

TABLE OF CONTENTS

Acknowledgments	iv
List of Tables	x
List of Figures	xi
Chapter 1: Introduction	1
1.1 Interference oscillations	4
1.2 Ionization of biomolecules	5
1.3 Overview of the thesis	7
Chapter 2: Experimental Details and Developments	9
2.1 Introduction	9
2.2 Experimental setup	9
2.2.1 ECR-Ion accelerator	9
2.2.2 Pelletron beamline	10
2.2.3 Beamline for electron gun	11
2.2.4 Scattering chamber	12
2.2.5 Effusive jet and oven assembly	15
2.2.6 Electron Spectrometer	19
2.2.7 Detector	21
2.2.8 Data Acquisition System	23

2.3	Testing of the spectrometer	23
2.4	Theory of Measurement	26
2.5	Summary	31
Chapter 3: Theoretical models		32
3.1	Introduction	32
3.2	CB1 Model	33
3.3	CDW-EIS Model	34
3.4	CTMC Model	36
3.5	CSP-ic Model	37
3.5.1	Static Potential	38
3.5.2	Exchange Potential	38
3.5.3	Polarization Potential	39
3.5.4	Absorption Potential	40
3.5.5	Deriving total ionization cross section	41
Chapter 4: Young type interference oscillations		43
4.1	Introduction	43
4.2	Experimental details	44
4.3	Ionization of N ₂	44
4.3.1	Distribution of Electron DDCS at Fixed Emission Angles	44
4.3.2	Theoretical understanding of interference effect from diatomic molecule	48
4.3.3	Experimental-to-theoretical DDCS ratio	50
4.3.4	Frequency Parameter	52
4.3.5	Distribution of Electron DDCS at Fixed Emission Energies	56

4.3.6	Asymmetry Parameter	56
4.3.7	Interference oscillations from forward-backward angular asymmetry . .	57
4.3.8	Second order interference effect	58
4.4	Ionization of O ₂	59
4.4.1	Distribution of Electron DDCS at Fixed Emission Angles	59
4.4.2	Experimental-to-theoretical DDCS ratios	61
4.4.3	Distribution of Electron DDCS at Fixed Emission Energies	61
4.4.4	Interference oscillations in O ₂ from forward-backward asymmetry parameter (FBAP)	64
4.5	Conclusions	65
Chapter 5: Electron impact ionization of N₂ : Energy dependence of e-DDCS, SDCS and TCS		67
5.1	Introduction	67
5.2	Experimental Conditions	67
5.3	DDCS : Energy Distribution	68
5.4	DDCS : Angular Distribution	75
5.5	Single Differential Cross Section	82
5.6	Total Ionization Cross Section	84
5.7	Conclusions	85
Chapter 6: Ion impact ionization of atoms and molecules : Comparative study at keV and MeV energy		87
6.1	Introduction	87
6.2	Experimental details	88
6.3	Double differential cross sections	88
6.4	Post collision interactions	96

6.4.1	Angular distribution of DDCS	96
6.4.2	Forward backward angular asymmetry	102
6.5	Single differential cross section	104
6.6	Conclusions	106
Chapter 7: Ionization of uracil and bromouracil : keV energy protons vs MeV energy HCl's		108
7.1	Introduction	108
7.2	Experimental details	109
7.3	Absolute normalization of DDCS spectra	111
7.4	Ionization of biomolecules by MeV energy bare C ions	112
7.4.1	Energy distribution of electron DDCS	112
7.4.2	DDCS ratios between bromouracil and uracil	116
7.5	Ionization of biomolecules by keV energy protons	118
7.5.1	Energy distribution of electron DDCS	119
7.5.2	DDCS ratios of bromouracil to uracil	121
7.6	Forward-backward angular asymmetry	122
7.7	Conclusions	125
Chapter 8: Summary		126
References		130