

Contents

1	Introduction	1
2	Bremsstrahlung in Collisions of Structureless Charged Particles with Atoms and Ions	19
2.1	Peculiar Features of PBrS	19
2.2	Non-Relativistic Distorted Partial Waves Approximation	28
2.2.1	DPWA Series for BrS Amplitude	28
2.2.2	BrS Cross Section	33
2.3	Multipole Series for PBrS Cross Section	35
2.4	BrS Spectrum in the Tip Region	37
3	Polarizational Bremsstrahlung in Collisions with Hydrogen Atom ..	41
3.1	Generalized Dipole Dynamic Polarizability of a Hydrogen Atom ..	41
3.2	BrS Cross Section in Collisions with Hydrogen Atom	44
3.3	BrS in Collisions of a Slow Charged Particle with an Excited Hydrogen Atom	46
3.3.1	Adiabatic Approximation	47
3.3.2	Bremsstrahlung Amplitude	50
3.3.3	Cross Section	52
3.3.4	Averaging procedure	55
3.3.5	Appendix	56
3.4	BrS in Electron and Positron Collision with Positronium	57
4	Cross Section of PBrS from Many-Electron Atoms and Ions	63
4.1	Spectral Distribution of BrS in Vicinity of Giant Resonances	63
4.2	Angular Distribution and Polarization of BrS	70
4.3	Approximate Method to Calculate the PBrS Cross Sections with Account for Many-Electron Correlations	73
4.3.1	Description of the Method	74
4.3.2	Numerical Results	75

4.4	Influence of Photon Absorption and Electron Energy Loss on the PBrS Spectrum in a Solid-State Target	79
4.4.1	Energy Distribution of Scattered Electrons	80
4.4.2	Numerical Results and Experimental Data	81
4.5	BrS Spectra in Broad Range of Photon Energies	83
4.6	'Stripping' Approximation	88
4.6.1	De-Screening of an Atom in the BrS Process	88
4.6.2	The 'Stripping' Effect beyond the Born Approximation ...	90
4.6.3	Alternative Approach to the 'Stripping' Effect	93
4.6.4	Numerical results	95
4.6.5	Experimental results	98
4.7	Bethe Ridge in the PBrS Process	100
4.7.1	Contributions of Various Radiative Processes to the Total Spectrum	101
4.7.2	Analysis of the Bethe Peculiarity in PBrS	103
4.7.3	Numerical Results	106
4.8	Polarizational Mechanism in Electron-Ion Radiative Capture	108
4.8.1	Qualitative Description of the Radiative Capture Channels for Multi-Electron Ionic Targets	109
4.8.2	Formalism	111
4.8.3	Numerical Results	117
5	PBrS in Non-Relativistic Collisions of Structural Particles with Atoms and Ions	123
5.1	Introductory Notes	123
5.2	Collisions of Fast Atomic Particles	124
5.2.1	BrS Amplitude	124
5.2.2	BrS Cross Section	128
5.2.3	Numerical Example: BrS in He + Xe Collision	131
5.3	Effect of Coherence and Total Cross Section of BrS	132
5.4	Polarizational BrS of Inner Electron Shells	135
5.4.1	Scaling Behaviour for the Inner-Shell PBrS Cross Section .	136
5.4.2	Numerical Results	138
5.5	BrS in Slow Collisions of Atomic Particles	141
5.5.1	BrS Amplitude	141
5.5.2	BrS Cross Section	144
5.5.3	Hydrogen-like system	146
5.5.4	Molecular Orbital X-Rays	150
6	Relativistic Effects in the Polarizational BrS Process	153
6.1	Introductory Notes	153
6.2	"Elastic" BrS in Atom-Atom Collisions	155
6.2.1	BrS Amplitude	156
6.2.2	BrS Cross Section	162
6.3	Electron-Atom Collisions	169

6.3.1	BrS Amplitude in a Relativistic Collision	169
6.3.2	Characteristics of PBrS	171
6.3.3	Total BrS Spectrum	174
6.4	Inelastic Collisions. Coherence Effect	175
6.4.1	Amplitude of "Inelastic" PBrS	176
6.4.2	Spectral-Angular Distribution of PBrS	178
6.4.3	Spectral Distribution of PBrS	184
6.5	Relativistic Effects due to Internal Structure of Particles	186
6.5.1	Amplitude of PBrS	188
6.5.2	Limiting Cases of the Relativistic PBrS Amplitude	194
6.5.3	Cross Section of PBrS	196
6.5.4	Numerical Results	200
6.5.5	Appendix A: Relativistic DPWA Formalism for PBrS	205
6.5.6	Appendix B: Generalized Polarizabilities Expressed in Terms of Relativistic Green's Function	210
7	PBrS from Atomic Clusters and Fullerenes	213
7.1	Introduction	213
7.2	Plasmon Resonance Approximation	214
7.2.1	Polarizabilities of Metal Clusters and Fullerenes	215
7.2.2	BrS Cross Section	219
7.2.3	BrS in Electron–Fullerene Collisions	225
7.2.4	Electron–Metal–Cluster Collisions	228
7.3	Calculation of PBrS Cross Section by Means of Many-Body Theory	231
7.4	Radiative Electron Capture by Metal Clusters	236
7.4.1	Cross Section of Radiative Capture	236
7.4.2	Numerical Results for Na_{20}^+ and Ag_{11}^+	239
7.4.3	Non-Radiative Capture by Means of Many-Body Theory	240
8	Conclusion	249
	References	251