

Contents

List of Publications	v
Abstract/Zusammenfassung	ix
1 Introduction to the Subject Matter	3
I Limitations of Plasmon-Assisted High-Harmonic Generation	7
2 Theory of Plasmon-Assisted High-Harmonic Generation	9
2.1 ‘Conventional’ High-Harmonic Generation	10
2.2 Surface Plasmons and Field-Enhancement	22
2.3 Metallic Nanoantennas	28
2.4 HHG in Inhomogeneous Fields	34
2.5 Laser-induced Damage	39
3 Laser-induced Damage Measurements on Nanoplasmonic Materials	47
3.1 Laser-induced Damage on Solid Gold Films	48
3.2 Laser-induced Damage on Nano-Structured Gold Targets	51
3.3 Measurements with Gold Bow-tie Antennas	57
4 Summary and Discussion (part I)	67
II Transfer of Phase Singularities in an High-Harmonic Process	71
5 Theory of Phase Singularities in Electromagnetic Fields	73
5.1 Optical Vortices	74
5.2 Orbital Angular Momentum in Electromagnetic Fields	78
5.3 Optical Orbital Angular Momentum in Spectroscopy	81
5.4 Optical Vortices in Nonlinear Processes	84

6	Measurement of an Optical Vortex in an High-Harmonic Beam	85
6.1	Phase Manipulation of the Fundamental Laser Light	86
6.2	High-Harmonic Generation with Vortex Beams	88
6.3	Intensity and Phase Signature of a Vortex in the XUV	89
7	Summary and Discussion (part II)	101
III	Literature, Lists and Appendices	105
	Bibliography	107
	List of Figures	121
	List of Tables	125
A	The Laser Source and Shot Delivery System	127
B	Design of the Bow-tie Sample	131
C	Details of the Vortex Generation and HHG Setup and Experiments	133