

Contents

Part I Photon Absorption

1 Main Points of the Theory of Photoabsorption	3
1.1 Most Important on Photoionization	3
1.2 Single Electron Hartree–Fock (HF) Approximation	5
1.3 Diagrammatical Technique	7
1.4 Many-Body Perturbation Theory	11
1.5 Random Phase Approximation with Exchange	13
1.6 Generalizations of RPAE	18
1.7 Calculation Procedures	19
1.8 Angular Anisotropy Parameter	22
1.9 Other Characteristics of Photoionization	28
1.10 Semiclosed Subshells Atoms	29
1.11 Open Shell Atoms	32
1.12 Negative and Positive Ions	34
1.13 Endohedral Atoms: The Effect of Electron Reflections	35
1.14 Endohedral Atoms: The Effect of Fullerene Polarization	39
1.15 Two-Shell Endohedrals	43
1.16 Current Induced by Photon Momentum	46
1.17 Inelastic Photoelectron Scattering	47
1.18 Satellite Excitation	49
1.19 Two-Electron Photoionization and Recombination	51
1.20 Photoionization of the Excited Atoms	54
1.21 Electron Correlations in RPAE at High Photon Energy	54
1.22 Electron Correlations at High Photon Energy Out of RPAE Frame	58
References	59
2 Results of Calculations	65
2.1 Data Representation and Used Formulas	65
2.2 Atoms and Ions of Noble Gases	70

2.3	Atoms and Ions of Group I Elements of the Periodic Table	123
2.4	Atoms and Ions of Group II Elements of the Periodic Table	166
2.5	Ions and Atoms of Group III Elements of the Periodic Table	188
2.6	Ions and Atoms of Group IV Elements of the Periodic Table	218
2.7	Atoms and Ions of Group V Elements of the Periodic Table	232
2.8	Atoms and Ions of VI Group Elements	248
2.9	Atoms and Ions of VII and VIII Group Elements	265
2.10	Endohedral A@C ₆₀ Atoms and Ions	306
2.11	Onion-Type Endohedral Atoms A@C ₆₀ @C ₂₄₀	390
	References	414

Part II Electron Scattering

3	Main Points of the Electron Scattering Theory	421
3.1	Most Important on Electron-Atom Scattering	421
3.2	Elastic Scattering in One-Electron Approximation	427
3.3	Polarization Interaction	428
3.4	Dyson Equation	431
3.5	Inelastic Scattering of Slow and Medium Energy Electrons	432
3.6	Inelastic Scattering of Fast Particles	433
3.7	Angular Distribution of Knocked-out Electrons	438
3.8	The Compton Effect	444
3.9	GOS for Semi-filled Shells	448
3.10	Inelastic Scattering of Fast Particles upon Endohedrals	450
3.11	Bremsstrahlung of Fast Particles	456
3.12	Positron Scattering with Account of Polarization Interaction	459
	References	462
4	Electron Scattering: Results of Calculations	465
4.1	Data Representation and Used Formulas	465
4.2	Atoms of Noble Gases	467
4.3	Atoms and Some Ions of Group I Elements of the Periodic Table	574
4.4	Atoms of Group II Elements of the Periodic Table	605
4.5	Atoms and Ions of Groups IV and V Elements of the Periodic Table	639
4.6	Ions of Group VII Elements of the Periodic Table	644
4.7	Endohedral A@C ₆₀ Atoms	648
4.8	Brief Discussion of Results	669
	References	676

Part III Vacancies Decay

5	Main Points on Vacancies Decay Theory	681
5.1	Most Important About Vacancies and Their Decay	681
5.2	The Energies of Atomic Levels	684

5.3	Polarization Interaction for Vacancies	685
5.4	Self-energy Part of Green's Function and Spectroscopic Parameters	686
5.5	Satellite Lines Shapes in Photoelectron Spectra	696
5.6	Effects in Interaction Between Satellite States	699
5.7	Radiative Decay	701
5.8	Nonradiative or Auger Decay	705
5.9	Line Shapes of Low-Energy Auger Spectra	710
5.10	Two-Electron and Radiative Auger Decay	711
5.11	Single Photon Decay of Two-Hole States	714
5.12	Auger and Radiative Decay of Excited States	715
5.13	Angular Anisotropy and Spin Polarization of Auger Electrons	717
5.14	Decay of Vacancies in Endohedral Atoms	722
	References	724
6	Vacancies Decay: Results of Calculations	729
6.1	Data Presentation and Used Formulas	729
6.2	Description of Figures	730
6.3	Description of Tables	740
	References	758
7	Off-shell Photoionization Cross-sections: Results of Calculations	761
7.1	Data Presentation	761
7.2	Description of Figures	762
	References	789
8	Conclusion and Perspectives	791
	References	794
	Index	795