

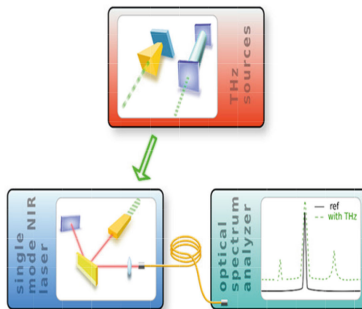


Jared Ombiro Gwaro (Autor)

Interaction of Terahertz Radiation with Semiconductor Lasers

Jared Ombiro Gwaro

Interaction of Terahertz Radiation With Semiconductor Lasers



Cuvillier Verlag Göttingen
Internationaler wissenschaftlicher Fachverlag

<https://cuvillier.de/de/shop/publications/8055>

Copyright:

Cuvillier Verlag, Inhaberin Annette Jentsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen, Germany
Telefon: +49 (0)551 54724-0, E-Mail: info@cuvillier.de, Website: <https://cuvillier.de>

Contents

1	Introduction	1
1.1	Organization of this dissertation	3
2	Fundamentals	4
2.1	Semiconductor diode laser	4
2.1.1	Energy bands	5
2.1.2	Different semiconductor laser structures	8
3	THz detection	13
3.1	Introduction	13
3.2	Classification of THz detection schemes	14
3.2.1	THz thermal detectors	14
3.3	Coherent detection	16
3.3.1	Heterodyne and homodyne detection	16
4	Semiconductor diode laser based THz detection	19
4.1	Introduction	19
4.2	Non-linear mixing process	21
4.3	Experimental description	22
4.3.1	SynView THz source	22
4.3.2	Gunn diode	25
4.3.3	THz-TDS system	25
4.4	Results and discussion	26
4.4.1	Diode characterization	26
4.4.2	Interaction experiment with THz TDS system	30
4.5	Conclusions and recommendations	31
5	Monolithically integrated two-color Distributed Bragg Reflector semiconductor laser diodes for THz emission	34
5.1	Introduction	34
5.2	Terahertz photoconductive antennas	37
5.3	Terahertz pulse generation and detection in PCAs	39
5.4	Continuous wave THz radiation generation via photomixing	42
5.4.1	The mechanism of THz photomixing	42
5.5	Properties of photoconductive materials	45
5.6	Two-color laser concepts for terahertz photomixing	47
5.6.1	Two color diode lasers based on external cavity configuration	48
5.6.2	Monolithically integrated two-color lasers	50
5.7	Device description and experimental setup	51

- 5.7.1 A two-color DBR diode laser 51
- 5.7.2 An electrically tunable two-color DBR diode laser 52
- 5.7.3 Experimental description for CW THz generation and detection 55
- 5.8 Results and discussion 56
 - 5.8.1 Measurements with two-color DBR laser 56
 - 5.8.2 Optical characteristics of the two-color DBR laser 56
 - 5.8.3 Stability characterization 57
 - 5.8.4 CW THz generation and detection with two-color DBR laser . . 59
 - 5.8.5 Potential application 60
 - 5.8.6 Measurements with an electrically tunable two-color DBR laser 63
 - 5.8.7 Optical characteristics with micro resistor heater current off
and output current off 64
 - 5.8.8 Optical characteristics with micro resistor heater current on . 67
 - 5.8.9 Optical characteristics with optical spectrum analyzer having
higher spectral resolution 69
 - 5.8.10 Terahertz emission and detection with two-color eDBR laser . 72
 - 5.8.11 Potential applications of developed THz system 78
- 5.9 Conclusion 89

- 6 Summary and conclusion 92**

- A Publications 105**