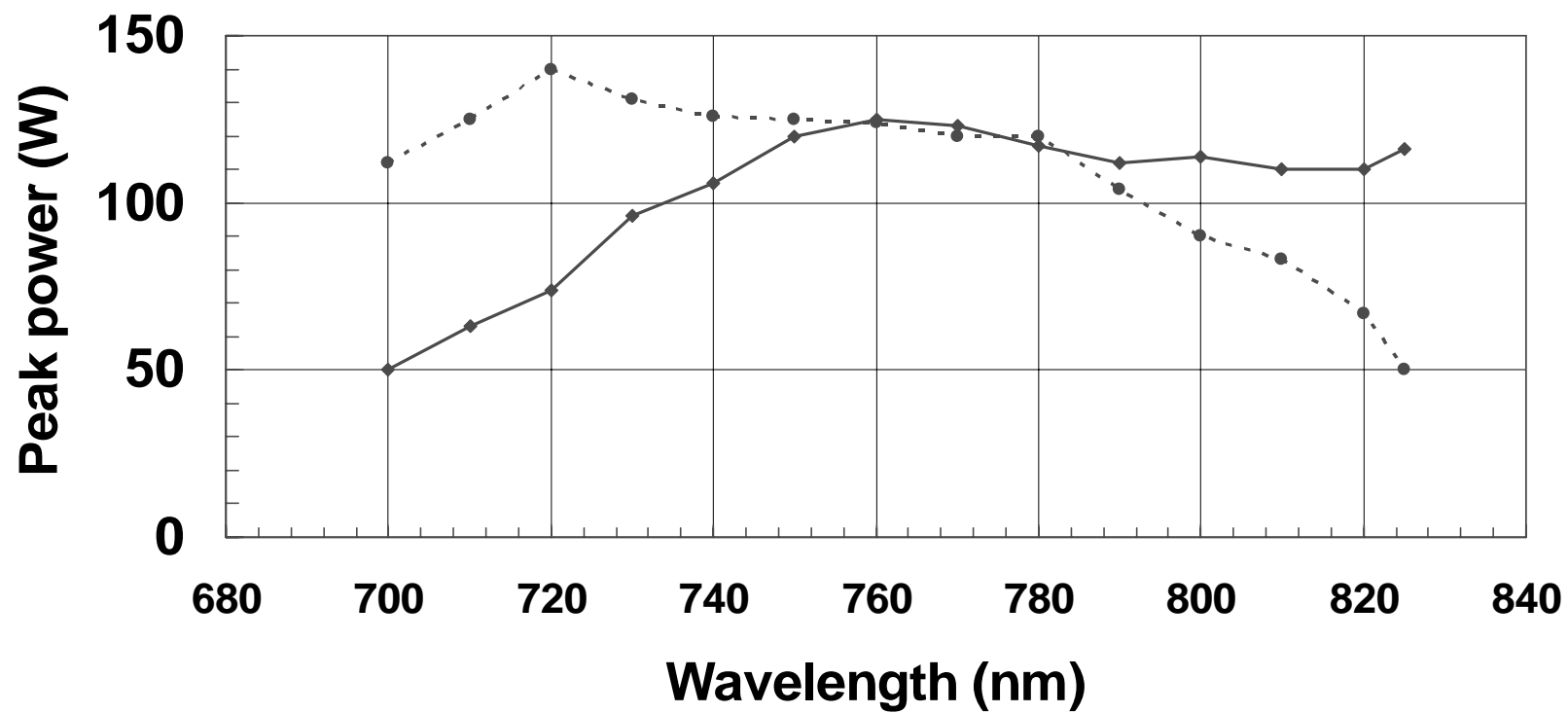
AVERAGE POWER vs. PULSE RATE





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PEAK POWER vs. WAVELENGTH

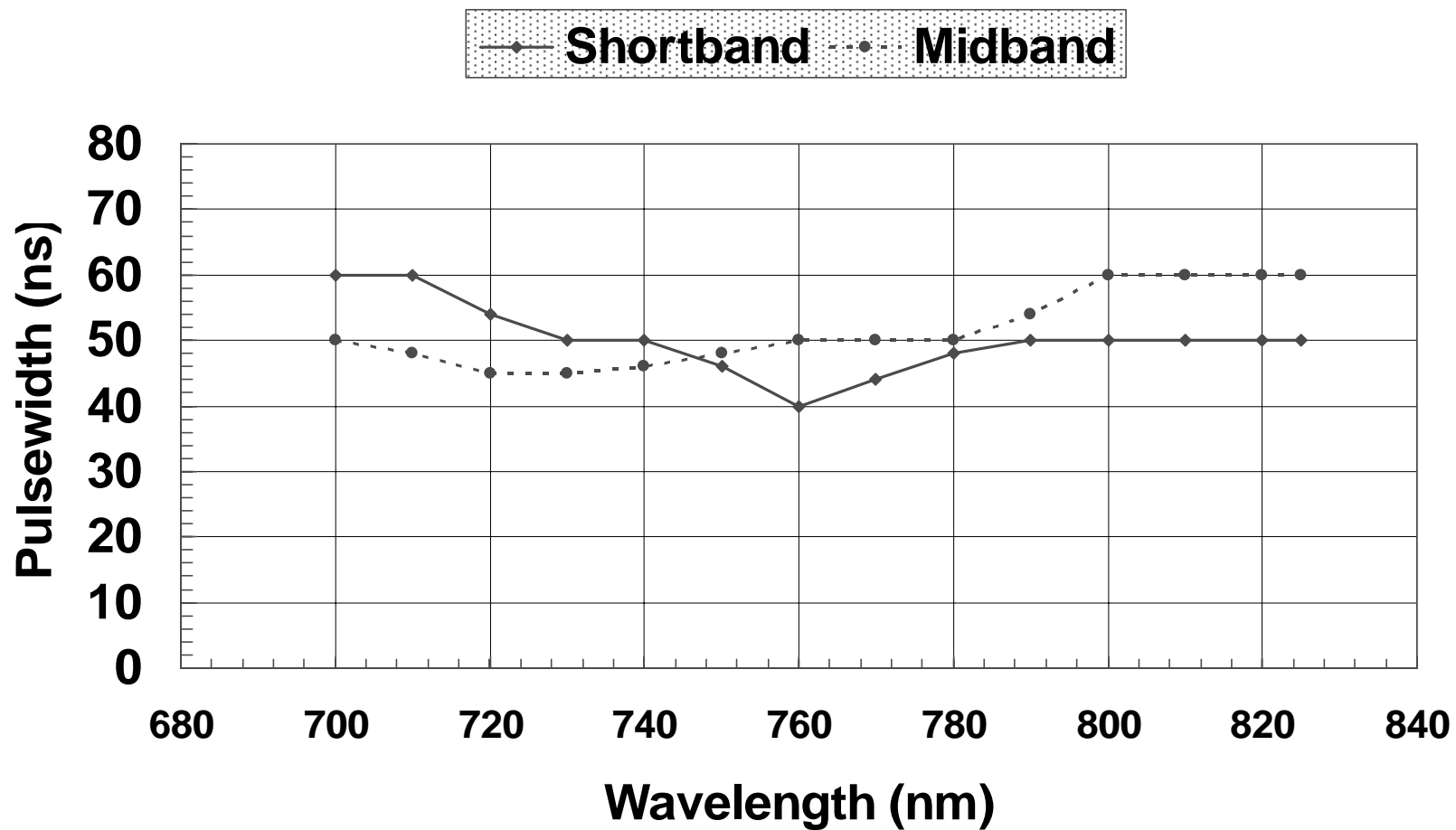


—◆— Shortband -●- Midband



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PULSEWIDTH vs. WAVELENGTH





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LATEST DATA (AT PRINCETON)

With 40% coupler (threshold increased to 2.8 W) at 100 kHz rate

- 22 ns pulses**
- Peak power of 190 W**

Type I SHG in pair of 6-mm-long BBO crystals generated 0.9% conversion efficiency, 1.7 W and 4.9 mW peak and average powers at 400 nm, 100-kHz rate

System used for alignment of THG system for 253.7 nm generation



CW-pumped, repetitively Q-switched Ti:sapphire laser shows, at 100 kHz:

- **Peak powers as high as 190 W**
- **Enhancements of 60 over cw power levels**
- **Pulsewidths of 20-40 nsec**

Pulse rates range to 900 kHz, limited by laser build-up time

Agreement with Q-switch theory is good

Applications: nonlinear optics, time-resolved diagnostics

**Future: shorter cavities would provide 10-ns pulses,
enhancements over 100**