

Table of Contents

<i>Symbols and Abbreviations</i>	VII
<i>List of Figures and Tables</i>	XIII
<i>Publications</i>	XV
<i>Abstract</i>	XX
<i>Kurzfassung</i>	XXIV
Chapter 1 Introduction	1
Chapter 2 Modelocking	11
2.1 Passive modelocking.....	12
2.2 Q-factor	13
2.3 AM- and FM-type modelocking.....	14
2.4 Semiconductor Saturable Absorber Mirrors	16
2.5 SESAM-based soliton modelocking.....	18
2.6 Q-switched modelocking	19
Chapter 3 Gigahertz high-power laser frequency comb sources	21
3.1 A gigahertz Yb:KGW with a strong CEO beat signal	25
3.1.1 Introduction	27
3.1.2 Experimental setup	29
3.1.3 Results.....	30
3.1.4 Conclusion	33
3.2 Pushing to shorter gigahertz pulses	34
3.3 High peak power gigahertz Yb:CALGO laser	37
3.3.1 Introduction	39
3.3.2 Experimental setup	41
3.3.3 Results.....	42
3.3.4 Conclusion and outlook.....	44

3.4	CEO beat detection at 1.8 GHz	47
3.5	Repetition rate scaling with Yb:CALGO	48
3.6	All-optical Q-switching limiter for high-power GHz lasers	51
3.6.1	Introduction	54
3.6.2	SESAM modelocked diode-pumped Yb:CALGO laser	57
3.6.3	Q-switching limiter: principle of operation and numerical analysis	58
3.6.4	Modelocking results	63
3.6.5	Conclusion and outlook	65
3.7	Discussion: Cutting-edge gigahertz DPSSLs	66
Chapter 4 Laser stabilization with feedback loops		67
4.1	Phase-locked loops	68
4.1.1	Voltage controllable oscillator	68
4.1.2	The phase detector	69
4.1.3	The loop filter	70
4.1.4	Transducer	71
4.1.5	Slew rate	72
4.2	Transfer functions	73
4.2.1	Measurement technique	73
4.3	Frequency noise measurements	76
4.4	β -separation line	77
Chapter 5 CEO-stabilization of high-power diode-pumped frequency combs		79
5.1	CEO phase-locking of thin disk laser	81
5.1.1	Introduction	84
5.1.2	CEO detection of Yb:CALGO modelocked TDL	85
5.1.3	Stabilization of the carrier-envelope-offset frequency	89
5.1.4	Conclusion	93
5.2	Discussion: Pumping of frequency combs	95
5.3	CEO frequency linewidth: TDL vs. bulk DPSSL	95
5.4	CEO frequency linewidth: Single-mode vs. multi-mode pumped DPSSL	98
5.5	CEO stabilized diode-pumped gigahertz frequency comb	101
5.5.1	Introduction	103
5.5.2	1-GHz DPSSL performance and optical setup	106
5.5.3	CEO frequency detection and transfer functions	107

5.5.4	CEO phase locking and noise characterization	110
5.5.5	Conclusion	114
Chapter 6	Conclusion and Outlook	115
	<i>References</i>	119
	<i>Curriculum Vitæ</i>	125
	<i>Acknowledgements</i>	127