

Contents

Abstract	v
Resumen	vii
Resum	ix
Acknowledgments	xi
List of Abbreviations	xiii
1 Introduction	1
1.1 Background and motivation	1
1.1.1 Technological platform: silicon photonics	1
1.1.2 High-index nanophotonics	3
1.1.3 Suppressing far-field scattering: Anapole states	4
1.1.4 Multipolar interference in periodic chains of high-index nanoparticles	10
1.1.5 Motivation of the thesis	12
1.2 Structure of the thesis	13
2 Observation of the first-order anapole state in silicon disks driven by integrated waveguides	17
2.1 Introduction	17
2.2 Scattering and multipolar response of silicon disks under normal and in-plane illumination	18
2.3 In-plane excitation of an isolated silicon disk: numerical simulations	22
2.4 Far-field scattering measurements of the on-chip silicon disk	26
2.5 Near-field measurements	31
3 Observation of higher-order anapole states in silicon disks driven by integrated waveguides	35
3.1 Introduction	35
3.2 Description of the system	36
3.3 Numerical simulations	36
3.3.1 Second-order electric anapole	36
3.3.2 Magnetic anapole	40
3.4 Far-field scattering measurements of the on-chip silicon disk	43

4	Light guidance along silicon slotted-disk chains driven by integrated waveguides	47
4.1	Introduction	47
4.2	Numerical simulations	48
4.3	Experimental measurements	55
5	Observation of photonic bandgap closure in 1D periodic chains of high-index nanobricks driven by integrated waveguides	59
5.1	Introduction	59
5.2	Numerical simulations	60
5.3	Experimental measurements	64
6	Conclusions and future work	67
	Appendices	71
A	Numerical Simulations	72
B	Fabrication	73
B.1	Samples of Chapter 2	73
B.2	Samples of Chapter 3	74
B.3	Samples of Chapter 4	75
C	Experimental set-up	76
C.1	System alignment process	77
D	Near-field optical measurements	79
E	Author's Merits	81
E.1	Publications	81
E.2	Conferences	81
	Bibliography	82