

Subject Index

- agency, *see* instruments, agencies, observatories, and programs
- Aristotelian doctrine, 11
- Asiago Supernova Catalogue, 26, 91
- asterism(s)
 - Chuanshe, 12
 - Nandou, 14
 - Nanmen, 15
 - Wei, 14
- Baade-Wesselink method, *see* supernova, distance, Baade-Wesselink method
- Big Bang, 445
 - nucleosynthesis, 455
- black hole, 29, 80, 86, 96, 221, 262, 271, 273, 274, 276–278, 285, 291, 294, 307, 333, 407, 408, 445, 446
- Blandford-Znajek mechanism, 262, 409
- blastwave, *see* (supernova, shock, circumstellar) or (GRB, shock, external)
- Chandrasekhar limit, 91, 221
- circumstellar shock, *see* supernova, shock, circumstellar
- CLUMPYSYN, *see* supernova, model, CLUMPYSYN
- collapsar, *see* GRB, progenitor, collapsar
- Compton Catastrophe, 369
- Compton scattering, 28, 52, 96, 125, 178
- Cosmic Microwave Background, 211, 213, 214, 445
- cosmic-rays, 410, 412
 - ultra-high energy, 394, 411, 412
- cosmology, 24, 31, 56, 59, 84, 87, 113, 195, 197, 199, 201, 203–207, 209, 211–217, 312, 446, 449
 - cosmological constant, 200, 201, 210, 211
 - dark energy, 202
 - gravitational lensing, 208
 - K-correction, 206
 - luminosity distance, 200, 204, 206
 - redshift-distance relation, 139
 - supernova evolution, 209
 - systematic effects, 212
 - time dilation, 200
 - Universe
 - acceleration, 200, 210
 - critical density, 199
 - curvature, 200, 213
 - dark energy, 210
 - deceleration, 195, 200, 210
 - expansion rate, 199
 - matter density, 210
 - topology, 195, 199, 202
- dark burst, *see* GRB, optical, dark
- Doppler broadening, 63, 108, 232
- Doppler shift, 48, 49
- Eddington limit, 221
- Einstein angle, 450, 454, 455
- epoch of reionization, 445–447, 449, 450
- Euclidean distribution, 307
- Eulerian frame, 49
- expanding photosphere method, *see* supernova, distance, expanding photosphere method
- Fermi acceleration, 157, 403, 410
- filled-center supernova remnant, *see* supernova remnant, plerionic
- forward shock, *see* (supernova, shock, circumstellar) or (GRB, shock, external)
- Friedman equation, 199
- galaxy

- active, 41
- AGN, 41, 171, 183, 284, 409
- blazar, 284
- disk, 39
- distance
- Cepheid, 24, 139, 203
- dwarf, 117
- early type, 24, 117
- elliptical, 23, 40, 117, 209
- inclined, 39
- individual
- ESO184-G82, 245, 330, 368
- Large Magellanic Cloud, 28, 91, 131, 132, 138, 224, 352
- M100, 98
- M51, 102, 121
- M74, 269, 270
- M81, 27, 28, 130
- M82, 176, 422
- M83, 121
- Milky Way, 132, 205, 208
- Mrk297A, 191
- NGC1380, 119
- NGC1637, 127
- NGC3877, 127
- NGC4041, 104
- NGC4321, 115
- NGC5236, 121
- NGC628, 106
- NGC6946, 100
- Small Magellanic Cloud, 352, 377
- late type, 24, 117, 209
- quasar, 445, 446
- micro, 409
- Seyfert, 41
- spiral, 23, 25, 39–41, 209
- starburst, 41
- General Relativity, 195, 199
- gravitational lensing, 447, 455
- microlensing, 450–453, 455
- GRB
- afterglow, 171, 243, 284, 289, 291, 343, 345, 349, 355, 358, 373, 374, 379, 382, 393, 403, 404, 406, 409, 410, 419, 420, 422, 425–427, 430–432, 434, 438, 440, 447, 450, 455
- circumburst medium, 283, 289, 291, 307, 324, 328, 329, 332, 334–336, 349, 351, 388, 393, 396, 399, 404, 406, 407, 410, 411, 413, 414, 420, 452
- clumps or filaments, 386, 438
- dust, 288, 352
- interstellar medium, 291, 324, 419, 420, 422, 423, 430, 433–436, 438–440
- stellar wind, 291, 386, 389, 420, 421, 426, 429, 430, 432–440
- class
- intermediate duration/intermediate intensity/soft, 306
- long/bright/soft, 306, 317, 373, 385
- short/faint/hard, 306, 336, 373
- very short, 307
- clustering, 306
- distribution, 317
- duration, 302
- long, 284, 302, 306, 308, 345, 404, 409
- short, 302, 306, 345, 404
- ejecta, 307, 348, 396, 399, 402, 406
- relativistic, 283, 284, 291, 318, 327, 399
- shocked, 402
- unshocked, 399
- explosion energy, 290, 329, 406
- failed, 286
- fireball, 290, 349, 352, 387, 393, 394, 404, 408–411, 413, 447, 450, 452, 455
- baryons, 396–398, 409
- deceleration, 407
- efficiency, 351, 407
- electrons, 395, 398, 400, 406, 410, 411
- equipartition, 401, 403, 408, 411
- evolution, 393, 396
- Lorentz factor, 395, 398–401
- muons, 413
- pair production, 395, 396, 401, 408, 431
- photo-meson, 414
- photons, 395, 397, 398
- pions, 413
- positrons, 395
- protons, 398, 400, 406, 410, 411, 413
- relativistic, 395–397, 453
- self-similar solution, 399, 402, 404, 414, 423
- size, 405
- Thomson cross section, 395
- Thomson optical depth, 398
- Thomson photosphere, 396
- Thomson scattering, 396, 398, 401
- two-photon collision rate, 396

- Galactic distribution, 305
- gamma-ray
 - emission, 243, 284, 413
 - energy, 293
 - light curve, 303, 310
 - luminosity, 293
- gravitational lensing, 305
- gravitational radiation, 310
- individual
 - GRB000131, 353, 355, 448
 - GRB000214, 330, 331, 336, 439
 - GRB000301C, 345, 349, 352, 353, 376, 382, 384, 386, 434, 435, 437, 438, 453–455
 - GRB000418, 434, 435, 438–440
 - GRB000926, 288, 321, 325, 326, 328, 434–438
 - GRB001109, 321
 - GRB010214, 326, 328
 - GRB010222, 288, 321, 325, 326, 328, 329, 353, 422, 434, 435, 438
 - GRB010510, 328
 - GRB011030, 318
 - GRB011121, 276, 349
 - GRB011130, 318
 - GRB920123, 419
 - GRB920501, 303
 - GRB920616, 31
 - GRB920723, 309
 - GRB940217, 307, 308
 - GRB960720, 318
 - GRB970228, 276, 283, 293–295, 318, 321, 325, 326, 334, 347, 349, 419, 439, 440
 - GRB970417A, 307
 - GRB970508, 318, 321, 325, 330, 331, 334, 336, 352, 357, 374–376, 385–387, 404, 405, 407, 419, 433–435, 438–440
 - GRB970514, 31, 271, 276
 - GRB970828, 321, 330, 331, 334, 336, 439
 - GRB971115, 31, 276
 - GRB971214, 324
 - GRB971216, 325
 - GRB980326, 276, 283, 293, 294, 349, 436, 438–440
 - GRB980329, 321, 354, 376–378, 382, 385, 387, 448
 - GRB980425, 30, 94, 105, 161, 243, 245, 276, 277, 283, 287, 291–294, 309, 311, 326, 329, 330, 334, 350, 354, 367–369, 372–374, 376, 385, 386, 388, 419, 421, 433, 434, 438–440
 - GRB980519, 326, 328, 376, 377, 379, 380, 387, 434–436, 438
 - GRB980613, 351
 - GRB980703, 321, 325, 439
 - GRB980910, 31, 276
 - GRB980923, 334
 - GRB981226, 334
 - GRB990123, 312, 321, 334, 349, 350, 356, 406, 432, 433, 438–440
 - GRB990506, 344
 - GRB990510, 285, 321, 323, 326, 328, 349, 419, 432, 433, 438–440
 - GRB990705, 333
 - GRB990712, 324, 349
 - GRB991002, 276
 - GRB991023, 437
 - GRB991208, 376, 379, 381, 434–440
 - GRB991216, 288, 325, 330–333, 376, 382, 383, 385, 434, 435, 437, 438
 - infrared, 77–79, 82, 83, 124, 320, 343, 348, 349, 351–355, 358
 - emission, 352, 355, 358, 374, 376, 377, 379, 382, 385, 389, 447
 - light curve, 349
 - jet, 283, 284, 289, 327–329, 335, 336, 351, 358, 388, 400, 407, 409, 414, 420, 430, 432, 434–438, 440
 - Lorentz factor, 430
 - relativistic, 327, 400
 - light curve, 301, 335, 387, 389, 423–426, 430, 432
 - break, 328, 385, 429
 - decline rate, 427
 - fast-rise exponential-decay (FRED), 303, 334
 - steepening, 351
 - light echo, 358, 439
 - Lorentz factor, 291
 - luminosity function, 359
 - magnetic field, 359, 400, 401, 403, 408–411, 413
 - model
 - cannonball, 337, 350
 - collapsar-bubble, 440
 - fireball, 284, 324–326, 328, 334, 336, 337

- interstellar medium interactor, *see* GRB, circumburst medium, interstellar medium
- wind interactor, *see* GRB, circumburst medium, stellar wind
- neutrinos, 310, 394, 408, 413, 414
- optical
 - $E(B - V)$, 374, 377, 379, 382, 385, 386
 - dark, 321, 336, 345, 348, 358, 439
 - decline rate, 345, 374
 - emission, 243, 283, 293, 318, 323, 325, 328, 330, 336, 337, 343, 344, 355, 374, 376, 377, 379, 382, 385, 389, 406, 419, 426, 427, 432, 437
 - extinction, 348, 352, 374, 376, 377, 382, 386
 - light curve, 243, 293, 310, 323, 326, 328, 336, 434, 436–438
 - polarization, 323, 349, 359
 - rebrightening, 30, 293
 - spectrum, 359
- progenitor, 283, 284, 289, 335, 394, 407
 - binary merger, 288, 408
 - collapsar, 262, 284–286, 288, 291, 335, 356, 408, 409, 414
 - high mass, 386, 389, 420, 439, 440
 - hypernova, *see* hypernova
 - mass-loss, 289, 389, 398, 409, 434
 - n*-black hole merger, 284, 288, 310
 - n*-n* merger, 284, 288, 306, 310, 335, 356, 409, 440
 - supernova, 356
 - Wolf-Rayet star, *see* star, Wolf-Rayet
- protons, 394
- radio
 - emission, 243, 291, 318, 320, 325, 337, 345, 355, 373, 374, 376, 377, 379, 382, 385, 389, 393, 404, 407, 426, 427, 433, 434, 437, 447
 - interstellar scintillation, 369, 374, 377, 379, 382, 385–387, 427
 - light curve, 291, 369, 374, 433
 - parameterization, 374, 376, 377, 379, 382, 385
 - scintillation, 318, 387, 405, 433, 434, 450
 - rate, 43, 286, 305, 406, 411, 413, 447
 - evolution, 406, 411
 - redshift, 318, 323, 330, 331, 333, 336, 337, 374, 376, 377, 379, 382, 385, 386, 388
 - shock, 325, 403, 406, 410
 - adiabatic, 325, 328, 424–426, 432
 - collisionless, 401, 403
 - cooling, 426
 - evolution, 325
 - external, 324, 334, 344, 348, 349, 351, 369, 371, 386, 411, 420, 422, 423, 426, 428, 431, 435, 437, 441
 - internal, 334, 400, 403, 410
 - Lorentz factor, 388, 410, 422, 423, 426
 - radiative, 325, 424–426
 - relativistic, 291, 333, 388, 399, 403, 419, 423, 424, 426, 433, 435, 450
 - reverse, 348, 349, 399, 402, 406, 410, 437
 - speed, 423
 - spectrum, 304
 - 3.5 keV, 330
 - 3.8 keV, 333
 - 4.4 keV, 330
 - 4.7 keV, 330
 - 5 keV, 330
 - absorption, 353, 359
 - annihilation lines, 305
 - break, 325, 326, 335, 374, 401, 407, 423, 424, 452
 - cyclotron lines, 305
 - Fe, 332, 333
 - Fe K, 331
 - Ly α , 345, 353, 448, 449
 - Mg I, 288
 - power-law, 326, 345
 - statistics, 345
 - supernova connection, 291, 293, 301, 312, 333, 334, 336, 350, 358, 367, 409, 422, 439, 440
 - synchrotron, 325
 - cooling, 324, 352, 401, 402, 423, 431
 - emission, 305, 321, 324, 328, 335, 349, 374, 400–404, 406, 410, 411, 422
 - losses, 385, 411
 - proton, 334
 - self-absorption, 352, 371, 377, 423–425, 427, 428, 433
 - self-Compton, 305
 - spectrum, 401, 431

- time dilation, 387
- ultraviolet, 343
- emission, 353, 437
- spectrum, 446
- web sites, 313
- X-ray
 - absorption, 321
 - decline rate, 434
 - delayed, 335
 - emission, 243, 245, 308, 318, 321, 323, 325, 328, 330, 334–337, 345, 351, 374, 376, 377, 379, 382, 393, 407, 419, 426, 427, 432, 436–438
 - light curve, 303, 323, 325, 326, 328, 335
 - precursor, 303
 - spectrum, 288, 321, 325, 330, 335, 336, 422
- guest star, *see* supernova, historical
- GZK cutoff, 412

- HR diagram, 163, 272
 - blue loop, 163
 - pink loop, 163
- Hubble constant, 24, 40, 139, 195, 197, 199, 203, 204, 245
- Hubble diagram, 139, 197, 198, 203, 209, 210
- Hubble parameter, 199, 445
- hypernova, 29, 31, 47, 243, 246, 248, 250, 252, 254, 257–260, 262, 263, 265, 267, 269–271, 273, 274, 276, 284, 306, 333, 335, 356
 - circumstellar medium, 273
 - density, 273
 - interaction, 271
 - ejecta, 257, 264
 - density, 271
 - mass, 269, 271, 276
 - speed, 265, 269, 273
 - explosion
 - aspherical, 246, 257, 260–262, 265, 267, 270, 276
 - explosion energy, 260, 262, 263, 270, 271, 273, 274, 277
 - GRB connection, 262, 267, 270, 271, 276, 277
 - individual
 - SN1997cy, 262, 271–273, 276, 278
 - SN1997dq, 262, 267
 - SN1997ef, 244, 246, 255, 262–267, 269, 270, 276, 278
 - SN1998bw, 243–257, 259–263, 265, 269, 270, 276, 278
 - SN1999as, 262, 270, 271
 - SN1999E, 262, 271, 276
 - SN1999ey, 267
 - SN2002ap, 244, 262, 268–270, 276
 - jet, 267, 270, 273, 278
 - light curve, 262, 263, 267, 269, 271, 273
 - ^{56}Ni , 263, 269
 - bolometric, 271
 - decline rate, 264, 267
 - photospheric phase, 267
 - luminosity, 262, 271
 - model
 - CO100, 263, 265–268
 - CO138, 259
 - CO60, 263, 265–267
 - nucleosynthesis, 277
 - ^{28}Si , 260
 - ^{32}S , 260
 - ^{51}Mn , 260
 - ^{51}V , 260
 - ^{52}Cr , 260
 - ^{52}Fe , 260
 - ^{55}Co , 260
 - ^{55}Mn , 260
 - ^{56}Ni , 260
 - optical
 - light curve, 273
 - polarization, 270
 - progenitor, 273, 278
 - binary, 270, 274, 277
 - mass, 273, 277
 - mass-loss, 272
 - radio
 - emission, 270, 273
 - shock
 - circumstellar, 271, 273
 - reverse, 271, 273
 - spectrum, 262, 267, 269, 271
 - $\lambda 10830$, 259
 - $\lambda 6355$, 265
 - $\lambda 7500$, 265
 - $\lambda 8200$, 265
 - Ca II, 265, 271
 - Fe II, 265, 269, 271
 - H α , 271
 - He I, 259

- line blending, 269
- O I, 265, 271
- photospheric phase, 270
- Si II, 265
- X-ray
- emission, 271
- instruments, agencies, observatories, and programs
 - International Ultraviolet Explorer (IUE), 113
- instruments, agencies, observatories, and programmes
 - BeppoSAX, 317
- instruments, agencies, observatories, and programs
 - Advanced Satellite for Cosmology and Astrophysics (ASCA), 98–101, 104, 318, 331, 410
 - Gas Imaging Spectrometer (GIS), 98
 - Solidstate Imaging Spectrometer (SIS), 98
 - Akeno Giant Air Shower Array (AGASA), 412
 - Anglo-Australian Observatory (AAO), 247
 - Anglo-Australian Telescope (AAT), 115
 - Asiago Observatory, 268
 - Astro-rivelatore Gamma a Immagini Leggero (AGILE), 337
 - Atacama Large Millimeter Array (ALMA), 237
 - Australia Telescope Compact Array (ATCA), 93, 227, 235–237, 243, 369
 - Australian National University (ANU), 247
 - Mount Stromlo Observatory (MSO), 247
 - Siding Spring Observatory (SSO), 247
 - Beijing Astronomical Observatory (BAO), 268
 - BeppoSAX, V, 2, 3, 105, 243, 245, 313, 317–320, 323, 329–331, 334, 336, 337, 344–347, 349, 368, 374, 376, 377, 404, 407
 - Gamma-Ray Burst Monitor (GRBM), 2, 3, 243, 318, 323, 330, 344
 - Medium-Energy Concentrator Spectrometers (MECS), 318, 330, 334
 - Narrow Field Instruments (NFIs), 105, 243, 245, 318, 319, 331, 345, 368
 - Phoswich Detector System (PDS), 318, 334
 - Wide Field Cameras (WFCs), 243, 318–320, 330, 344–346
 - Calan/Tololo Supernova Search (CTSS), 198, 204, 205, 211, 212
 - Canada France Hawaii Telescope (CFHT), 206
 - Center for Particle Astrophysics, 204
 - Cerro Tololo Inter-American Observatory (CTIO), 79, 198, 247
 - Yale-AURA-Lisbon-Ohio (YALO), 79
 - Chandra X-ray Observatory – AXAF (CHANDRA), 99, 102, 103, 105, 106, 108, 234, 236, 318–320, 323, 329–332, 345, 346, 355
 - Compton Gamma-Ray Observatory (CGRO), V, 1, 101, 243, 303, 304, 307, 317, 319
 - Burst and Transient Source Experiment (BATSE), 243, 245, 304–307, 309, 312, 313, 315, 317, 319, 334, 336, 344–346, 348, 349, 376, 377, 382, 395, 401, 402
 - Energetic Gamma Ray Experiment Telescope (EGRET), 307, 308
 - Oriented Scintillation Spectrometer Experiment (OSSE), 101
 - Cosmic Background Explorer (COBE), 208
 - Digitized Sky Survey (DSS), 345
 - Einstein Observatory – HEAO-2 (Einstein), 98, 100, 115
 - Imaging Proportional Counter (IPC), 100
 - European Southern Observatory (ESO), 32, 115, 243, 247, 449
 - New Technology Telescope (NTT), 243, 291, 355
 - European Space Agency (ESA), 115, 134, 135
 - Faint Object Camera (FOC), 134
 - Gamma-Ray Large Area Space Telescope (GLAST), 312, 313, 337
 - Goddard Space Flight Center (GSFC), 132

- GRB Coordinates Network (GCN), 313
- Gunma Astronomical Observatory (GAO), 268
- Harvard-Smithsonian Center for Astrophysics (CfA), 79
- High Energy Astrophysics Science Archive Research Center (HEASARC), 313
- High Energy Transient Explorer (HETE-2), 312, 313, 347, 441
- High-Z SN Search (HZSNS), 205, 206, 210–212
- Hubble Space Telescope (HST), 1, 2, 66, 68, 108, 113, 115, 116, 119, 122, 126, 129, 130, 132, 134–139, 162, 173, 182, 203, 204, 210, 219, 226, 227, 229, 233, 235, 237, 252, 254, 255, 287, 343, 350, 353–356, 358
- Advanced Camera for Surveys (ACS), 359
- Faint Object Camera (FOC), 119, 132, 135, 137
- Faint Object Spectrograph (FOS), 119, 122, 126, 130, 135, 136
- Investigation Definition Team (IDT), 132
- Key Project, 203
- Near Infrared Camera and Multi-Object Spectrometer (NICMOS), 359
- Space Telescope Imaging Spectrograph (STIS), 2, 129, 132, 137, 229–232, 238, 353, 354, 356, 358
- Wide-Field Planetary Camera 2 (WFPC2), 132, 135, 137, 226, 234, 358
- International Gamma-Ray Astrophysics Laboratory (INTEGRAL), 337
- International Ultraviolet Explorer (IUE), 113, 115–119, 121–124, 131–136, 138, 225
- Interplanetary Network (IPN), 312, 313, 319, 320, 344–347
- Italian Space Agency (ASI), 337
- James Clerk Maxwell Telescope (JCMT), 377
- Laser Interferometer Gravitational Wave Observatory (LIGO), 310
- Lawrence Berkeley National Laboratory (LBNL), 204
- Lick Observatory, 130, 268
- Lick Observatory and Tenagra Observatory Supernova Search (LOTOSS), 79
- Livermore Optical Transient Imaging System (LOTIS), 314
- MDM Observatory, 125
- Medium-sized Explorer (MIDEX), 313
- Microwave Anisotropy Probe (MAP), 213
- Milagro Gamma-Ray Observatory (MGRO), 307
- Mount Wilson Observatory (MWO), 10
- Multiple Mirror Telescope (MMT), 126
- National Aeronautics and Space Administration (NASA), 115
- Infrared Processing and Analysis Center (IPAC), 115
- Infrared Telescope Facility (IRTF), 115
- Next Generation Space Telescope (NGST), 359, 447
- PLANCK, 213
- Röntgensatellit (ROSAT), 98–104, 158, 229, 234, 236, 318, 319
- High Resolution Imager (HRI), 98–104, 319
- Position Sensitive Proportional Counter (PSPC), 98–101, 103
- Robotic Optical Transient Search Experiment (ROTSE), 310, 312, 314, 348, 349
- Rossi X-ray Timing Explorer (RXTE), 318–320, 344–346
- Proportional Counter Array (PCA), 319, 320, 344, 345
- Solar Maximum Mission (SMM), 307
- Space Telescope Science Institute (STScI), 345
- Subaru Telescope, 210, 268, 269
- High Dispersion Spectrograph (HDS), 269
- Supernova Cosmological Project (SCP), 204–206, 210–212, 270
- Supernova INTensive Study (SINS), 124, 128, 132

- SuperNova/Acceleration Probe (SNAP), 212–214
- Swift Gamma-Ray Burst Explorer (Swift), 312, 313, 337, 358, 441, 447, 455
- UltraViolet and Optical Telescope (UVOT), 358
- Télescope à Action Rapide pour les Objets Transitoires (TAROT – Rapid Action Telescope for Transient Objects), 314
- UK Science and Engineering Research Council (SERC), 115
- Ulysses, 302, 308, 309
- United Kingdom Infra-Red Telescope (UKIRT), 115
- VELA satellites, 301, 317
- Very Large Array (VLA), 93, 99, 115, 145, 187, 374, 376, 377, 379, 382
- Very Large Telescope (VLT), 247, 296, 353, 355, 449
- Very Long Baseline Interferometry (VLBI), 146, 163, 187, 191, 192, 387
- Villafranca Satellite Tracking Station (VILSPA), 132
- W.M. Keck Telescope, 210, 357
- W.M. Keck Telescope), 125, 210, 288, 353
- William Herschel Telescope (WHT), 268
- XMM-Newton (XMM), 98, 105, 106, 108, 318, 319
- EPIC-MOS, 98
- EPIC-PN, 98, 106
- Optical Monitor (OM), 106
- intergalactic medium, 114, 359, 445, 447, 448, 450
- interstellar medium, 29, 37, 113, 114, 132, 150, 288, 290, 291, 325, 396, 399, 403, 405, 410, 414, 420, 422, 426, 427, 429, 430, 432–441, 450, 451
- interstellar polarization, 55–57
- interstellar scintillation, *see* GRB, radio, scintillation
- inverse Compton, 305, 324, 431
 - emission, 400, 438
 - limit, 388
 - losses, 187
 - scattering, 94, 349, 431, 436, 438
 - self, 325, 334, 335
- Lagrangian point, 227
- Larmor radius, 410
- Lorentz factor, 187, 284, 326, 349, 450
- Malmquist Bias, 208
- ML MONTE CARLO, *see* supernova, model, ML MONTE CARLO
- NLTE (non-local thermodynamic equilibrium), *see* supernova, model, NLTE
- observatory, *see* instruments, agencies, observatories, and programs
- outgoing shock, *see* (supernova, shock, circumstellar) or (GRB, shock, external)
- PHOENIX, *see* supernova, model, PHOENIX
- Planck function, 196
- planetary nebula, 113, 174
- presupernova wind, *see* supernova, progenitor, wind
- program, *see* instruments, agencies, observatories, and programs
- pulsar, *see* star, neutron
- radio supernova, *see* supernova, radio
- Rayleigh-Taylor instability, 173, 176, 222, 247
- RL NEBULAR, *see* supernova, model, RL NEBULAR
- Robertson-Walker Metric, 199
- Schwarzschild radius, 407, 408
- SNu, 40, 44
- Sobolev approximation, *see* supernova, model, Sobolev approximation
- special relativity, 414
- standard candle, 195–197
- star
 - B3, 28, 132, 421
 - binary, 28, 102, 107, 121, 146, 174, 227, 287
 - C+O, 96, 244, 246–248, 260, 270, 277, 278, 368
 - Cepheid, 202
 - degenerate, 174

- formation rate, 40, 41, 43, 44, 87, 411, 447
- He, 277
- high mass, 25, 27, 37, 40–42, 86, 173, 196, 197, 244, 247, 262, 271, 283, 287, 288, 291, 294, 335, 445, 446
- individual
 - α Cen, 15
 - α Orionis, 173
 - β Cen, 15
 - ϵ Cen, 15
 - τ Cas, 17
 - ζ Tau, 13
 - AR Cas, 17
 - Polaris, 10
 - SAO35386, 17
 - Sirius, 207
 - Sk-69 202, 28, 102, 132
 - Vega, 207
- KOIa, 27
- low mass, 41
- luminous blue variable, 159
- mass, 85
- mass-loss
 - rate, 173, 174, 179, 185, 186, 190–192, 422
- neutron, 12, 43, 80, 82, 85, 94, 96, 221, 222, 274, 276, 287, 291, 317, 335, 408, 409, 445, 446
- red giant, 113
- solar analog, 207
- stellar population, 24, 37, 41, 42
- supergiant, 31
 - blue, 102, 108, 124, 131, 132, 139, 157, 161, 162, 165, 227, 272, 273, 421
 - red, 68, 96, 102, 108, 121, 124, 125, 131, 132, 151, 155, 157, 161–163, 172, 173, 176, 184, 185, 191, 227, 272, 273, 372, 373, 421, 439
- VY CMa, 173
- white dwarf, 23, 31, 58, 60, 82, 108, 173, 174, 197, 207
- wind, 173, 174, 176, 178, 183–186
 - speed, 173, 174, 183, 291
- Wolf-Rayet, 41, 172, 174, 277, 278, 421, 422, 426, 434, 439, 440
- Sunyaev-Zeldovich effect, 204
- superluminal motion, 388, 450
- supernova
 - absorption
 - free-free, 185, 186, 189–191
 - interstellar, 78
 - circumstellar medium
 - density, 174
 - circumstellar medium, 28, 30, 42, 43, 47, 64, 78, 81, 82, 92, 94, 104, 107, 114, 125, 127, 131, 146, 148, 151, 158, 167, 172, 174, 176, 183, 185, 186, 219, 220, 225, 227, 228
 - clumps or filaments, 151
 - clumps or filaments, 176
 - clumps or filaments, 30, 58, 107, 108, 146, 148, 149, 155, 161, 176, 178, 180, 182, 183, 190, 371, 372
 - density, 25, 29, 98, 101, 102, 104, 106, 146, 158, 159, 162, 163, 173, 176, 178, 179, 182, 183, 185, 189, 190, 369
 - dust, 24, 180, 184, 185, 227
 - hot spots, 233, 234, 236–238
 - hydrodynamics, 172, 178
 - interaction, 27–29, 49, 52, 54, 171, 172, 174, 178, 182, 185, 191, 192, 219, 255
 - ring, 108, 125, 134, 136, 138, 162, 219, 226, 233, 234, 236, 238
 - spectrum, 47, 54
 - temperature, 175, 177, 182, 184, 186, 190
 - cooling, 78, 176, 179, 180, 182, 223, 234
 - radiative, 176, 183
 - core-collapse, 21, 22, 25, 27–29, 31, 37, 40–44, 55, 60, 62, 78, 79, 85–87, 92, 94, 105, 124, 162, 172, 173, 244, 262, 269, 276, 420
 - cosmology, *see* cosmology
 - Coulomb losses, 187, 189
 - deflagration, 58, 59, 96
 - detonation, 58, 59, 91, 96
 - distance, 83, 196, 199
 - Baade-Wesselink method, 114
 - Cepheid, 138
 - expanding photosphere method, 66, 196, 197, 202–204
 - ejecta, 42, 47, 48, 54, 59, 78–86, 92, 96, 100, 107, 114, 127, 132, 172, 176, 183, 220, 222, 228, 231, 238, 248, 251, 253, 255
 - clumps or filaments, 222, 223, 225, 257

- density, 29, 92, 96, 105, 107, 172, 174, 183, 184
- dust, 81, 126, 221, 224, 225
- dynamics, 219
- interaction, 28, 29, 219
- mass, 24, 27, 86, 122, 247, 264
- speed, 24, 25, 31, 47, 79, 86, 92, 96, 134, 173–175, 187, 257, 260, 269
- temperature, 175, 179, 180, 183, 184
- explosion energy, 28, 30, 31, 247, 250, 253, 259, 260, 262
- extinction, 39, 41
- Galactic rate, 43
- gamma-ray
 - absorption, 223, 248
 - emission, 96, 221, 222, 224, 238, 245
- high redshift, 204
- historical
 - AD1006, 7, 12, 13, 18
 - AD1054, 7, 12, 13, 18
 - AD1181, 7, 11–13
 - AD1230, 17, 18
 - AD1408, 17
 - AD1572, 7, 10
 - AD1592, 17
 - AD1604, 7–10, 131
 - AD1671, 16
 - AD1680, 8, 16, 17
 - AD185, 7, 14, 15, 18
 - AD369, 14, 15
 - AD386, 14, 18
 - AD393, 14, 18
 - AD837, 17, 18
 - Arab records, 8, 13, 14, 18
 - Cas A, 8, 16, 17
 - cave paintings, 13
 - Chinese records, 7–11, 13, 14, 17, 18
 - European records, 8–10, 13, 14, 18
 - Flamsteed’s star, 8, 16, 17
 - Japanese records, 8, 11–13, 17, 18
 - Kepler’s Supernova, 8, 10, 131
 - Korean records, 8–10, 17, 18
 - spurious, 17
 - Tycho’s Supernova, 10
- hyperenergetic, 54, 63, 64, 66, 68, 122, 267
- individual
 - SN1895B, 203
 - SN1937C, 203
 - SN1954A, 61
 - SN1954J, 31
 - SN1957D, 81, 82
 - SN1960F, 203
 - SN1961V, 31
 - SN1962L, 121
 - SN1964L, 121
 - SN1970G, 82, 151, 157
 - SN1972E, 203
 - SN1974G, 203
 - SN1978G, 115
 - SN1978K, 81, 98–100, 151, 157, 159, 162, 176, 191
 - SN1979C, 79, 81, 82, 94, 98, 99, 106, 115, 124–127, 150, 151, 153, 157, 158, 161–163, 179, 185, 191, 192, 369, 373
 - SN1980K, 79, 81, 82, 94, 100, 106, 115, 124–126, 150, 151, 153, 157, 158, 161–163, 185, 191, 369, 373
 - SN1981B, 115, 118, 119, 203
 - SN1981K, 151, 157
 - SN1982aa, 151, 157, 191, 368
 - SN1983G, 119
 - SN1983N, 25, 115, 121–123, 150–152, 157, 191, 368
 - SN1984A, 62
 - SN1984L, 25, 61, 151, 157, 264, 292
 - SN1985F, 25, 264
 - SN1986G, 119, 197
 - SN1986J, 81, 94, 99, 100, 106, 151, 157, 180, 182, 191, 368
 - SN1987A, 23, 27, 28, 37, 38, 42, 47, 53, 55, 56, 65, 77–83, 85, 87, 91, 92, 96, 97, 102, 106, 108, 113–115, 124, 125, 130–139, 157, 159, 161–166, 171, 172, 174, 182, 185, 191, 192, 219–229, 232, 236, 238, 269, 273, 274, 276, 368, 369, 415, 421
 - SN1987M, 25, 27
 - SN1988L, 25
 - SN1988Z, 29, 31, 68, 81, 91, 99, 106, 150, 151, 157, 162, 163, 176, 191, 271, 273, 368
 - SN1989B, 203
 - SN1989C, 29
 - SN1989M, 119
 - SN1990aj, 30, 31
 - SN1990B, 25, 94, 150–152, 157
 - SN1990E, 79
 - SN1990I, 23, 26
 - SN1990N, 82, 115, 117, 119–121, 203

- SN1991bg, 24, 42, 56, 58–60, 82, 197
- SN1991D, 26
- SN1991T, 24, 42, 58, 59, 83, 119–121, 197, 203
- SN1992A, 115, 117, 119, 120, 130, 140, 141
- SN1992am, 29
- SN1992ar, 31
- SN1992bc, 83
- SN1992bi, 205, 207
- SN1992H, 28
- SN1993J, 27, 28, 67, 68, 78, 79, 92, 100–104, 106, 108, 130, 131, 151, 157–160, 162–166, 179–181, 184, 187–190, 192, 269, 273, 276
- SN1993R, 31
- SN1994aj, 28
- SN1994D, 59
- SN1994G, 38
- SN1994I, 23, 25, 63, 65, 94, 100, 102–104, 107, 121, 122, 151, 157, 159, 191, 244, 246, 263–265, 269, 273, 276, 292
- SN1994W, 103, 104
- SN1995N, 29, 68, 69, 81, 94, 104, 106, 176, 182, 183, 192
- SN1995V, 65
- SN1996cb, 27, 68
- SN1996L, 28
- SN1996N, 62
- SN1996X, 23, 56, 58, 60
- SN1997B, 23
- SN1997br, 58, 274
- SN1997bs, 31
- SN1997cn, 58
- SN1997cy, 31, 68
- SN1997D, 29, 42, 67, 274
- SN1997dd, 27
- SN1997dt, 56
- SN1997ef, 31, 63, 66, 122
- SN1997ff, 91, 139, 209, 210
- SN1997X, 94
- SN1998bu, 24, 58, 82, 83, 203
- SN1998bw, 30, 31, 43, 47, 63, 64, 92, 94, 105, 122, 151, 157, 161, 191, 283, 287, 291–295, 309, 330, 350, 367–373, 385, 386, 388, 419, 421, 433, 438
- SN1998de, 58
- SN1998eq, 203
- SN1998ey, 31, 276
- SN1998S, 29, 68, 70, 78, 79, 94, 99, 100, 105, 106, 108, 124, 125, 127–129, 140, 141, 182, 185, 191, 192
- SN1998Z, 101
- SN1999aa, 58
- SN1999as, 64
- SN1999br, 274
- SN1999bw, 31
- SN1999by, 56, 58, 60, 70, 203
- SN1999cq, 25
- SN1999de, 82
- SN1999di, 61
- SN1999dn, 23, 61, 63
- SN1999E, 31, 68
- SN1999eb, 276
- SN1999em, 28, 66, 67, 78, 79, 105, 106, 125, 127, 129, 179, 191, 192, 196, 197, 270
- SN1999eu, 29
- SN1999gi, 28, 106
- SN2000cx, 58, 84
- SN2000er, 30, 31
- SN2000H, 61
- SN2001ke, 276
- SN2002ap, 94, 106
- infrared
 - emission, 91, 124, 171, 180, 184, 185, 219, 221–224
- light curve
 - ^{56}Ni , 86
 - light curve, 31, 42, 77–79, 81–83, 86, 87, 197, 247, 253–255, 257, 260
 - β decay, 83
 - ^{44}Ti , 52, 253
 - ^{56}Co , 28, 52, 78, 80, 82–84, 96, 222, 243, 253
 - ^{56}Fe , 28, 78, 96
 - ^{56}Ni , 24, 31, 42, 52, 58, 65, 78, 80, 83–86, 96, 222, 223, 243, 247, 257, 368
 - ^{57}Co , 81, 96, 222, 253
 - ^{57}Fe , 96
 - ^{57}Ni , 96, 222
- bolometric, 78, 83–86, 121, 222, 253, 255
- Branch Normal, 198
- Coulomb heating, 52
- decline rate, 27, 28, 31
- gamma-rays, 52, 78, 80–86, 96, 253
- infrared, 24, 30, 78, 79, 82, 83

- multi-color light curve shape method (MLCS), 198, 199, 203
- polarization, 30, 56, 60
- positrons, 24, 53, 82–84, 222, 253, 255
- radioactive decay, 24, 52, 78, 96, 219, 243
- snapshot method, 199
- stretch method, 198
- light echo, 24, 78, 81, 83, 114, 134, 185, 227, 238
- magnetic field, 146, 185–187
- model
 - CLUMPYSYN, 58, 60, 68
 - CO100, 246, 263, 264
 - CO138, 246, 248, 252, 253, 255, 257, 263
 - CO21, 246
 - CO6, 257
 - CO60, 263, 264, 267
 - DD4, 119
 - deflagration, 120
 - delayed detonation, 119, 120
 - ML MONTE CARLO, 52, 63, 66–68
 - NLTE, 52–54, 57, 58, 61, 62, 64, 68
 - PHOENIX, 52, 54, 59, 62, 63, 65–68, 70, 127
 - piecewise parabolic method, 176
 - RL NEBULAR, 53, 60, 64
 - self-similar, 172, 232
 - Sobolev approximation, 48, 50–53, 67
 - SYNOW, 50–52, 58, 61, 63, 65, 66, 68, 122, 127, 129
 - synthetic spectra, 47–54, 60–62, 64–69, 252, 253, 257, 265
 - W7, 120
- nebular phase, 47, 48, 52–54, 255
- neutrinos, 28, 91, 219, 221, 262
- nucleosynthesis, 222, 224, 238, 257, 261
 - ⁴⁴Ca, 259
 - ⁴⁴Ti, 259
 - ⁴⁸Cr, 259
 - ⁴⁸Ti, 259
 - ⁵⁹Co, 259
 - ⁵⁹Cu, 259
 - ⁶³Cu, 259
 - ⁶³Zn, 259
 - ⁶⁴Ge, 259
 - ⁶⁴Zn, 259
- optical, 154
 - emission, 91, 94, 122, 162, 219, 221, 237
 - light curve, 114, 245
 - polarization, 163, 260
 - peculiar, 31, 92
 - photospheric emission, 79, 125, 178, 220
 - photospheric phase, 48–51, 53, 54, 60, 232
 - progenitor, 77–79, 85, 86, 95, 102
 - high mass, 131
 - binary, 113, 158, 163
 - high mass, 98, 99, 101, 104, 113, 121, 124, 148, 151, 162
 - low mass, 92
 - mass, 105, 107, 108
 - mass-loss, 92, 95, 98, 100–103, 105–107, 127, 146, 148, 154, 156, 158, 159, 161–163, 371
 - wind, 92, 95, 101–103, 107, 113, 127, 148, 154, 158, 159, 162, 163, 165
 - ZAMS mass, 106, 146
- radio
 - absorption, 94, 146, 148, 149, 151, 154, 155, 157–159, 161, 190, 371
 - decline rate, 94, 102
 - distance, 146, 167
 - emission, 25, 27–30, 91–94, 99, 101, 102, 104–108, 127, 131, 145, 162, 163, 167, 171, 176, 185–187, 189–191, 219, 221, 227, 231, 236, 237, 245, 368, 372
 - evolution, 245
 - light curve, 100, 145, 146, 148, 150, 158, 159, 161–163, 245, 369
 - luminosity, 145, 146, 166, 245
 - non-detection, 147
 - spectral index, 25, 145, 146, 159
 - spectral luminosity, 166, 368
 - standard candle, 146, 166
 - rate, 37–44, 113, 205
 - records
 - Astronomiae Instaurate Progymnas-mata, 11
 - Chungbo Munhon Pigo, 9
 - De Stella Nova in Pede Serpentarii, 9
 - Hou Hanshu, 15
 - Jinshu, 14, 18
 - Ming Shenzong Shilu, 8, 10
 - Ming Shigao, 10
 - Mingshi, 8, 10

- Songshu, 14
- Sonjo Sillok, 9, 17
- Wenxian Tongkao, 12
- Yifeng Xianzhi, 10
- searches, 37–44, 86
- shock, 29, 78, 79, 81, 82, 92, 121, 125, 146, 172, 174, 176, 178–180, 182, 183, 187, 228, 238, 245, 247, 257
- adiabatic, 179
- breakout, 81, 82, 94, 114, 134, 182, 185
- circumstellar, 29, 92, 94, 96, 98, 100–102, 107, 108, 146, 148–151, 156, 159, 162, 163, 174–181, 183, 219, 220, 222, 228, 232–234, 236, 237, 369, 371
- deceleration, 146, 164
- relativistic, 369
- reverse, 29, 91–94, 96, 98–101, 105, 107, 108, 174–181, 183, 184, 192, 220, 229, 230, 234, 236, 238
- speed, 146, 159, 174–176, 179, 180, 190–192, 234, 371, 372
- spectrum, 119, 260
- 1.04 MeV, 96
- 1.24 MeV, 96
- 1.26 μm , 225
- 1.76 MeV, 96
- 1.89 keV, 105
- 10.2 μm , 225
- 122 keV, 96
- 136 keV, 96
- 14 keV, 96
- 2.02 MeV, 96
- 2.60 MeV, 96
- 3.25 MeV, 96
- 511 keV, 96
- 6.7 keV, 100
- 847 keV, 96
- λ 6300, 223
- λ 10250, 122
- λ 10830, 25, 122, 253
- λ 1240, 125
- λ 1470, 114
- λ 1486, 125
- λ 1550, 114, 125
- λ 1665, 114
- λ 1750, 114, 125
- λ 1909, 114, 125
- λ 2324, 126
- λ 2325, 126
- λ 2470, 126
- λ 2796, 126
- λ 2800, 118, 125
- λ 2803, 126
- λ 3060, 118
- λ 3726, 126
- λ 3729, 126
- λ 3969, 126
- λ 4068, 125, 126
- λ 4072, 125, 126
- λ 4363, 126
- λ 4571, 256
- λ 4959, 126
- λ 5007, 126
- λ 5876, 27
- λ 6150, 117, 121
- λ 6300, 125
- λ 6347, 117
- λ 6355, 117, 244
- λ 6364, 125
- λ 6371, 117
- λ 6548, 127, 232, 233
- λ 6583, 127
- λ 6584, 232, 233
- λ 6678, 27
- λ 6716, 125, 127
- λ 6717, 233
- λ 6731, 125, 127, 233
- λ 7065, 27
- λ 7155, 125, 126
- λ 7293, 225
- λ 7319, 125
- λ 7324, 225
- λ 7330, 125
- λ 7773, 119
- λ 6300, 224
- λ 6364, 224
- ^{56}Co , 25, 238
- ^{56}Ni , 25, 121
- [AX], 29
- [Ca II], 225
- [Co III], 58
- [Co I], 225
- [Fe III], 23, 58
- [Fe II], 23, 58, 125, 126, 225
- [Fe VII], 29
- [Fe X], 29
- [N II], 127, 159, 232, 233
- [Ne III], 126
- [O III], 126

- [O II], 125, 126
- [O I], 125, 126, 223, 224
- [S II], 125–127, 233
- absorption, 49, 50, 52, 103
- Balmer lines, 29, 124, 130, 183
- C I, 122
- C II], 126
- C III], 114, 125
- C IV, 114, 125, 134
- Ca II, 58, 114, 251, 256
- Ca II, 60
- CO, 223, 225
- Co, 119, 223
- Co II, 119
- Fe, 23, 223
- Fe I, 118
- Fe II, 31, 49, 58, 60, 61, 104, 118, 119, 121, 183, 252, 256
- Fe III, 31, 58, 257
- Fe-L, 236
- H, 23, 25–27
- H α , 25, 28, 29, 67, 94, 125, 126, 159, 183, 184, 187, 229, 231, 233, 236–238
- He, 25
- He I, 22, 25, 27, 29, 31, 60, 61, 63, 65–67, 121, 122, 244, 253
- infrared, 86, 224
- ionization ratio, 51, 52
- line blanketing, 49, 119, 257
- line blending, 50
- line formation, 48
- line profiles, 47
- line scattering, 49, 55
- line velocity, 249
- line-photon interaction, 50
- Ly α , 229, 231, 236, 238
- Mg, 236
- Mg I, 256
- Mg II, 58, 118, 119, 121, 125–127, 134, 183
- Mg/Si ratio, 105
- multiple scattering, 50, 51
- N III], 114, 125
- N IV], 114, 125
- N V, 125
- N/C ratio, 125
- Na I, 29, 114, 252
- narrow lines, 81, 94, 100
- Ne, 236
- Ne/Si ratio, 105
- nebular lines, 25
- Ni, 119, 223
- O, 236
- O I, 58, 119, 251, 256
- O II, 256
- O III], 114
- O/Si ratio, 105
- opacity, 48, 49
- optical depth, 48, 50
- oscillator strength, 48
- P Cygni lines, 21, 28, 31, 49, 50, 53–55, 66, 114, 119, 121, 124, 130, 134, 253
- photon branching, 52
- polarization, 55, 56
- rate equations, 51, 52
- Rayleigh scattering, 67
- resonance scattering, 48, 50, 52, 54
- S II, 58
- Si, 236
- Si I, 122
- Si II, 25, 58, 59, 117, 244, 252
- Si III, 31
- SiO, 223
- spectropolarimetry, 56, 57
- stimulated emission, 48
- Ti II, 58, 59
- submillimeter
 - emission, 221
 - synchrotron
 - cooling, 187, 189, 190
 - emission, 146, 186, 244, 245
 - self-absorption, 148, 150, 186, 190, 191, 371
 - taxonomy, 1–3, 21, 31
 - thermonuclear, 23, 78, 85–87, 173, 197, 245
 - type
 - plateau, 79, 80, 85
 - SNIa, 10, 22, 25, 91, 121, 124, 140, 141, 197, 373
 - SNIa, 21–25, 27, 30, 31, 37, 40–44, 47, 52, 54–56, 58–60, 62, 70, 77–79, 82–87, 91, 92, 96, 108, 113–115, 117–122, 139–141, 145, 173, 174, 195–199, 203–213, 244, 245, 247, 265, 308, 368, 373
 - SNIb, 21–23, 25–27, 30, 43, 47, 52, 54, 60–64, 92, 121, 130, 131, 145, 150,

- 152, 174, 244, 264, 265, 278, 292, 368, 373, 421
- SNIb/c, 22, 25–27, 30, 31, 37, 40–43, 77, 79, 81, 92, 94, 107, 108, 114, 115, 121, 122, 124, 141, 145, 146, 156, 157, 166, 191, 197, 243, 245, 260, 265, 286, 292, 293, 367–369, 371, 373, 388
- SNIc, 22, 23, 25, 30, 31, 43, 47, 52, 54, 56, 62–66, 92, 93, 102, 106, 107, 121, 122, 145, 150, 152, 174, 197, 243, 244, 246–248, 252, 253, 255, 256, 262–265, 267, 270, 271, 276–278, 292, 294, 330, 368, 373, 421
- SNII, 10, 22, 23, 25–29, 37, 40–43, 47, 54, 65, 67, 77, 79, 91–94, 107, 108, 113–115, 124, 125, 127, 130, 131, 140, 141, 145, 146, 150, 153, 156–159, 161, 162, 166, 172, 173, 191, 195–197, 202, 204, 244, 245, 271, 274, 369, 373, 421
- SNIIf, 21, 27, 67, 68, 92, 106, 130, 160, 373
- SNIId, 28, 29
- SNIIL, 27, 28, 65, 92, 94, 100, 106, 124, 126, 191, 271
- SNIIn, 21, 27, 29, 31, 42, 68–70, 92, 94, 105, 106, 108, 127, 150, 161, 176, 180, 182, 185, 191, 262, 271, 273, 278, 368, 373
- SNIIP, 27, 28, 56, 65–67, 92, 105, 106, 124, 127, 179, 192, 196, 271, 274
- SNIIfpec, 373
- Zwicky, 22, 373
- Zwicky III, 22
- Zwicky IV, 22
- Zwicky V, 22, 31
- ultraviolet, 148, 154
- absorption, 114, 118
- C III–IV, 183
- decline rate, 118, 125
- emission, 28, 106, 114, 115, 119, 121, 122, 131, 171, 179, 182, 183, 221
- evolution, 127
- light curve, 83, 114, 115, 119
- N III–V, 182, 183
- O III–VI, 183
- opacity, 125
- spectroscopy, 114
- spectrum, 66, 68, 120, 121, 133, 234, 237
- X-ray, 93, 94, 148
- absorption, 101, 102, 104, 107, 108
- decline rate, 94, 99–102, 105
- emission, 234
- emission, 27, 29, 91–109, 158, 162, 171, 179, 180, 182–184, 219–222, 227, 228, 230, 231, 234, 236, 237
- light curve, 96, 98, 100, 102, 105, 245
- luminosity, 92, 95, 98, 100–103
- spectrum, 98, 99, 101, 104, 108
- supernova remnant
 - individual
 - 3C10, 11
 - 3C58, 12
 - Cas A, 8, 220
 - Crab Nebula, 12, 94, 221, 321, 432
 - CTB80, 17
 - IC443, 18
 - MSH14 – 415, 14
 - PKS1459 – 51, 14
 - SN1006, 410
 - SNR11.2 – 0.3, 15
 - SNR120.1 + 2.1, 11
 - SNR130.7 + 3.1, 12
 - SNR189.1 + 3.0, 18
 - SNR315.4 – 2.3, 15
 - SNR327.4 + 14.6, 14
 - SNR4.5 + 6.8, 10
 - SNR41.9 + 58, 176
 - SNR69.0 + 2.7, 17
 - SNR1987A, 219, 234, 236–238
 - plerionic, 12, 82, 94
- supernova, 335, 440
- synchrotron self-absorption, *see* supernova, synchrotron, self-absorption
- SYNOW, *see* supernova, model, SYNOW
- synthetic spectrum, *see* supernova, model, synthetic spectra
- VLBI, *see* instruments, agencies, observatories, and programs, VLBI
- Weibel instability, 403