CONTENTS

Preface by Vice President Narjes	v
Preface, The Success of EJOB	vii
Coordinators Preface	ix
EJOB Contributors and Addresses	xiii
EJOB Publication Lists	xvii

FINAL REPORT

Chapter	1
---------	---

THE BACKGROUND AND OBJECTIVES OF THE EUROPEAN JOINT OPTICAL BISTABILITY COLLABORATIVE PROJECT				
	pter 2 ICAL NONLINEARITIES FOR BISTABILITY: THEORY	19		
2.1	Scaling Rules and One-Electron Theory	21		
2.2	Many-Body Theory of Nonlinear Optical Properties of Semiconductors	29		
2.3	The Nonlinear Dielectric Function of Three-Level Systems	35		
Cha	pter 3			
OPT	ICAL NONLINEARITIES FOR BISTABILITY: EXPERIMENTS	47		
3.1	Studies of Electronic Nonlinearities in InSb, and Thermal Nonlinearities			
	in InSb and ZnSe	49		
3.2	CdS, CdSe and CdS _{1-x} Se _x Mixed Crystals	59		
3.3	Biexciton Nonlinearities in CuCl	65		
3.4	Lead Chalcogenide Semiconductors	74		
3.5	Transient Optical Nonlinearities in the Alloy Semiconductors			
	CdHgTe and GaInAsP	81		
3.6	Si and Semi-Insulating InP	88		
Chaj	pter 4			
OPT	ICAL BISTABILITY AND DEVICES: THEORY	95		
4.1	The Two-Level Atom Approach	97		
4.2	General Properties of Bistability	102		
4.3	Optical Transistor Action	109		
4.4	Switching Dynamics	115		
4.5	Dynamics of Electronic and Thermal Refractive Bistability	121		



4.6	The Role of Noise	129		
4.7	Noise-Induced Switching of Photonic Logic Elements			
4.8	Diffusion and Diffraction			
4.9				
Chap				
OPTI	CAL BISTABILITY AND DEVICES: EXPERIMENTS	159		
5.1	Indium Antimonide	161		
5.2	Dispersive Optical Bistability and Optical Bistability by Bleaching of			
	Absorption in CdS and Related Materials	174		
5.3	Optical Bistability and Switching Dynamics in CuCl	180		
5.4	Lead Chalcogenide Semiconductors	187		
5.5	Thermal CO ₂ -Laser Bistability in Pb _{0.95} Sn _{0.05} Se	195		
5.6	Optical Bistability Studies in CdHgTe, CdTe, GaAs and ZnSe	201		
5.7	Optical Bistability in ZnSe Interference Filters	208		
5.8	Critical Slowing Down in Bistable Interference Filters	220		
5.9	Fast Switching at Room Temperature of ZnSe Interference Filters	225		
5.10	Dynamics of a Bistable Optical Device in the Presence of Noise	230		
5.11	The Roles of Electronic and Thermal Diffusion	238		
Chap	ter 6			
ALT	ERNATIVE OPTICAL BISTABILITY SCHEMES	247		
6.1	Theory of the Dynamics of Bistability by Increasing Absorption	249		
6.2	Induced Absorption Optical Bistability; Formation of "Kinks" and			
	Oscillations in a Ring Cavity	252		
6.3	Bistability by Increasing Absorption in InSb, ZnSe and GaAlAs	259		
6.4	Bistability and Multistability in Si and InP Self-Electrooptic-Effect Devices	267		
6.5	Ultrafast Switching using Guided Mode Excitation in Silicon on Sapphire	274		
6.6	Bistability in Nonlinear Optical Waveguides	277		
6.7	Lasers with Saturable Absorbers	284		
6.8	Radiation Pressure Bistability	292		
6.9	Light Pressure Bistability at Microwave Frequencies	294		
6.10	Bistability in Quantum Optics: Chaos and Noise Effects	301		
Chapter 7				
OPTICAL CIRCUITRY AND OPTICAL COMPUTING ARCHITECTURES				

	optical circulary	507
7.2	Multiple Beam Devices	321
7.3	Principles of Digital Optical Processing	325
7.4	Lock-and-Clock Architecture	331
7.5	Adders and Multipliers	337
7.6	The Computational Loop Experiment	343

Chapter 8 SUMMARY AND CONCLUSIONS TO EJOB