

Cambridge University Press

978-0-521-76051-5 - Heliophysics: Space Storms and Radiation: Causes and Effects

Edited by Carolus J. Schrijver and George L. Siscoe

Index

[More information](#)

Index

- AA index, 39
- absorption, free–free, 103
- absorption coefficient, 90
- Advanced Composition Explorer (ACE), 373
- Akasofu–Chapman sequence, 18
- ALARA, 361
- analyzer
 - retarding potential, 62
 - small-angle deflection, 62, 65
 - spherical, cylindrical section, 62
 - spherical section, 64
- anomalous cosmic rays, 236
- atmospheric solar heating, 29
- aurora
 - characteristic energy of precipitating particles, 328
 - early drawing, 16
 - heating, 327
 - historical, 16
 - planetary, 148
 - precipitation, 326, 327
 - relation to sunspot cycle, 16
 - terrestrial, 148
- auroral substorm, 265
- ballooning instability, 286
- β decay, 114
- Birkeland current, 18, 271
- blackbody radiation, 89
- bow shock
 - Earth, 224
 - planetary, 196
- breakout model, 187
- bremsstrahlung, 83, 95, 106
- brightness temperature, 88
- Carrington–Hodgson flare, 17, 25, 37
- Chapman profile, 350
- chromospheric evaporation, 127
- CIR, 237
- classification
 - flares, 125
 - radio bursts, 83
 - shocks and discontinuities, 200
- climate, in space, 9
- CME, 117
 - association with filament eruptions, 160
 - energy distribution, 167
 - failed, 168
 - flare association, 126
 - kinetic energy, 167
 - and quiet-Sun filaments, 131
 - radio emission, 117
 - shock wave, 204
 - statistical properties, 165
 - three-part structure, 160
 - without major flare, 132
- Compton scattering, 111
- Constellation program, 368
 - ISS mission phases, 369
 - lunar base habitation, 371
 - lunar mission phases, 369
 - lunar sorties, 370
 - Mars exploration, 371
- contact discontinuity, 200
- convective energy transport, 10
- corona
 - characteristic energy density, 164
 - hard X-ray sources, 140
 - ion inertial length, 153
 - thick target, 146
- coronal dimming, 137, 154
- coronal hole, transient, 154
- coronal mass ejection, *see* CME
- corotating interaction region, 237
- cosmic rays
 - 22-year cycle, 260
 - 11-year cycle, 260
 - anisotropies, 252
 - anomalous, 43, 236
 - differential intensity, 234
 - discovery of, 233
 - energy change, 251
 - energy spectrum, 234
 - galactic, 235

knee in spectrum, 235
 lifetime in heliosphere, 259
 modulation, 259
 origin of, 233
 spectrum, 235
 streaming flux, 253
 Sun's shadow, 235
 suprathermal tail, 234
 transport equation, 245, 252
 current disruption region, 18
 current sheet, 5
 CME, 153
 flare, 153
 current-driven instability, 285

deep dielectric discharge, 294
 definition of
 baroclinic instability, 11
 blackbody radiation, 89
 brightness temperature, 89
 coronal mass ejection, 7
 corotating interaction region, 8
 Dst index, 264
 Dungey cell, 11
 effective temperature, 91
 emission measure, 149
 Ferrell cell, 10
 flare, 123
 Hadley cell, 10
 ionosphere, 323
 Kp index, 19
 magnetic storm, 7, 264
 optical depth, 91
 optically thick, thin, 91
 phase space density, 46
 plasma β , 131
 polar cell, 10
 Poynting flux, 171
 reconnection, 12
 shock wave, 7
 solar cosmic rays, 7
 solar energetic particles, 7
 solar wind, 7
 source function, 91
 streamer belt, 7
 thermosphere, 323
 Vasyliunas cell, 11
 delay line anode, 56
 δ spot, 129
 Department of Energy radiation regulations, 363
 detectors
 analyzer constant, 65
 channeltron, 54
 channel electron multiplier, 54
 chevron configuration, 55
 energy analyzer, 62
 energy defect, 57
 energetic-neutral atom composition, 74
 energetic-particle composition, 72
 Faraday cup, 62
 gas-filled counters, 52

Geiger counter, 52, 43
 geometrical factor, 47
 ion feedback, 54
 ionization chamber, 52
 length to diameter ratio, 54
 microchannel plate, 55
 particles, 52
 plasma composition, 67
 proportional counter, 52
 scintillation, 60
 semiconductor, solid-state, 57
 time of flight, 66
 differential intensity, 246
 diffusion
 compound, 251
 cross field, 248
 quasi-linear theory, 253
 super- and sub-, 250
 tensor, 253
 diffusion equation, phase space, 246
 diffusive anisotropy, 252
 diffusive compression acceleration, 237
 diffusive shock acceleration, 236
 dipolarization, 134, 287
 distribution function, 46, 245
 Dst index, 288
 definition, 264
 relation to magnetosphere energy, 289
 dynamic spectroscopy, 82

Earth bow shock, 224
 Earth current, 19
 effective temperature, 91
 EIT wave, 162
 electrojet, 18, 23, 265
 electromagnetic spectrum, 79
 electron beam, suprathermal, 104
 electron distribution, power law, 109
 electrostatic discharge, 30, 31
 emerging flux, 129
 emission coefficient, 90
 emission measure, definition, 149
 energetic particles, 8, 13
 γ -rays, 106, 112
 hard X-rays, 106
 non-thermal bremsstrahlung, 106
 radiation, 93
 radio emission, 94
 radio radiation pattern, 94
 range in material, 51
 shock acceleration, 214, 112
 solar, 237
 transport, 233
 energetic storm particle event, 238
 energy
 flow in magnetosphere, 278
 from bulk flow, 273
 from planetary rotation, 274
 Explorer, 43
 extended events, 145
 extreme-ultraviolet emission, 85

- far-infrared radiation, 83
 Faraday rotation, 92
 rotation measure, 92
 Fermi acceleration, 237
 field equations
 gravity, 3
 magnetic, 3
 field lines, random walk, 249
 filament cavity, 135
 first invariant of particle motion, 299
 flare
 analogs, 144
 association with CMEs, 131
 association with SEPs, 129
 astrobiology, 157
 bolometric detection, 132
 breakout model, 187
 bulk energy, 132, 143
 cartoons, 124
 chromospheric lines, 125
 confined, 129
 coronal hard X-ray sources, 140
 current sheet model, 172
 definitions, 123, 159
 effect on ionosphere, 351
 emerging flux, 129
 emission measure, 149
 emission modeling, 179
 emission temperature, 149
 energy distribution, 130
 energy partition, 143, 156
 energy requirements, 164
 eruptive, 129
 evaporation, 143
 evolution, 162
 first recorded, 17
 force-free field model, 173
 global waves, 137
 GOES classes, 125
 gradual, impulsive, 129
 H α classes, 125
 helioseismic signature, 138
 impulse response event, 147
 injection model, 170
 magnetic field changes, 138
 Masuda flare, 146
 morphology, 159
 multithread modeling, 144
 nanoflare, 143
 phases, 126
 power-law energy distribution, 130
 radio emission, 117
 reconnection rate, 168
 resemblance to substorm, 265
 ribbons, 164
 ribbon motions, 154
 role of current, 189
 shock waves, 146
 spectrum, 346
 statistical properties, 165
 stellar, 149
 stellar hard X-rays, 145
 storage model, 169
 UV continuum, 131
 white light, 131
 flare phases
 gradual, 134
 impulsive, 132
 precursor, 128
 flux density, definition, 88, 246
 flux rope, 174
 force-free field models, 173
 2d, 173
 3d, 181
 frame of reference
 de Hoffman–Teller, 201
 normal incident, 201
 free magnetic energy, 165
 frequency cutoff, 106

 galactic cosmic rays, 235
 environment modeling, 398
 heliospheric life time, 259
 gamma-ray burst, 38
 gamma-ray emission, 86
 geomagnetic field, variability, 16, 17
 geomagnetically induced current, 19, 23
 Geostationary Operational Environment Satellite (GOES), 373
 global merged interaction region, 196, 261
 global wave
 EIT, 137
 Moreton, 137
 seismic, 138
 GMIR, 196
 gravity waves, 332
 guiding center motion, 298
 gyrofrequency, 96, 240
 gyromotion, 240
 gyroradius, 241

 Halloween storm, 39, 295, 336, 340, 341
 hard X-ray emission, 86
 hormesis, 360

 ICME, 194
 index of refraction, 105
 instability
 ballooning, 286
 current-driven, 285
 interchange, 286
 tearing mode, 285
 Institute of Electrical and Electronics Engineers (IEEE), 362
 interchange instability, 286
 International Commission on Radiation Units and Measurements (ICRU), 361
 International Commission on Radiological Protection (ICRP), 361
 International Space Station (ISS), 367
 interplanetary CME, 194
 interplanetary shock, particle acceleration, 223, 226

- ion-sound waves, 103
- ionization, energy loss, 49, 327
- ionization chamber, 52
- ionization potential, 50
- ionizing radiation
 - ALARA, 361
 - constellation program, 368
 - effects on spacecraft, 391
 - extra-vehicular activity (EVA), 366
 - galactic cosmic rays, 364
 - hormesis, 360
 - relation to cancer, 360
 - Shuttle and ISS, 367
 - solar energetic particles, 365
 - solar particle events, 365
 - trapped radiation, 364
 - total dose effects, 391
- ionosphere
 - Blanc–Richmond scenario, 344
 - collisional heating, 270
 - composition effect on ionization, 336
 - definition, 323
 - D, E, F* regions, 351
 - energy injection, 324
 - equatorial ionization anomaly (EIA), 343
 - flare response, 351
 - flywheel effect, 331
 - high-latitude storm response, 329
 - Joule heating, 270
 - particle precipitation, 271
 - photo-chemical equilibrium, 328
 - positive, negative storm phases, 338
 - solar-wind dynamo, 342
 - storm-time neutral-wind dynamo, 342
 - TEC bulge, 339
 - total electron content (TEC), 339
- jet, 134
 - polar, 135
 - soft X-ray, 134
- kinetic process, description, 212
- Langmuir waves, 98, 102, 105
 - frequency drift, 104
- Larmor formula, 94
- laws of heliophysics, 1
- line-tying, 169
- linear no-threshold model, 360
- Liouville's theorem, 301
- Living With a Star (LWS) program, ix
- long-duration event, 163
- loop prominence system, 125
- Lorentz factor, 94
- Lorentz force, 239
- Mach number, 197
- magnetar, 150
- magnetic compass, 17
- magnetic crochet, 26
- magnetic field
 - energy storage, 142
 - extrapolation, 139
 - flare effects, 138
 - reconnection, 151
 - Masuda flare, 151
 - supra-arcade downflows, 151
 - magnetic reconnection, 6, 146, 149, 153
 - magnetic storm, 18, 264
 - definition, 264
 - Earth, 288
 - magnetosphere
 - EM radiation, 271
 - energy budget, 273
 - energy conversion sequence, 278
 - energy from planetary rotation, 270
 - energy flow, 278
 - explosive energy release, 283
 - magnetic topology change, 283
 - neutral particle escape, 271
 - particle motion, 296
 - planetary, 263
 - rotation dominated, 282
 - solar-wind dominated, 281
 - sources of energy, 269
 - magnetospheric substorm, 264
 - Maxwell–Boltzmann distribution, 89
 - merged interaction region, 196
 - meson decay, 113
 - microflare, 130
 - micrometeoroid environment, 385
 - MIR, 196
 - mode conversion, 103
 - mode coupling, 92
 - model atmosphere, VAL-C151
 - modes of activity, 144
 - Moreton wave, 162, 194
 - multiple-bit upset (MBU), 396
- nanoflare, 130, 143
- National Council on Radiation Protection and Measurements (NCRP), 361
- National Space Sciences Data Center (NSSDC), 394
- National Space Weather Program (NSWP), 379
- near-infrared radiation, 83
- Neupert effect, 127, 144
 - stellar flare, 145, 149
- neutral environment
 - effects, 383
 - modeling, 384
- Nuclear Regulatory Commission (NRC), 362
- Occupational Safety and Health Administration, 363
- optical depth, definition, 91
- optical radiation, 83
- optically thick, thin, 91
- orbital-debris environment, 385
- orthopositronium, 114
- parapositronium, 114
- Parker transport equation, 252

- particle acceleration
 - chromospheric, 156
 - diffusive shock, 220
 - first-order Fermi, 220
 - in reconnection shocks, 156
 - interplanetary shocks, 223, 226
 - kinematic versus kinetic, 216
 - magnetic reconnection, 155
 - modeling in shocks, 228
 - shocks, 216
 - shock drift, 217
- particle detectors, 52
- particle diffusion, energy dependence, 249
- particle drift, 240
 - electric field, 240
- particle energization, equation, 297
- particle invariants, 299
- particle motion, 239, 296
 - artificial aspects in 1D and 2D, 243
 - bounce motion, 297
 - first invariant, 299
 - general force drift, 299
 - guiding center, 298
 - gyration, 297
 - invariants, 299
 - L parameter, 300
 - mirror point, 297
 - second invariant, 300
 - third invariant, 300
- particle precipitation, 271
- particle scattering, 241
 - resonance condition, 242
- particle-wave interaction, 310
- phase space density, 46, 245, 301
- pickup ions, 44
- pion decay, 113
- pitch angle, 240
- Planck function, 89
- planetary magnetosphere, 263
- plasma β , 131
 - definition, 131
- plasma environment modeling, 390
- plasma frequency, 97
- plasma oscillation, 98
- plasma radiation, 98
- polar airline routes, 28
- polar cap absorption, 27
- polarization, 91
 - degree of circular, 92
 - degree of linear, 92
 - hard X-rays, 111, 122
 - Stokes parameters, 92
- power law
 - CME energy distribution, 167
 - first-order Fermi acceleration, 220
 - flare energies, 130
 - suprathermal tail, 70
- Poynting flux, 134, 155, 171, 270, 327
 - Alfvén waves, 156
- preflare activity, 128
- proportional counter, 52
- quasi-linear theory, 253
- quasi-periodic oscillations, 120
- Quebec blackout, 23
- radiation
 - annihilation, 122
 - bremsstrahlung, 95
 - cancer, 360
 - cyclotron, 96
 - free-bound, 125
 - free-free, 95, 125
 - from energetic particles, 93
 - gyroresonance, 96
 - gyrosynchrotron, 96
 - incoherent, coherent, 93
 - non-thermal gyrosynchrotron, 98
 - plasma, 102, 105
 - polarization, 91
 - synchrotron, 97
 - thermal, non-thermal, 90
- radiation belt, 43, 293
 - acceleration mechanism, 305
 - Earth, 302
 - electrons, 302
 - electron losses at Earth, 315
 - inner belt, 302
 - Jupiter, 304
 - losses, 315
 - losses at Jupiter and Saturn, 319
 - modeling, 394
 - outer belt, 302
 - particle acceleration at Jupiter and Saturn, 315
 - particle diffusion, 307
 - proton acceleration, 314
 - proton losses at Earth, 319
 - protons, 302
 - Saturn, 304
 - slot region, 293
 - synchrotron radiation at Jupiter, 304
- radiation effects
 - DOE regulations, 363
 - environmental monitoring, 372
 - IEEE, 362
 - OSHA, 363
 - sources of exposure, 363
- radiation environment effects, single-event upset, 394
- radiation protection, 359
- radiation units, 359
 - gray, 359, 391
 - rad, 359
 - sievert, 360
- radiative diffusion, 10
- radiative transfer, 90
 - equation, 91
- radio burst
 - ejecta, 146
 - meter wave, 140
 - type II, 105, 118, 137, 140, 146, 194, 205
 - type III, 104, 134, 137
 - type III, shock-associated, 117
 - type IV, 145

- radio bursts, types of, 83
- radio emission, 81
- radio waves, refraction and scattering, 106
- random walk of field lines, 249
- Rankine–Hugoniot jump conditions, 198, 202, 215
- Rayleigh–Jeans law, 89
- Razin suppression, 100, 106
- reactive power, 25
- reconnection, 6, 12
 - magnetic topology, 285
 - rate measured in flare, 168
 - topology in magnetosphere, 283
- refraction, index of, 105
- relativistic electron acceleration mechanism, 305
 - external, 306
 - internal, 310
- relativistic electrons, 294
- relaxation oscillator, 129
- resistive anode, 56

- satellite anomaly, 30
 - statistics, 30
- satellite re-entries, 29
- satellites, de-orbiting, 29
- scintillator
 - inorganic, 61
 - organic, 61
- second invariant of particle motion, 300
- secondary electrons, 49
- shielding current, 5
- shock
 - corona, 206, 211
 - cosmic-ray modified, 215, 226
 - Earth bow shock compared to IP shocks, 229
 - fast mode, 211
 - heating versus acceleration, 214
 - jump conditions, 199
 - maximum compression, 212
 - MHD, 211
 - particle acceleration, 216
 - slow mode, 211
 - supercritical, 211
- shock wave, 193, 197, 201
 - classification, 200
 - CME driven, 204
 - oblique, 202
 - parallel, 202
 - perpendicular, 202
 - planetary bow shock, 196
 - SEP production, 194
 - strength, 197
 - termination shock, 196
- shock-drift acceleration, 217
- shock-induced acceleration, 306
- single-event upset (SEU), 32, 294, 395
- soft X-ray emission, 85
- Solar and Heliospheric Observatory (SOHO), 374
- solar energetic particles, 237
 - impulsive-event problem, 256
 - point-source evolution, 256
 - time–intensity profile, 238
- two-class paradigm, 237
- solar flare classification, 375
- solar flare effects, 376
- solar particle event (SPE), 32, 365
 - modeling, 398
- solar proton event, 32
- solar wind termination shock, 204
- source function, definition, 91
- sources of radiation exposure in space, 363
- South Atlantic Anomaly, 367
- space environment climatology, 377
- space environment effects, 381
 - micrometeoroid and orbital debris, 385
 - neutral environment, 383
 - solar UV degradation, 382
 - vacuum, 382
- space environment monitoring, 372
- space physics, 43
- Space Radiation Analysis Group (SRAG), 366
- space weather
 - aircraft operations, 27
 - awareness, 38
 - economic impact, 35
 - electrical power grids, 22
 - ESD, SEU, 33
 - first recorded impact on technology, 19
 - forecast, 33
 - forecasting, 40, 376
 - human health, 14
 - human impact, 17
 - media coverage, 38
 - satellite de-orbiting, 29
 - satellite re-entries, 29
 - solar panels, 34
- Space Weather Prediction Center (SWPC), 367
- spacecraft charging, 385
 - floating potential, 386
 - geosynchronous orbit, 389
 - low-Earth orbit, 386
- spacecraft, ionizing radiation, 391
- specific intensity, definition, 88
- Sputnik, 43
- stars
 - II Pegasi, 144
 - Vega (α Lyrae), 132
 - T Tauri, 151
- stellar flare
 - binary star, 150
 - energy, 149
 - magnetic reconnection, 149
 - Neupert effect, 149
- Stokes parameters, 92, 93
- stopping power, 13, 50
- sub-diffusion, 250
- submillimeter radiation, 83
- substorm, 148, 264
 - auroral, 265
 - auroral breakup, 265
 - current-disruption model, 287
 - dipolarization, 265
 - Earth, 286

Cambridge University Press

978-0-521-76051-5 - Heliophysics: Space Storms and Radiation: Causes and Effects

Edited by Carolus J. Schrijver and George L. Siscoe

Index

[More information](#)*Index*

447

- electric field, 306
- expansion phase, 265, 286, 287
- growth phase, 266, 286, 287
- Mercury, 289
- NEXL model, 287
- recovery phase, 265
- resemblance to flare, 265
- Saturn, 290
- triggering, 267
- Uranus, 290
- sudden ionospheric disturbance, 26, 38
- sudden storm commencement, 18
- sunspot cycle, discovery, 16
- super-diffusion, 250
- supra-arcade downflows, 153
- suprathermal tail, 234
- surface charging, 294
- T Tauri star, 151
- TAD, 11
- tangential discontinuity, 200
- tearing mode instability, 285
- telegraphy, 19
- thermodynamic equilibrium, definition, 89
- thermosphere, 29
 - composition bulge, 334
 - composition response to geomagnetic storm, 334
- definition, 323
- flare response, 354
- geomagnetic storm response, 331
- thermal change by geomagnetic storm, 334
- thick-target emission, 108
- thin-target emission, 108
- third invariant of particle motion, 300
- Thomson scattering, 103
- total electron content (TEC)
 - unit, 340
- transport equation, Parker's, 252
- trapped particles, 293
- traveling atmospheric disturbances (TAD), 11
- two-stream instability, 103
- ultraviolet emission, 83
- universal processes, 12, 291
- vacuum environment effects, 382
- Voyager, 45, 196
- wave steepening, 196
- wave-particle interaction, Chorus-EMIC, 312
- weather, in space, 9, *see also* space weather
- wedge and strip anode, 56
- Wien's displacement law, 89