Further Readings

1. M. Born, E. Wolf, *Principles of Optics*, 4th edn. (Pergamon Press, New York, 1970)
2. W.A. Shurcliff, *Polarized Light Production and Use* (Harvard University Press, Harvard, 1962)
3. J. Kessler, *Polarized Electrons*, 2nd edn. (Springer, Heidelberg, 1985)
4. I.E. McCarthy, E. Weigold, *Electron–Atom Collisions* (University Press, Cambridge, 1995)
5. K. Blum, *Density Matrix Theory and Applications*, 3rd edn. (Springer, New York, 2012)
6. G.W.F. Drake (ed.), *Handbook of Atomic, Molecular, and Optical Physics*, 2nd edn. (Springer, Heidelberg, 2006)
7. K. Bartschat (ed.), *Computational Atomic Physics — Electron and Positron Scattering from Atoms and Ions* (Springer, Heidelberg, 1996)
8. V.V. Balashov, A.N. Grum-Grzhimailo, N.M. Kabachnik, *Polarization and Correlation Phenomena in Atomic Collisions* (Plenum, New York, 2000)
9. N. Andersen, J.W. Gallagher, I.V. Hertel, Collisional alignment and orientation of atomic outer shells. I. Direct excitation by electron and atom impact. Phys. Rep. **165**, 1 (1988)
10. N. Andersen, J.T. Broad, E.E.B. Campbell, J.W. Gallagher, I.V. Hertel, Collisional alignment and orientation of atomic outer shells. II. Quasi-molecular excitation, and beyond. Phys. Rep. **278**, 107 (1997)
11. N. Andersen, K. Bartschat, J.T. Broad, I.V. Hertel, Collisional alignment and orientation of atomic outer shells. III. Spin-resolved excitation. Phys. Rep. **279**, 251 (1997)
12. N. Andersen, K. Bartschat, Complete experiments in atomic collisions, Adv. At. Mol. Opt. Phys. **36**, 1 (1996)
13. N. Andersen, K. Bartschat, Collisional excitation of atomic D states. J. Phys. B **30**, 5071 (1997)

N. Andersen and K. Bartschat, *Polarization, Alignment, and Orientation in Atomic Collisions*, Springer Series on Atomic, Optical, and Plasma Physics 96, DOI 10.1007/978-3-319-55216-3

Index

A
Alignment angle
  definition of, 20
  relationship to charge cloud, 20
  relationship to scattering amplitudes, 23

C
Charge cloud
  height, 24
  length, 24
  state-multipole expansion, 120
  width, 24
Close-coupling expansion
  for electron scattering, 105
  for heavy-particle scattering, 116
Coordinate frame
  atomic, 20
  collision, 19
  natural, 19

D
Density matrix
  elements of, 77
  reduced, 76
  state-multipole expansion, 84
Density operator
  irreducible components of, 84
Dirac equation
  for free particle, 37
  spinor solutions, 37

E
Experiment
  complete, 7
  first-generation, 7
  perfect, 7
  second-generation, 7
  third-generation, 8
  time-reversed, 8

F
Fano effect
  definition of, 338
  experimental verification, 338

G
Generalized STU parameters
  definition, 61
  in terms of scattering amplitudes, 78
  in the collision frame, 80
  in the natural frame, 80
  physical meaning, 61
  special cases of, 80

L
Light polarization
  circular, 13
  linear, 13
  Poincaré sphere, 17
  Stokes parameters, 14, 15

N. Andersen and K. Bartschat, *Polarization, Alignment, and Orientation in Atomic Collisions*, Springer Series on Atomic, Optical, and Plasma Physics 96, DOI 10.1007/978-3-319-55216-3

M
Maxwell's equations, 11

O
Orientation
definition of, 20

P
Propensity rule
definition of, 285
for orientation, 286, 287
violation of, 306, 307

Q
Quantum beats
example of, 26
experimental observation, 356
time integration over, 88
zero-field, 364

S
Scattering amplitudes
definition of, 72, 75
in the collision frame, 73
in the natural frame, 73
non-relativistic, 76
symmetry properties, 74
transformation properties, 72
Spin polarization
definition, 39
density matrix description, 40
measurement of, 41
Mott detector for, 41
optical measurement, 42, 133
vector description, 39
State multipoles
definition of, 84
for coupled systems, 86
symmetry properties, 85
transformation properties, 85
Stokes parameters
generalized
definition of, 63
measurement of, 63
in terms of state multipoles, 90
reduced, 27
Stokes vector
reduced, 27

T
Tensor operator
for coupled systems, 86
irreducible, 83
orthogonality condition, 84
transformation properties, 84