

Name index

- Abbe, Cleveland, 232
 Abbot, Charles Greeley (1872–1973), 271, 273
 Abell, George, 205, 244, 253
 Abney, William, 168
 Abt, Helmut (b 1925), 168, 319, 320
 Abū Jafar, *see* Al Mansūr
 Abū Mahmūd al-Khujandī, 7
 Acuña, Mario (1940–2009), 120
 Adams, John Couch (1819–1892), 36, 87, 134, 154
 Adams, Walter S. (1876–1956), 80, 101, 165, 166, 168, 176, 194, 196, 219, 226, 230, 250, 276, 310, 331, 332, 347
 Adel, Arthur, 112
 Airy, George Biddell (1801–1892), 315
 Akiyama, Mitsuo, 325
 Al Mansūr (c. 711–775), 22
 Al-Battānī (or Albategnius) (c. 855–929), 6, 22
 Al-Bīrūnī, 22
 Albrecht, Sebastian (1876–1960), 207
 Aldrich, Lloyd, 273
 Aldrin, Edwin (Buzz), 408
 Alexander the Great (356–323 BC), 4, 10, 18
 al-Fazārī, 6, 21
 Alfonso The Wise, King of Castile, (1221–1284), 14
 Alhazen, *see* Ibn al-Haytham
 Al-Khwārizmī (780–850), 8, 21
 Aller, Lawrence, 205
 al-Ma'mūn, 22, 23
 Alpher, Ralph A. (1921–2007), 174, 242, 243
 al-Shātīr, *see* Ibn al-Shātīr
 al-Sūfī, Abd al-Rahman (903–986), 22, 268
 Altobelli, Ilario (1560–1637), 212
 Alvarez, Luis Walter (1911–1988), 142
 Alvarez, Walter, 142
 Ambartsumian, Viktor A. (1908–1996), 196, 306
 Anaxagoras (c. 500–428 BC), 17, 245
 Anaximander (c. 610–545 BC), 17
 Anderson, Carl, 239–240
 Anderson, John A. (1876–1959), 264, 278, 332
 Anderson, Thomas D., 191, 192
 Andrew, Brian, 235
 Angel, Roger, 195, 236, 294, 321, 333, 334
 Ångström, Anders J. (1814–1874), 277
 Anthelme (c. 1618–1683), 191
 Antoniadi, Eugène M. (1870–1944), 98, 105, 192, 338
 Antonucci, Robert, 233, 237
 Apian, Peter (or Apianus) (1495–1552), 147
 Apollonius of Myndus, 143
 Apollonius of Perga (c. 265–190 BC), 6, 67
 Apt, Jerome, 135
 Aquilar, Felix, 300
 Aquinas, Thomas (1225–1274), 14, 15, 249
 Arago, Dominique François Jean (1786–1853), 97, 337
 Argelander, Friedrich Wilhelm A. (1799–1875), 178, 187, 268, 269
 Aristarchus of Samos (c. 310–230 BC), 18, 91
 Aristillus (fl c. 280 BC), 176
 Aristotle (384–322 BC), 4, 29, 30, 67, 79, 86, 91, 143, 150, 212, 241, 245, 249
 Armstrong, Neil A., 408
 Armus, L., 252
 Arnett, David, 174
 Arp, Halton C. (b 1927), 234, 237, 251
 Arrhenius, Svante Augustus (1859–1927), 147, 250
 Aryabhata (476–550 AD), 21
 Atteia, Jean-Luc, 211
 Attridge, Joanne, 168
 Atwood, William, 465
 Auger, Pierre, 240, 338
 Augustine of Hippo, Saint (354–430), 14, 249
 Aumann, H. H., 52
 Auwers, Georg F. J. Arthur (1838–1915), 178, 185, 218
 Auzout, Adrien, 337
 Azarquiel, *see* Ibn al-Zarqāllu
 Baade, Walter (1893–1960), 44, 57, 141, 165, 167, 202, 204, 206, 208, 213, 216, 217, 227, 232, 236, 237, 239, 242, 251, 256, 312, 313, 332, 357
 Babcock, Harold D. (1882–1968), 81, 332
 Babcock, Horace W. (1912–2003), 81, 167, 168, 261, 310, 332
 Babinet, Jacques, 76, 277
 Backer, Donald C., 206
 Backlund, Jöns Oskar (1846–1916), 342
 Bacon, Francis (1561–1626), 88, 249
 Bacon, Roger (c. 1220–1292), 15, 296
 Bahcall, John, 333–334
 Bailey, Solon I. (1854–1931), 207, 208, 269
 Baillaud, Benjamin (1848–1934), 338
 Baillaud, Jules, 338
 Baldwin, John M., 217, 237, 358
 Baldwin, Ralph, 92, 106
 Balick, Bruce, 227, 299
 Ballard, Robert, 89
 Balmer, Johann J. (1825–1898), 276–277
 Bame, Samuel J., 84
 Bannan, Thomas J., 329
 Barnard, Edward Emerson (1857–1923), 106, 115, 123, 134, 192, 229, 231, 324
 Barrett, A. H., 230
 Barringer, Daniel, 152
 Bartels, Julius (1899–1964), 80
 Barthel, Peter, 237

488 Name index

- Basri, Gibor, 167, 190
 Bath, Geoffrey, 194
 Baumgardner, Jeffrey, 94, 99
 Beals, Carlyle S. (1899–1979), 197, 199, 230
 Becker, Tammy, 136
 Becklin, Eric (b 1940), 52
 Becquerel, Alexandre-Edmond (1820–1891), 275
 Becquerel, Henri, 239
 Beer, Wilhelm (1797–1850), 91, 104–105
 Bell Burnell, Jocelyn (b 1943), 205, 358
 Belopol'skii, Aristarkh A. (1854–1934), 186, 199, 207, 340
 Belton, Michael J. S., 134, 158
 ben Mahir, Jacob, 7
 Bender, Ralph, 239
 Benedict, Harry, 328
 Benfer, Robert, 27
 Benzenberg, Johann Friedrich (1777–1846), 153
 Berg, Richard, 194
 Berkner, Lloyd V., 378
 Berkowski, M., 265
 Berman, Louis (b 1903), 200
 Bernal, John D., 87
 Bernard, A., 146
 Bernoulli, Johann, 303
 Berossus (fl c. 290 BC), 8
 Berthelot, Marcellin, 250
 Bessarion, Johannes (Cardinal) (1403–1472), 15
 Bessel, Friedrich Wilhelm (1784–1846), 91, 145, 166, 178, 185
 Bethe, Hans A. (1906–2005), 79, 173
 Bevis, John (1695–1771), 215
 Bhabha, Homi, 240
 Bhaskara I (c. 600–680 AD), 21
 Bickerton, Alexander W., 76
 Bieberstein, C. W. von, 92
 Bieberstein, E. F. L. M. von, 92
 Biermann, Ludwig F. (1907–1986), 40, 46, 83, 147
 Bigg, Keith, 120
 Bignami, Giovanni, 234
 Billings, John, 331
 Binzel, Richard, 141
 Biot, Jean-Baptiste, 152
 Birch, Francis, 87
 Birkeland, Kristian, 83
 Birmingham, John, 191
 Blackett, Patrick M. S. (1897–1974), 240, 359, 388, 389
 Blaeu, William, 199
 Blamont, Jacques, 443
 Blanco, Victor, 236, 323
 Blythe, John, 358
 Bode, Johann Elert (1747–1826), 129, 139, 178, 303
 Boeddicker, Otto, 273
 Boffat of Toulouse, 297
 Bogard, Donald, 153
 Bohlin, Karl P. T. (1860–1939), 228
 Bohr, Niels H. D. (1885–1962), 165, 277
 Bok, Bart J. (1906–1983), 183, 321
 Boldt, Elihu, 253
 Boley, Forrest, 188
 Bolton, John G. (1922–1993), 236, 237, 356
 Bolton, Thomas, 188
 Boltzmann, Ludwig, 273
 Bond, George Phillips (1825–1865), 122, 125, 238, 265–266, 267, 297, 316–317
 Bond, William Cranch (1789–1859), 122, 125, 316
 Bondi, Hermann (1919–2005), 242
 Bontemps, George, 297
 Bookbinder, Jay, 198
 Borodzich, E. V., 362
 Borra, Ermanno, 308
 Boss, Benjamin, 226
 Boss, Lewis (1846–1912), 225
 Bothe, Walther, 239, 240
 Bouchet, P., 214
 Bouguer, Pierre (1698–1758), 268
 Boulliau, Ismaël (1605–1694), 210
 Bourne, William, 288, 296
 Bouvard, Alexis (1767–1843), 133
 Bowen, Edward G. (Taffy), 353, 375
 Bowen, Ira S. (1898–1973), 169, 205, 276, 310, 320
 Bowyer, C. Stuart, 188, 203, 234, 236, 463
 Boyden, Uriah A., 317
 Boyer, Charles (1911–1989), 101
 Boyle, Willard S., 262
 Bradley, Charles, 189
 Bradley, Francis, 145
 Bradley, James (1692–1762), 86, 166, 178, 315
 Bradt, Hale, 236
 Bradt, Helmut, 240
 Bradwardine, Thomas (c. 1290–1349), 15
 Braes, Luc, 188
 Brahe, *see* Tycho Brahe
 Brahmagupta (598–668), 21
 Brandes, Heinrich Wilhelm (1777–1834), 153
 Braun, F. W., 275
 Braun, von, *see* von Braun
 Bredikhin, Fëdor Alexandrovich (1831–1904), 340
 Breger, Michel, 209
 Bridge, Herbert S. (b 1919), 121
 Brisbane, Thomas M., 301
 Broadfoot, A. L., 121
 Brock, Thomas, 89
 Brophy, Thomas, 25
 Brown, Ernest William (1866–1938), 88
 Brown, Fay, 270
 Brown, Michael E. (b 1965), 159
 Brown, Robert L., 227
 Brown, Timothy, 263
 Bruce, Catherine W., 317
 Brunhes, Bernard (1867–1910), 89
 Bruno, Giordano (1548–1600), 15, 245
 Buck, Peter, 27
 Buffon, Comte de (or Leclerc, Georges-Louis) (1707–1788), 71, 113
 Bunner, A. N., 217
 Bunsen, Robert Wilhelm E. (1811–1899), 36, 275
 Burbidge, E. Margaret (b 1919), 174, 215, 233, 318
 Burbidge, Geoffrey R. (1925–2010), 174, 215, 233, 234, 318, 333
 Burchell, W. J., 198
 Burgay, Marta, 206
 Buridan, Jean (1300–1358), 15
 Burke, Bernard F. (b 1928), 120
 Burnham, Sherburne Wesley, 185, 196, 324
 Burnight, Robert, 414

- Bus, Schelte J. (Bobby), 158
 Bush, Vannevar, 335
 Butcher, Harvey, 278
 Butler, Paul, 160
 Byram, Edward T., 216, 217, 234, 237
- Caldwell, John, 123
 Callippus of Cyzicus (c. 370–300 BC), 18, 19
 Calvin, Melvin, 250
 Cameron, Alastair Graham W. (b 1925), 96, 174, 202
 Camichel, Henri, 101
 Campbell, William Wallace (1862–1938), 101, 105, 200, 226, 324
 Cannon, Annie Jump (1863–1941), 170, 176, 199, 213, 317
 Canup, Robin, 157
 Capella, Martianus of Carthage (c. 365–440 AD), 17
 Carnegie, Andrew (1835–1919), 331
 Carpenter, Edwin, 198
 Carpenter, Geoff, 221
 Carpenter, Gordon, 326
 Carpenter, Roland, 101
 Carretta, Eugenio, 245
 Carrington, Richard Christopher (1826–1875), 79, 83, 145
 Carroll, Sean, 187
 Casares, Jorge, 221
 Cassegrain, Laurent, 289
 Cassini, Gian (or Giovanni) Domenico (or Jean Dominique) (1625–1712), 68, 100, 104, 115, 121, 125, 337
 Cavendish, Henry (1731–1810), 83, 113
 Celsius, Anders, 83, 268
 Chadwick, James, 202
 Chamberlin, Thomas C. (1843–1928), 76, 88
 Chandler, Seth Carlo (1846–1913), 86, 271
 Chandrasekhar, Subrahmanyan (1910–1995), 76, 183, 209, 219, 347, 460
 Chant, Clarence, 307
 Chapman, Sydney (1888–1970), 83, 84
 Charbonneau, David, 160
 Charles II, King of England (1630–1685), 314
 Charles, Philip A., 221
 Charlier, Carl (1862–1934), 271
 Charlois, Auguste Honoré P. (1864–1910), 140
 Chaucer, Geoffrey (c. 1343–1400), 7
 Chauvin, Gael, 160
 Chen, Herb, 391
 Chladni, Ernst Florenz F. (1756–1827), 69, 150, 152
 Chodas, Paul, 146
 Chree, Charles, 80
 Christensen-Dalsgaard, Jørgen, 263
 Christian IV, King of Denmark, 344
 Christiansen, Chris, 357, 367
 Christie, William Henry M. (1845–1922), 315
 Christy, James W. (b 1938), 156, 346
 Chubb, Talbot A., 216, 217, 237
 Ciardullo, Robin, 244
 Clairaut, Alexis Claude (1713–1765), 143
 Clark, Alvan (1804–1887), 185, 218, 298
 Clark, Alvan Graham (1832–1897), 185, 218, 298
 Clark, G. W., 53, 194
 Claus, George, 250
 Clay, Jacob, 240
 Clay, Landon T., 310
- Clayton, Donald, 174
 Clegg, John, 359
 Cloëz, Stanislas, 249
 Coblenz, William W. (1873–1962), 101, 105, 113, 273
 Cocconi, Guiseppe, 248
 Cocke, William J., 206
 Cohen, Charles, 157
 Cohen, Marshall, 235
 Colbert, Jean-Baptiste, 337
 Collins, Andy, 126
 Comella, John M., 206
 Common, Andrew Ainslie (1841–1903), 265–266, 291
 Compton, Arthur Holly, 240, 462
 Conklin, Edward K., 250
 Conner, J. P., 220
 Conti, Peter, 198
 Cook, Thomas, 298
 Cooke, Brin, 220
 Coolidge, Albert Sprague, 112
 Copeland, Ralf (1837–1905), 146
 Copernicus, Nicolaus (1473–1543), 15, 16, 29, 30, 68, 166, 212, 301
 Corliss, John, 89
 Couder, André, 294
 Covington, Arthur, 365
 Cowley, Anne P., 194, 196
 Cowling, Thomas (1906–1990), 173
 Cox, Allan, 89
 Crabtree, William, 99
 Crampton, David, 196
 Crawford, John, 186
 Critchfield, Charles (1910–1994), 79, 173
 Crookes, William, 272
 Crossley, Edward (1841–1905), 324
 Cruikshank, Dale P., 134, 135, 156, 157
 Curtis, Heber D. (1872–1942), 213, 231, 237, 255
 Curtiss, Ralph (1880–1929), 165
 Cyr, D. L., 106
 Czar Aleksander I, 339
 Czar Peter I, 339
- D'Agelet, Joseph, 191
 d'Arrest, Heinrich Louis (1822–1875), 134, 303
 d'Arturo, Guido Horn, 294
 Daguerre, Louis, 265
 Daly, Reginald, 96
 Damineli, A., 199
 Dana, James, 88
 Danjon, André, 338
 Dante (1265–1321), 15
 Danziger, I. J., 214
 Darwin, Charles Robert (1809–1882), 87, 427
 Darwin, George Howard (1845–1912), 95
 Das Gupta, Mrinal K. (b 1923), 217, 237
 Dauzère, Camille, 338
 Davelaar, Jaap, 222
 Davidson, George, 324
 Davidson, Kris, 199
 Davies, John, 154
 Davis, Donald, 96
 Davis, Leverett, 231
 Davis, Raymond (1914–2006), 82, 390

490 Name index

- Dawes, William Rutter (1799–1868), 125, 126
 de Beaumont, Elie, 88
 de Bournon, Jacques, 152
 de Chéseaux, Jean Philippe, 229
 de Fontenelle, Bernard le Bovier, 245
 de Freycinet, Charles, 139
 de Groot, Mart, 200
 De La Beche, Henry, 88
 De La Rue, Warren (1815–1889), 265, 285
 de Laverny, Patrick, 200
 de Montlivant, Sales Gyron, 250
 de Nansouty, Charles, 338
 de Rheita, Anton, 296
 de Sitter, Willem (1872–1934), 88, 242
 de St Pierre, Le Sieur, 314
 de Vaucouleurs, Gérard (1918–1995), 49, 101, 105, 244, 251, 253, 302
 De Vries, Hessel, 82
 Dee, John, 296
 Delannoy, J., 363
 Delaunay, Charles-Eugène (1816–1872), 87, 337
 Delisle, Joseph Nicholas (1688–1768), 100, 339
 della Porta, Giambattista, 296
 Dellinger, J. Howard (1886–1962), 84, 356
 Delporte, Eugene, 140, 141
 Delsemme, Armand (b 1918), 147
 Democritus (460–370 BC), 245
 Denisse, J. F., 363
 Denning, William Frederic (1848–1931), 98
 Descartes, René du Perron (1596–1650), 30, 241, 245, 249
 Deslandres, Henri Alexandre (1853–1948), 146, 275, 338
 Deubner, Franz-Ludwig, 263
 Deutsch, Armin J. (1918–1969), 214
 Dicke, Robert (1916–1997), 244
 Digges, Leonard, 296
 Digges, Thomas (c. 1546–1595), 16
 Dirac, Paul, 240
 Dixon, Robert, 248
 Dolland, John, 297
 Dolland, Peter, 297
 Dollfus, Audouin C. (b 1924), 98, 106, 123
 Dombrovsky, Viktor A., 216
 Donati, Giovanni Battista (1826–1873), 145, 276, 277
 Dörffel, Georg Samuel (1643–1688), 143
 dos Santos, Marques, 233
 Downs, G. S., 373
 Drake, Frank D., 120, 227, 248
 Drake, Stillman, 134
 Draper, Henry (1837–1882), 265, 277, 291
 Draper, John W. (1811–1882), 265, 277
 Dravskikh, A. F., 362
 Dravskikh, Z. V., 362
 Dressler, Alan, 253
 Du Bridge, Lee, 335
 du Pont, Irénée, 310
 Duffield, W. Geoffrey, 301–302
 Duhalde, Oscar, 213
 Duncan, John C., 215, 216
 Duncan, Robert, 203, 211
 Dunham, Edward, 51
 Dunham, Theodore (1897–1984), 101, 111, 276
 Dunlap, David, 307
 Dunthorne, Richard (1711–1775), 33
 Duthie, Joseph Graeme, 194
 Duvall, Thomas, 263
 Dyce, Rolf, 98, 366
 Dyson, Frank W. (1868–1939), 315–316
 Dziembowski, Wojciech, 263
 Eberly, Robert E., 329
 Eddington, Arthur Stanley (1882–1944), 44, 79, 165, 168, 171–172, 173, 207, 210, 219, 226, 241, 264
 Eddy, John A. (1931–2009), 82
 Edge, D. O., 217
 Edgeworth, Kenneth (1880–1972), 157
 Edison, Thomas A. (1847–1931), 356
 Edlén, Bengt (1906–1993), 80, 197
 Edmondson, Frank, 141
 Einstein, Albert (1879–1955), 97, 173, 188, 238, 242, 387
 Eisenhower, President Dwight D. (1890–1969), 413
 Elkin, W. L., 341
 Elliot, James, 51, 131
 Elster, J. P. L. Julius (1854–1920), 270
 Elvey, Christian T. (1899–1972), 168, 328
 Elvis, Martin, 221
 Emden, Robert (1862–1940), 207
 Encke, Johann Franz (1791–1865), 68, 98, 126, 134, 145, 303
 Ephorus of Cyme, 145
 Epicurus (341–270 BC), 245
 Eratosthenes of Cyrene (c. 276–195 BC), 6, 18
 Ericsson, John, 272
 Erman, George Adolf (1806–1877), 145
 Eudoxus of Cnidus (c. 400–350 BC), 11, 18
 Euler, Leonhard (1707–1783), 86, 246
 Evershed, John (1864–1956), 146
 Ewen, Harold I. (b 1922), 230
 Faber, Sandra (b 1944), 189
 Fabricius, David (1564–1617), 210
 Fabricius, Johann (1587–1616), 79
 Fahlman, Greg, 211
 Fath, Edward, 233
 Fayet, Gaston, 147
 Fechner, G. Theodore (1801–1887), 269
 Fehrenbach, Charles, 313
 Feibelman, Walter, 126
 Feil, Charles, 298
 Felten, James, 253
 Fermi, Enrico, 248, 465
 Fernandez, Julio A., 157
 Ferraro, Vincent, 83, 84
 Fisher, W. A., 196
 Fitch, W. S., 233
 Fitzgerald, George, 147
 Fizeau, Armand Hippolyte L. (1819–1896), 264, 265, 277
 Flammarion, Camille (1842–1925), 105, 192, 246
 Flamsteed, John (1646–1719), 31, 68, 98, 130, 143, 166, 218, 314–315
 Flandro, Gary, 401
 Fleming, Williamina P. S. (1857–1911), 175, 207, 213, 317
 Foerster, Wilhelm, 303–304
 Fontana, Francesco (c. 1580–1656), 99
 Forbush, Scott Ellsworth, 82
 Ford, Holland C. (b 1940), 54

- Ford, Kent, 244
 Foucault, Jean Bernard Léon (1819–1868), 265, 275, 277, 291
 Foukal, Peter V. (b 1945), 82
 Fountain, John W., 123
 Fournier, Georges (1881–1954), 105
 Fowler, Alfred (1868–1940), 79, 146
 Fowler, Ralph Howard (1889–1944), 165, 169, 219
 Fowler, William A. (1911–1995), 174, 215
 Foy, Renaud, 261
 Frail, Dale, 160, 211
 Franklin, Kenneth L. (1923–2007), 120
 Franks, William, 270
 Fraunhofer, Joseph von (1787–1826), 174, 275, 277, 297
 Frederick II, King of Denmark (1534–1588), 344
 Frederick II, King of Prussia (1712–1786), 303
 Frederick III, Elector of Brandenburg (1657–1713), 303
 Frederick William III, King of Prussia (1770–1840), 303
 Freedman, Wendy (b 1957), 245
 Freeman, John W., 84
 Freier, Pyllis, 240
 French, R. G., 130
 Fried, David, 261
 Friedman, Herbert (1916–2000), 80, 84, 203, 216, 217, 234, 237, 414
 Friedmann, Alexandr A. (1888–1925), 44, 242
 Fritsch, Johann, 187
 Fritz, Gilbert, 54, 216
 Frost, Edwin B. (1866–1935), 209, 347
 Fu An, 6
- Galama, Titus, 202
 Galbraith, Bill, 388
 Galileo Galilei (1564–1642), 29–30, 91, 115, 125, 134, 185, 212, 225, 245, 296
 Galle, Johann Gottfried (1812–1910), 134, 303
 Gallet, Jean Charles (1637–1713), 100
 Gamow, George (1904–1968), 174, 242
 Gan De, 12
 Gaposchkin, Sergei, 187
 Garcia-Munoz, 240
 Garrick-Bethell, Ian, 94
 Gault, Donald, 98
 Gauss, Carl (or Karl) Friedrich (1777–1855), 83, 139
 Gautier, Alfred (1793–1881), 83
 Gaviola, Ernesto, 300
 Gavriil, F. P., 212
 Gehrz, Robert, 199, 333
 Geitel, F. K. Hans (1855–1923), 270
 Geller, Margaret J., 253
 Gellibrand, Henry, 86
 Geng Shouchang, 6
 Genzel, Reinhard, 189
 George III, King of England (1738–1820), 129
 Gerstenkorn, Horst, 96
 Ghez, Andrea (b 1965), 189
 Ghezzi, Ivan, 27
 Giacconi, Riccardo (b 1931), 53, 201, 237, 256, 453, 460, 469, 482
 Gibbs, Josiah Willard (1839–1903), 154
 Gibson, Brad, 232
 Gibson, Everett Jr., 153
 Gilbert, Grove K., 92
 Gilbert, William (1540–1603), 83
- Gill, David (1843–1914), 266, 341, 342
 Gillett, Frederick C. (1937–2001), 52, 200, 335
 Gilvarry, J. J., 141
 Ginzburg, Vitaly, 361
 Giovannini, Gabriele, 369
 Gold, Thomas (1920–2004), 92, 205–206, 242
 Goldader, Jeffrey, 141
 Goldberg, Leo (1913–1987), 319
 Goldin, Daniel, 429
 Goldreich, Peter (b 1939), 126, 127, 205
 Goldstein, Richard M. (b 1927), 101
 Goodricke, John (1764–1786), 185, 186, 207
 Gordon, William, 352, 365
 Gore, John E. (1845–1910), 264
 Görlich, Paul, 270
 Gott, J. Richard, 244, 253
 Gough, Douglas, 263
 Gould, Benjamin Apthorp (1824–1896), 146, 300
 Graham Smith, F. (b 1923), 217, 237, 357
 Graham, George, 83, 315
 Green, Simon, 154
 Greenewalt, Crawford, 310
 Greenhill, L. J., 190
 Greenstein, Jesse L. (1909–2002), 231, 234
 Gregory, James (1638–1675), 100, 289
 Gregory, Philip, 211
 Gregory, Stephen A., 253
 Greisen, Kenneth, 388
 Griffiths, Richard E., 195, 221
 Grimaldi, Francesco Maria (1618–1663), 30
 Grindlay, Jonathan, 219, 236
 Grotrian, Walter (1890–1954), 80
 Grubb, Howard, 298
 Gruithuisen, Franz von P., 91, 92
 Gubbay, Jack, 235, 373
 Guinand, Henry, 297
 Guinand, Pierre L. (1748–1824), 297–298
 Gull, Stephen, 217
 Gully, Ludovic, 212
 Gunn, James E. (b 1938), 235, 238, 244
 Guo Shoujing, 6, 13
 Gursky, Herbert, 253
 Gutenberg, Beno (1889–1960), 87
 Guth, Alan (b 1947), 244
 Guthnick, Paul (1879–1947), 115, 209, 270, 304
 Guthrie, 100
 Gylden, Hugo, 226
- Hackman, Robert J., 92, 152
 Haddock, Fred, 380
 Hadley, John, 289
 Hagan, John, 380
 Hagenbach, Eduard, 277
 Hahn, Otto, 250
 Haldane, John, 249
 Hale, George Ellery (1868–1938), 63, 79, 80, 167, 264, 274–275, 286, 310, 331–332, 335, 346–347
 Hale, William, 331
 Haley, Floyd, 274
 Hall, Asaph (1829–1907), 105, 122
 Hall, Chester Moor, 297

492 Name index

- Hall, Donald, 334
 Hall, John, 231
 Hall, Maxwell, 135
 Hall, R. D., 236
 Halley, Edmond (1656–1742), 31–32, 86, 87, 100, 153, 178, 198, 228, 315
 Halzen, Francis, 391
 Hamilton Brown, Robert, 134–135, 136
 Hanbury Brown, Robert (b 1916), 217, 264, 359
 Hansen, Peter Andreas (1795–1874), 345
 Harang, Leiv, 83
 Hardie, Robert, 156
 Harding, Karl Ludwig (1765–1834), 97, 139
 Harkness, William (1837–1903), 80
 Härn, Richard, 183
 Harmanec, Petr, 187
 Harper, William, 346
 Harries, J., 220
 Harriot, Thomas (1560–1621), 79, 91, 296
 Harrison, George, 278
 Hart, John, 302
 Hartmann, Johannes F. (1865–1936), 230, 269
 Hartmann, William K., 92, 94, 96
 Hartwig, Carl Ernst A. (1851–1923), 212
 Hasselberg, Bernhard, 340
 Haswell, Carole, 189
 Hawking, Stephen, 188
 Hawkins, Gerald, 25
 Hayashi, Chushiro (1920–2010), 183
 Hayes, Sethanne, 134
 Hazard, Cyril, 217, 359, 360, 376
 Hearn, D. R., 194
 Heaviside, Oliver (1850–1925), 83
 Heckmann, Otto (1901–1983), 313
 Heesch, David, 379
 Heger, Mary, 230
 Heis, Eduard (1806–1877), 187
 Heise, John, 198, 219
 Heitler, Walter, 240
 Helin, Eleanor, 141
 Helmholtz, *see* von Helmholtz
 Hemmel, Heidi, 135
 Hencke, Karl Ludwig (1793–1866), 139
 Henderson, Thomas (1798–1844), 166
 Hennert, J. F., 129
 Henry, Paul Pierre (1848–1905), 266, 337
 Henry, Prosper Mathieu (1849–1903), 266, 267, 337
 Henyey, Louis G. (1910–1970), 183
 Heracleides of Pontus (c. 388–315 BC), 18
 Herbig, George H. (b 1920), 196
 Herbst, William, 168
 Herman, Robert (1914–1997), 242, 243
 Herodias, 13
 Herrick, Edward C. (1811–1862), 145
 Herring, Alike, 325
 Herschel, F. William (1738–1822), 33, 35, 39, 71, 76, 91, 100, 101, 104–105, 113, 121–122, 125, 128, 130, 139, 141, 145, 178, 185, 204, 225, 226, 228, 229, 246, 250, 251, 254, 268, 270, 272, 289, 290
 Herschel, John Frederick W. (1792–1871), 105, 178, 225, 228, 229, 231, 250, 251, 268, 270, 285, 289, 341
 Hertzprung, Ejnar (1873–1967), 166, 170, 181, 198, 208, 304
 Herzberg, Gerhard (1904–1999), 112
 Hess, Harry (1906–1969), 89
 Hess, Victor F. (1883–1964), 239
 Hevelius (or Hewelcke), Johannes (1611–1687), 91, 143, 191, 296
 Hewish, Antony (b 1924), 205, 358
 Hewitt, Jacqueline N., 238
 Hey, James Stanley (1909–2000), 236, 356
 Hicetas of Syracuse (fl 5th c. BC), 18
 Hickson, Paul, 308
 Hill, John, 278, 294
 Hillas, A. M., 389
 Hiltner, William Albert (b 1914), 231, 321, 322, 347
 Hind, John Russell (1823–1895), 146, 191, 194, 196
 Hinshaw, Gary, 245
 Hiorter, Olof, 83
 Hipparchus (c. 185–120 BC), 6, 11, 19, 20, 176, 178, 469
 Hippocrates of Chios, 143
 Hirayama, Kiyotsugu (1874–1943), 140
 Hjellming, Robert M., 188
 Hobby, Bill, 329
 Hodgson, Richard, 83
 Hoffleit, Ellen Dorrit (b 1907), 234
 Hogg, Helen Sawyer, 307
 Höglund, Bertil, 379
 Holden, Edward S. (1846–1914), 324
 Holmberg, Erik, 251
 Holmes, Arthur, 89, 241
 Holt, S. S., 54
 Holwarda, Phocylides (1618–1651), 210
 Hooke, Robert (1635–1703), 31, 91, 115, 297, 315
 Hooker, John D. (1837–1910), 331
 Hopkins, William, 86
 Horrocks (or Horrox), Jeremiah (1618–1641), 99
 Houck, James, 334
 Howard, Edward, 152
 Howard, William E., 98
 Hoyle, Fred (1915–2001), 25, 174, 215, 234, 242, 243, 250
 Huang, Su-Shu, 187
 Hubbard, Clyde, 157
 Hubbard, J.S., 146
 Hubble, Edwin Powell (1889–1953), 204, 213, 215, 229, 239, 242–243, 251, 255–256, 332, 347
 Huber, Martin, 197
 Huchra, John P. (b 1948), 252, 253
 Hudson, Hugh S. (b 1939), 263
 Huggins, Margaret (1848–1915), 191
 Huggins, William (1824–1910), 101, 145, 175, 191, 192, 204, 254, 265, 271, 273, 277
 Huguenin, Richard, 369
 Hulbert, Henry, 286
 Hulburt, Edward Olson, 84
 Hulse, Russell (b 1950), 206
 Humason, Milton La Salle (1891–1972), 198, 200, 213, 242
 Humphreys, Roberta, 199
 Hunger, Kurt, 197
 Hunten, Donald, 123–124
 Huntingdon, Hillard, 114
 Husband, Charles, 360
 Hussey, William J., 101, 331, 342
 Huygens, Christiaan (1629–1695), 30, 104, 241, 246, 289, 296–297, 337

- Huygens, Constantyn, 296
 Hvatum, Hein, 120
- Ibn al-Haytham (or Alhazen) (965–1039), 22
 Ibn al-Nadīm, 6
 Ibn al-Sarrāj, 6
 Ibn al-Shātīr (1304–1375), 8, 22
 Ibn al-Zarqāllu (or Azarquiel) (c. 1029–1087), 6, 14, 22
 Iglesias, C. A., 209
 Ihle, Abraham, 228
 Innes, Robert (1861–1933), 199
 Ioannisian, Bagrat, 305
 Isidore, Bishop of Seville (c. 560–636), 14
- Jackson, John, 341
 Jacob, William, 125
 Jacoby, George H., 244
 James, Hubert M., 112
 Jansky, Karl Guthe (1905–1950), 355
 Janssen, Pierre Jules C. (1824–1907), 101, 266, 275, 276, 337–338
 Jeans, James Hopwood (1877–1946), 76
 Jefferies, John, 326, 333
 Jeffreys, Harold (1892–1989), 87, 88, 92, 113
 Jelley, John, 388
 Jennison, Roger C. (b 1922), 217, 237
 Jernigan, J. Garrett, 201
 Jewitt, David (b 1958), 159, 326
 Johnson, Harold L. (1921–1980), 271–272, 274
 Johnson, Hollis, 169
 Johnson, Joseph, 213
 Johnson, Lyndon B., 395, 408
 Johnson, Manuel, 269
 Johnson, Mike, 283
 Johnson, Pratt, 153
 Johnson, Thomas, 84
 Johnson, Warren, 322
 Johnson, William, 213
 Joliot-Curie, Irène, 318
 Joy, Alfred H. (1882–1973), 168, 194, 196, 198, 200, 226, 231
 Jurgens, Ray, 101
- Kalachev, P. D., 361
 Kalas, Paul, 160
 Kaluzienski, Lou, 220
 Kamiński, Michael (1880–1973), 145
 Kamper, Karl W., 217
 Kane, Alex, 299
 Kankah, 21
 Kant, Immanuel (1724–1804), 71, 104, 225, 246, 254
 Kaplan, Lewis D., 106
 Kapteyn, Jacobus C. (1851–1922), 192, 200, 225, 226, 227, 231, 266, 342
 Kardashev, Nicolai S., 248, 362
 Kaspi, Victoria M., 212
 Keeler, James Edward (1857–1900), 126, 197, 199, 254, 278, 324
 Kellogg, Edwin, 237, 253
 Kelvin (Lord), (or William Thomson) (1824–1907), 86–87, 241, 250
 Kempf, Paul F. (1856–1920), 187, 226, 268, 269, 270
 Kendall, James M. (1899–1986), 274
 Kennedy, President John F. (1917–1963), 396, 408
 Kennelly, Arthur (1861–1939), 83
- Kepler (or Keppler), Johannes (1571–1630), 15, 29, 30, 99, 139, 143, 147, 245, 296
 Kerr, Frank J., 227
 Kerr, Roy A., 188
 Khachikian, Edward, 233
 Khālid al-Marwarrūdhī, 23
 Khaykin, S. E., 361, 362
 Kienle, Hans, 319
 Kiess, Carl C. (1887–1967), 112, 207
 Kincaid, Sidney, 270
 King, A. R., 196
 King, Arthur, 332
 King, Ivan R., 239
 Kinney, W. L., 331
 Kirch, Gottfried (1639–1710), 228, 303
 Kirch, Maria Margarethe, 228
 Kirchhoff, Gustav Robert (1824–1887), 36, 79, 275–276, 304
 Kirkwood, Daniel (1814–1895), 98, 126, 139, 146, 154
 Kirshner, Robert P., 213, 253
 Klebesadel, Ray, 483
 Klinkerfues, E. F. Wilhelm (1827–1884), 192
 Kohlschütter, Arnold (1883–1969), 166, 176, 332
 Kolhörster, Werner, 239, 240
 Komesaroff, Max, 120
 Korff, Serge, 84
 Kormendy, John, 189
 Kothari, Daulat S. (1906–1993), 114
 Kouveliotou, Chryssa, 211
 Kowal, Charles T., 134, 157
 Kraan-Korteweg, Renée C., 253
 Kraft, Robert P. (b 1927), 194, 195, 327
 Kraus, John, 248, 374
 Kraushaar, William L., 256
 Kreutz, Heinrich Carl F. (1854–1907), 146
 Krieger, Allen S., 81
 Kron, Gerald E. (b 1913), 270
 Krzeminski, Wojciech (b 1933), 193, 206
 Kuiper, Gerard P. (1905–1973), 76–77, 94, 106, 112, 123, 130, 134, 141, 148, 157, 169, 182, 187, 219, 322, 325, 330, 347
 Kulkarni, Shrinivas R., 211
 Kumar, Shiv, 190
 Kunkel, William, 236
 Küstner, Karl Friedrich (1856–1936), 36
 Kuz'min, A. D., 362
 Kuz'min, Vadim, 388
 Kwal-luk, 23
- Labeyrie, Antoine, 261, 264, 283
 Lacaille, Nicholas-Louis de (1713–1762), 198, 199
 Lacy, John H., 189
 Lagadha, 21
 Lagrange, Joseph Louis de (1736–1813), 140
 Lalande, Joseph Jérôme le François de (1732–1807), 129, 134
 Lalande, Michel de, 134
 Lallemand, André, 270
 Lamansky, Sergei, 273
 Lamb, D. Q., 195
 Lambert, Johann Heinrich (1728–1777), 139, 185
 Lamont, R. P., 342
 Lampland, Carl Otto (1873–1951), 101, 105, 113
 Landauer, Fred, 262

494 Name index

- Langley, Samuel P. (1834–1906), 272, 273
 Laplace, Pierre Simon, Marquis de (1749–1827), 33, 34, 36, 69, 71, 76, 125, 145, 188, 192
 Laques, P., 123
 Large, Michael, 206
 Larson, Richard, 252
 Larson, Stephen, 123, 134
 Lassell, William (1799–1880), 39, 122, 125, 126, 130, 134, 290–291
 Lauer, Tod, 189, 239
 Laurikainen, Eija, 252
 Laval, Honoré, 27
 Le Monnier, Pierre Charles (1715–1799), 130
 Le Sueur, Albert, 199
 Le Verrier (or Leverrier), Urbain Jean Joseph (1811–1877), 97, 134, 154, 156, 337
 Lean, Judith, 82
 Learned, John, 391
 Leavitt, Henrietta Swan (1868–1921), 44, 166, 207, 269, 317
 Lebedev, Peëtr (1866–1912), 273
 Lebovitz, Norman, 209
 Lecacheux, Jean, 123
 Ledoux, Paul, 209
 Legesse, Asmerom, 28
 Lehmann, Inge, 87
 Leibnitz, Gottfried Wilhelm (1646–1716), 303
 Leighton, Robert B. (1919–1997), 263, 274, 286
 Lemaitre, Georges E. (1894–1966), 44, 242
 Lennon, Alice P., 329
 Lennon, Fred A., 329
 Lépine, J. R. D., 233
 Lescarbault, Edmond Modeste (1814–1894), 97
 Leucippus (fl c. 450 BC), 245
 Leuschner, Armin O. (1868–1953), 156
 Levi ben Gerson, Rabbi, 7
 Lewin, Walter H. G., 219, 220
 Lexell, Anders Johan (1740–1784), 128–129, 143
 Liais, Emmanuel (1826–1900), 105
 Libbrecht, Kenneth G., 263
 Lick, James (1796–1876), 324
 Lin, Chia-Chiao, 227
 Lin, Douglas, 232
 Lindblad, Bertil (1895–1965), 226, 227
 Lindsay, John, 430
 Linsley, John, 240
 Lipperhey or Lippershey, Hans, 296
 Little, Alec, 357
 Littleton, Raymond, 157
 Lo, Kwok-Yung, 189
 Lockyer, J. Norman (1836–1920), 25, 179, 186, 200, 276
 Loewy, Maurice, 337
 Lomonosov, Mikhail Vasilievitch (1711–1765), 100
 Loreta, Eppe, 200
 Lovelace, Richard, 366
 Lovell, A. C. Bernard (b 1913), 198, 359–360
 Lovell, James, 409
 Low, Frank James (1933–2009), 274, 330, 334
 Lowell, Percival (1855–1916), 98, 105, 130, 156
 Loxia Hong, 13
 Lubliner, Jacob, 327
 Lucretius (95–55 BC), 241
 Lucy, Leon, 187
 Ludendorff, F. W. Hans (1873–1941), 187, 200
 Lundmark, Knut (1889–1958), 215, 251
 Luu, Jane (b 1963), 159, 326
 Luyten, Willem Jacob (1899–1994), 198, 219
 Lynch, B. M., 28
 Lynds, Roger, 238
 Lyot, Bernard (1897–1952), 92, 98, 101, 338
 Maclear, Thomas, 341
 MacLeod, John, 235
 Mädler, Johann Heinrich von (1794–1874), 91, 104–105, 218
 Madras, Claudine, 141
 Magellan, Ferdinand, 231
 Mahler, Franz Joseph, 297
 Maksutov, Dmitri D. (1896–1964), 294, 305
 Mal'tsov, N. S., 311, 340
 Malin, David, 237
 Malville, J. McKim, 25
 Mantois, E., 298
 Maraldi, Giacomo Filippo (1665–1729), 104, 115
 Maraschi, L., 201
 Marchis, Franck, 142
 Marconi, Guglielmo (1874–1937), 83
 Marcy, Geoffrey W. (b 1954), 160, 190
 Marius, Simon (1573–1624), 238, 296
 Markarian, Beniamin, 306
 Marsden, Brian G., 146, 159, 189
 Marshack, Alexander, 28
 Martin, Eduardo L., 190
 Martyn, David, 361
 Mascart, Jean, 308
 Maskelyne, Nevil (1732–1811), 128, 315
 Mason, Ronald, 89
 Mast, Terry, 327
 Mästlin (or Maestlin), Michael (1550–1631), 16, 143
 Mather, John C. (b 1946), 461
 Mathewson, Donald Seaforth, 232, 302
 Matthews, Drummond, 89
 Matthews, Thomas A. (b 1927), 234
 Maunder, Edward Walter (1851–1928), 80, 82, 199
 Maury, Antonia C. (1866–1952), 179, 197
 Maury, Matthew, 345
 Maxwell, James Clerk (1831–1879), 76, 125, 147
 Mayall, Nicholas U. (1906–1993), 216, 227, 320, 322
 Mayer, Cornell H., 101, 216
 Mayer, Julius R., 173
 Mayer, Johann Tobias (1723–1762), 33
 Mayor, Michel (b 1942), 160
 Mazets, E. P., 210–211
 McClean, Frank, 341
 McClintock, Jeffrey, 189
 McCrea, William Hunter (1904–1999), 43, 76, 165
 McCrosky, Richard, 141
 McDonald, W. J., 328
 McElroy, Neil, 395
 McHardy, Ian M., 235
 McIvor, Violet Locke, 328
 McKay, David, 153
 McKinnon, William, 157
 McLaughlin, Dean, 168
 McMath, Francis, 286

- McMath, Robert R., 278, 286, 319, 320
 Méchain, Pierre-François A. (1744–1804), 33, 128, 129
 Mecke, Reinhard, 111–112
 Meech, Karen J., 158
 Meekins, John F., 253
 Mehlen, T. G., 328
 Meinel, Aden B., 319–320, 330
 Mékarnia, Djamel, 200
 Mellish, John, 106
 Melloni, Macedonio, 272, 273
 Mendillo, Michael, 94
 Menzel, Donald Howard (1901–1976), 101, 105, 113, 130, 134, 165, 205, 273, 287
 Merkle, Fritz, 261
 Merrill, Paul W. (1887–1961), 174, 199, 332
 Merz, George, 297
 Messel, Harry, 367
 Messier, Charles (1730–1817), 143, 204, 215, 228, 238, 254
 Metius, Jacob, (or Adriaanzoon, Jacob), 296
 Meton of Athens (c. 460–400 BC), 19
 Meyer, Edgar, 270
 Mezger, P. G., 379
 Michell, John, 185, 188
 Michelson, Albert A. (1852–1931), 264
 Michelson, Peter, 465
 Mikesell, Alfred, 231
 Miles, B., 114
 Miley, George, 188
 Miller, Joseph S., 233, 237
 Miller, R. L., 88
 Miller, Stanley, 249
 Miller, William (1817–1870), 175, 191
 Millikan, Robert A. (1868–1953), 239–240
 Millis, Robert L., 131
 Millman, Peter, 154–155
 Mills, Bernard Y., 206, 236, 356–357, 359, 366–367
 Mills, Darius, 324
 Milne, E. Arthur (1896–1950), 165, 169
 Minkowski, Rudolph or Rudolf (1895–1976), 213, 217–218, 236, 237, 357, 359
 Minnaert, Marcel (1893–1970), 165
 Mittlefehldt, David, 153
 Miyoshi, Makoto (b 1962), 190
 Mohn, Henrik, 145
 Mohorovičić, Andrija (1857–1936), 87
 Molyneux, Samuel (1689–1728), 166
 Montanari, Geminiano (1632–1687), 185
 Moore, Charlotte E. (1898–1990), 165
 Moore, Jonas, 314–315
 Moore, Joseph H. (1878–1949), 130, 134
 Moore, Richard, 236
 Morabito, Linda A., 115
 Morgan, Thomas H., 94, 99
 Morgan, William W. (1906–1994), 53, 176, 227, 251, 271, 347
 Morris, William, 342
 Morrison, Philip, 248
 Mouchez, Ernest B. (1821–1892), 337
 Moulton, Forest R. (1872–1952), 76, 95, 115, 207
 Mueller, Steve, 157
 Muhleman, Duane, 99
 Muller, C. A., 363
 Müller, Karl Hermann Gustav (1851–1925), 98, 187, 268, 269, 270
 Müller, Johannes, *see* Regiomontanus
 Münch, Guido (b 1921), 106, 230
 Münch, Wilhelm, 271
 Munk, W. H., 88
 Murakami, Toshio, 211
 Murdin, Paul (b 1942), 188, 221
 Mutel, Robert L., 235
 Myers, George W., 186
 Nagy, Bartholomew, 250
 Nakai, Naomasa, 233
 Nakajima, Tadashi, 190
 Namiki, Noriyuki, 141
 Nangong Yue, 13
 Nasīr al-Dīn al-Tūsī (1201–1274), 22–23
 Nasmyth, James (1808–1890), 100, 290
 Nather, R. E., 195
 Neddermayer, Seth, 240
 Needham, John, 249
 Nelson, Jerry, 294, 326–327
 Ness, Norman F. (b 1933), 81, 120, 420
 Neugebauer, Gerry (b 1932), 52, 57, 199, 274
 Newcomb, Simon (1835–1909), 86, 88, 97, 345
 Newton, Hubert Anson (1830–1896), 38, 154
 Newton, Isaac (1642–1727), 30–31, 86, 113, 143, 167, 192, 241, 249, 289
 Ney, Ed, 199, 214
 Nicholas of Cusa (1401–1464), 15, 245
 Nichols, Ernest, 273
 Nicholson, Seth B. (1891–1963), 98, 273
 Nickel, Anna, 325
 Nicolai, Friedrich, 134
 Nolan, James, 95
 Novikov, Igor, 234
 O'Day, Marcus, 287
 Occhialini, Giuseppe, 240, 459
 Oertel, Goetz, 333
 Oke, J. Beverley (1928–2004), 213, 233, 235
 Olbers, Heinrich Wilhelm M. (1758–1840), 139, 152, 154, 229
 Oldham, Richard (1858–1936), 87
 Olmsted, Denison (1791–1859), 153
 Olson, Roy, 483
 Oort, Jan Henrick (1900–1992), 148, 216, 226–227, 230, 312, 355, 363–364
 Oparin, Alexander, 249
 Öpik, Ernst Julius (1893–1985), 106, 147, 173, 174, 183
 Oppenheimer, J. Robert (1904–1967), 188
 Oresme, Nicole (c. 1323–1382), 15
 Oriani, Barnaba (1752–1832), 129
 Osaki, Yoji, 187, 194, 209
 Osiander, Andreas (1498–1552), 16
 Oskanjan, Vasilije, 198
 Osterbrock, Donald (1924–2007), 173, 227
 Osthoff, Heinrich, 271
 Owen, Tobias, 157
 Pacholczyk, Andrzej G., 233, 234
 Pacini, Franco (b 1939), 205–206
 Paczyński, Bohdan, 197

496 Name index

- Page, Thornton (1913–1996), 43
 Pagel, Bernard, 199
 Pallas, Pyotr, 150
 Palmer, Henry, 359, 361
 Parameśvara, 7
 Parenago, Pavel, 183
 Parker, Eugene N. (b 1927), 81
 Parrot, Georg, 339
 Parsons, Lawrence (fourth Earl of Rosse) (1840–1908), 273
 Parsons, William (third Earl of Rosse) (1800–1867), 39, 254, 289–290, 294
 Pascu, Dan, 123
 Pasteur, Louis, 249
 Patterson, Claire, 241
 Patterson, Joseph, 195
 Pawsey, Joseph L. (1908–1962), 351, 356
 Payne (Payne-Gaposchkin), Cecilia H. (1900–1979), 165, 169, 182, 213
 Peale, Stanton J., 115
 Pearce, Joseph, 227
 Peary, Robert E. (1856–1920), 152
 Pease, Francis G. (1881–1938), 196, 264, 332, 335, 347
 Peebles, James (b 1935), 243
 Penzias, Arno A. (b 1933), 243
 Perez-Torres, Miguel, 369
 Perlmutter, Saul (b 1959), 244, 245
 Perrault, Claude, 337
 Perrin, Guy, 169
 Perrine, Charles D. (1868–1951), 192, 205, 300
 Peters, Bernard, 240
 Peters, Carl Friedrich W. (1844–1894), 154
 Peters, Christian (1806–1880), 185
 Petrosian, Vahè, 238
 Pettengill, Gordon, 98, 366
 Pettit, Edison, 98, 273
 Peurbach, Georg (1423–1461), 15
 Pfund, Herman, 273
 Phillips, R. B., 235
 Philolaus (c. 450–400 BC), 18
 Philoponus, John (or Joannes Grammaticus) of Alexandria, 6
 Piazzi, Giuseppe (1746–1826), 139, 166
 Pickering, Edward Charles (1846–1919), 43, 175, 176, 178, 179, 185, 186, 215, 268–270, 277, 317
 Pickering, William Hayward, 395
 Pickering, William Henry (1858–1938), 92, 105, 122, 156, 247, 317
 Pierce, Keith, 278, 286
 Pigafetta, Antonio, 231
 Pigott, Edward, 178, 200, 207
 Plamondon, Joseph A., 274
 Planck, Max K. E. L. (1858–1947), 271, 478
 Plaskett, John S. (1865–1941), 168, 227, 230, 307
 Plato (c. 427–347 BC), 18, 67, 245
 Plücker, Julius, 275
 Plutarch (46–120 AD), 245
 Pogson, Norman R. (1829–1891), 194, 269
 Pohle, Joseph, 246
 Pond, John, 315
 Pons, Jean Louis (1761–1831), 37
 Pontecorvo, Bruno (1913–1993), 82
 Pope, Alexander, 246
 Porco, Carolyn, 127
 Potter, Andrew E., 94, 99
 Pouillet, Claude-Servais, 272
 Powell, Cecil, 240
 Prager, Richard (1883–1945), 209
 Prentice, J. P. Manning, 193
 Price, Christopher, 195
 Priedhorsky, William C., 195, 220, 222
 Prince, C. Leeson, 98, 100
 Pringle, John, 153
 Pritchard, Charles (1808–1893), 266–267
 Proctor, Richard Anthony (1837–1888), 92, 246
 Ptolemy of Alexandria (c. 100–170 AD), 6, 19–20, 21, 22, 29, 178, 268, 270
 Puiseux, Pierre, 337
 Purcell, Edward M. (1912–1997), 230
 Pythagoras (c. 580–500 BC), 17
 Qi Meng, 13
 Queloz, Didier (b 1966), 160
 Quetelet, Lambert A. J. (1796–1874), 154
 Rabe, Eugene (1913–1974), 41
 Rabinowitz, David L., 158
 Radau, Jean Charles R. (1835–1911), 97
 Radhakrishnan, Venkataraman, 120
 Raff, Arthur (b 1917), 89
 Ramsay, William (1852–1916), 276
 Ramsey, William H. (1922–1965), 41, 114
 Ranyard, Arthur C., 105, 230
 Rappaport, Saul, 188, 194
 Rayet, Georges Antoine Pons (1839–1906), 197
 Rayleigh, Lord (John William Strutt) (1842–1919), 87
 Reber, Grote (1911–2002), 44, 355–356
 Rebolo, Rafael, 190
 Redi, Francesco, 249
 Rees, Martin (b 1942), 235
 Regiomontanus (1436–1476), 15
 Reichley, P. E., 373
 Reid, Paul B., 217
 Reifenstein, Edward C., 206
 Reinhold, Erasmus (1511–1553), 16
 Reinmuth, Karl (1892–1979), 141
 Reitsem, Harold, 134, 137
 Rense, William, 414
 Reynolds, John, 254, 302
 Riccioli, Giovanni Battista (1598–1671), 91, 185
 Richards, David, 206
 Richer, Jean (1630–1696), 68
 Richter, Hermann, 250
 Ridgway, Stephen, 169
 Rig, Jim, 326
 Ritchey, George W. (1864–1945), 192, 213, 291, 331–332, 346, 347
 Rittenhouse, David, 153
 Ritter, Arthur (1826–1908), 179, 207, 210
 Ritter, Johann, 272
 Robbins, L. H., 28
 Roberts, David, 238
 Roberts, Isaac, 238
 Roberts, James, 120
 Roberts, Morton, 197, 239
 Robertson, Douglas S., 373
 Robinson, Henry, 335

- Rocard, Yves, 362
 Roche, Edouard Albert (1820–1883), 126
 Roddier, François, 261
 Römer, Ole C. (1644–1710), 337
 Röntgen, Wilhelm, 478
 Rösch, Jean, 338
 Rose, Wickliffe, 335
 Rosenberg, Hans O. (1879–1940), 169, 270, 271
 Ross, F. E., 292
 Ross, John, 152
 Rosse, fourth Earl of, *see* Parsons, Lawrence
 Rosse, third Earl of, *see* Parsons, William
 Rossi, Bruno B. (1905–1993), 53, 240, 479
 Rossiter, Richard, 168
 Rousset, Gerard, 261
 Rowland, Henry A. (1848–1901), 277
 Rubin, Vera C. (b 1928), 244
 Ruderman, Malvin A., 206
 Ruggles, Clive, 27
 Rümker, Karl Ludwig C., 145
 Runcorn, Stanley (1922–1995), 88
 Russell, Henry Norris (1877–1957), 112, 165, 168, 170, 178, 181–182, 204, 207, 210, 218
 Russell, Henry, 301
 Rutherford, Lewis M. (1816–1892), 277, 297
 Rutllant, Federico, 322
 Ryle, Martin (1918–1984), 355, 357–358
- Saal, Alberto, 94
 Sabine, Edward (1788–1883), 83
 Safronov, Viktor S. (1917–1999), 77
 Sagan, Carl (1934–1996), 101, 248, 250
 Saha, Megh Nad (1894–1956), 165, 169, 197
 Sahade, Jorge, 168
 Salo, Heikki, 252
 Salpeter, Edwin E. (1924–2008), 174
 Sampson, Ralf, 271
 Sampson, Ralph A (1866–1939), 79
 Sandage, Allan R. (1926–2010), 183, 233, 234, 243, 244, 251
 Sanford, Roscoe, 196
 Sargent, Wallace L. W. (b 1935), 189, 233
 Sarmiento, Domingo, 300
 Saron, Jean Baptiste de (1730–1794), 128
 Savary, Felix (1797–1841), 185
 Schaeberle, John M. (1853–1924), 147, 185, 218, 324
 Scheiner, Christoph (1573–1650), 296
 Scheiner, Julius (1858–1913), 169, 178, 226, 271
 Schellbach, K. H., 304
 Schiaparelli, Giovanni Virginio (1835–1910), 98, 101, 105, 107, 145
 Schlesinger, Frank (1871–1943), 168, 178, 267
 Schmidt, Bernhard V. (1879–1935), 292, 327
 Schmidt, Brian (b 1967), 244, 245
 Schmidt, Johann F. Julius (1825–1884), 191
 Schmidt, Maarten (b 1929), 234
 Schmitt, Harrison, 409
 Schmitt, John, 235
 Scholz, Gerhard, 187
 Schönberg, Mario, 183
 Schönfeld, Eduard (1828–1891), 194
 Schreier, Ethan, 236
 Schröter, Johann Hieronymus (1745–1816), 91, 98, 100–101, 104
- Schultz, Peter H., 98
 Schultze, Max, 271
 Schuster, Arthur, 83
 Schwabe, Samuel Heinrich (1789–1875), 79
 Schwartz, Steven, 412
 Schwarzschild, Karl (1873–1916), 147, 171, 188, 207, 225, 226, 267, 269, 271, 304
 Schwarzschild, Martin (1912–1997), 183
 Scott Archer, Frederick, 265
 Scott, William, 301
 Seares, Frederick H. (1873–1964), 255, 269, 332
 Secchi, Angelo P. (1818–1878), 79, 98, 105, 175, 178, 200, 210, 230, 265, 270, 272, 277
 Sedgwick, W. F. 76, 96, *see* Thomas
 Seebeck, Thomas, 272
 Seidel, Ludwig, 268
 Seielstad, G. A., 235
 Sekanina, Zdenek, 146
 Seleucus of Seleucia (fl. 2nd c. BC), 18
 Seneca, Lucius Annaeus (c. 4 BC–65 AD), 145
 Setti, Giancarlo, 256
 Severus Sebokht of Syria, 6
 Seyfert, Carl K. (1911–1960), 233
 Shafter, Allen, 189
 Shajn, Alex, 120
 Shajn, Grigorij, 168, 311
 Shakeshaft, John, 358
 Shane, C. Donald, 325
 Shao, Cheng-Yuan, 141
 Shao, Michael, 283
 Shapley, Harlow (1885–1972), 166, 208–209, 228–229, 231, 232, 255–256, 317–318, 332
 Sharpless, Stewart, 227
 Shelton, Ian, 213
 Shepard, Alan B., Jr., 408
 Shi Shen, 12
 Shigeru, Kanda, 216
 Shklovskii, Iosif S. (1916–1985), 203, 205, 216, 233, 248, 361
 Shoemaker, Carolyn, 148
 Shoemaker, Eugene, 92, 141, 152
 Short, James, 289
 Showalter, Mark, 120, 127
 Shu, Frank (b 1943), 227
 Sill, Godfrey, 102
 Silva, Giovanni, 301
 Silvaggio, Peter, 135
 Simon, Norman, 209
 Singer, S. Fred, 83
 Skinner, Gerry, 221
 Slee, O. Bruce (b 1924), 236, 237, 356, 357
 Slettebak, Arne, 168
 Slipher, E. C., 342
 Slipher, Vesto Melvin (1875–1969), 101, 111, 112, 130, 215, 230, 233, 242, 254, 255, 276
 Smith, Bradford A., 123, 134, 160, 262
 Smith, George, 262
 Smith, Graham, *see* Graham Smith
 Smith, Harlan J., 209, 234, 328
 Smith, Lindsey, 197
 Smith, Myron, 209
 Smithson, Robert, 261

498 Name index

- Smoot, George F. (b 1945), 461
 Smyth, Charles Piazzi (1819–1900), 308
 Smyth, William, 270
 Snider-Pellegrini, Antonio, 88
 Snow, Helen, 347
 Soderblom, Lawrence, 136
 Solá, José Comas, 123, 247
 Sophie Charlotte, Electress of Brandenburg (1668–1705), 303
 Sorby, Henry C. (1826–1908), 152
 Sorochenko, R. L., 362
 Southworth, George C. (1890–1972), 80
 Spence, Edward, 346
 Spencer Jones, Harold (1890–1960), 193, 341
 Sphujidhvaja, 21
 Spinrad, Hyron, 49, 106
 Spitzer, Lyman (1914–1997), 76, 251, 470, 480
 Spörer, Gustav (1922–1995), 82, 304
 Staelin, David H., 206, 283
 Stagg, James, 80
 Stampfer, S., 269
 Stanley, Gordon J. (b 1922), 236, 237, 356, 357
 Starrfield, Sumner, 194
 Steavenson, William H., 342
 Stebbins, Joel (1878–1966), 167, 186, 239, 270
 Stefan, Joseph (1835–1893), 272
 Stein, J. Wayne (1871–1951), 200
 Steinheil, Karl August von (1801–1870), 268, 269, 291
 Stella, L., 200
 Stewart, Balfour, 83
 Stock, Jurgen, 322
 Stockman, Hervey S., 195, 236
 Stone, Edward James (1833–1897), 273, 341
 Stoney, George Johnstone (1826–1911), 105
 Störmer, Carl, 83
 Stoy, Richard, 341
 Stoyko, N., 88
 Strewinski, W., 313
 Strittmatter, Peter, 334
 Strom, Robert, 98
 Strömberg, Gustav B. (1882–1962), 226
 Strömberg, Bengt G. D. (1908–1987), 165, 170, 182, 187, 328
 Strömberg, Svante Elis (1870–1947), 147
 Strong, Ian, 483
 Strong, John D., 278, 291
 Struve, Friedrich Georg Wilhelm (1793–1864), 166, 229, 269, 270, 339–340
 Struve, Karl Hermann (1854–1920), 304
 Struve, Otto (1897–1963), 76, 168, 187, 200, 230, 319, 328, 347
 Struve, Otto Wilhelm (1819–1905), 130, 185, 266, 340
 Su Song, 8
 Suess, Eduard, 88
 Sūri Mahendra, 7
 Swanenburg, Boudewijn, 234
 Swenson, George, 381
 Swings, Polydore F. (1906–1983), 43, 147
 Swope, Henrietta, 310
 Synge, Edward, 330
 Szkody, Paula, 195
 Taam, Ronald E., 211, 220
 Tammann, Gustav (b 1932), 244
 Tanaka, Yasuo, 222
 Tananbaum, Harvey, 460
 Tapia, S., 195
 Tarter, Jill, 190
 Taylor, Frank, 88
 Taylor, Geoffrey, 88
 Taylor, Joseph H. (b 1941), 206, 387
 Tebbutt, John, 301
 Tempier, Étienne, Bishop of Paris (d 1279), 15
 Terrell, Jame, 222
 Terrile, Richard J., 126, 134, 160
 Tesla, Nikola, 248
 Thābit ibn Qurra (836–901), 8, 22
 Thackeray, Andrew D. (1910–1978), 199, 232
 Thales of Miletus (c. 625–547 BC), 17, 241
 Tharp, Marie (b 1920), 89
 Thénard, Louis, 249
 Theon of Alexandria (c. 335–400), 6, 22
 Thom, Alexander, 25
 Thome, John, 300
 Thompson, Christopher, 203, 211
 Thomson, William, *see* Kelvin (Lord)
 Thorstensen, John R., 221
 Tikhov, Gavril Adrianovich (1875–1960), 105
 Tillinghast, Carlton W., 330
 Timocharis of Alexandria (c. 320–260 BC), 176
 Tinsley, Beatrice M., 244, 252
 Titius, Johann Daniel (1729–1796), 139
 Todd, David, 248
 Todd, David P., 156
 Tombaugh, Clyde William (1906–1997), 106, 156
 Toomre, Alar, 252
 Toomre, Juri, 252
 Torricelli, Evangelista (1608–1647), 115
 Tousey, Richard (b 1908), 84, 414
 Townes, Charles, 283
 Tremaine, Scott D. (b 1950), 126, 127
 Troitsky, V. S., 362
 Trujillo, Chadwick A. (b 1973), 159
 Trümper, Joachim, 478
 Trumpler, Robert Julius (1886–1956), 182, 229, 231
 Tuohy, I. R., 217
 Turner, Herbert H. (1861–1930), 226
 Tuve, Merle, 310, 378–379
 Twining, Alexander C. (1801–1884), 153
 Twiss, Richard, 264
 Tycho Brahe (1546–1601), 6, 7, 16–17, 29, 104, 143, 166, 178, 192, 212, 344
 Udal'tsov, V. A., 362
 Ulich, Bobby L., 250
 Ulrich, Roger K., 263
 Ulugh Beg (1394–1449), 7, 23
 Umar ibn 'Abd al-'Azīz (682–720), 8
 Underhill, Anne B. (b 1920), 197
 Unsöld, Albrecht (1905–1995), 182, 355
 Urey, Harold C. (1893–1981), 41, 77, 95–96, 249
 Usherwood, William, 266
 Vaiana, Giuseppe, 435
 Väisälä, Yrjö, 141, 330

- Vajpayee, Atal, 411
 Van Allen, James A. (1914–2006), 84, 413
 van de Hulst, Hendrick C. (1918–2000), 230, 363
 van den Bergh, Sidney (b 1929), 217, 251
 van den Heuvel, E. P. J., 201, 211
 van der Riet Wooley, *see* Woolley, Richard v. d. R.
 van Kuilenburg, J., 232
 van Leeuwenhoek, Anton, 249
 van Maanen, Adriaan (1884–1946), 198, 255, 332
 van Paradijs, Jan, 211, 220
 van Woerkom, Adrianus Jan Jasper (1915–1991), 148
 Varāhamihira (505–587 AD), 21
 Vashakidze, Mikheil A., 216
 Vauquelin, Louis, 249
 Vaussenat, Célestin, 338
 Vegard, Lars, 84
 Verschuur, Gerrit, 380
 Very, Frank, 255
 Vicaire, 272
 Vine, Frederick, 89
 Violle, Jules, 272, 273
 Vitkevich, V. V., 361
 Vitruvius (c. 75–10 BC), 8
 Vogel, Hermann Carl (1841–1907), 98, 101, 168, 175, 178, 179, 185–186, 187, 226, 270, 304
 Volkoff, George, 188, 202
 von Braun, Wernher (1912–1977), 395, 413
 von Gothard, Eugen, 186
 von Helmholtz, Hermann (1821–1894), 173, 241, 250
 von Humboldt, Friedrich W. H. Alexander (1769–1859), 88, 153, 303
 von Liebig, Justus, 291
 von Oppolzer, Theodor (1841–1886), 145, 154
 von Seeliger, Hugo, 192, 225
 von Weizsäcker, Carl F. F. (1912–2007), 76, 173–174
 von Zach, Franz Xaver (1754–1832), 139
 Vonberg, Derek D., 357
 Vorilong, William, 245
- Wachmann, Arno A., 198
 Wade, Campbell M., 188
 Waldmeier, Max, 81
 Walker, Merle F. (b 1926), 156, 183, 193, 194, 195, 196, 233
 Walker, Sears Cooke (1805–1853), 345
 Walsh, David, 238
 Walther, Bernhard (1430–1504), 6, 15
 Wampler, Joe, 326
 Wannier, Peter, 232
 Ward, William, 96
 Waterston, John J. (1811–1883), 173, 272
 Watson, James, 139
 Watson, Kenneth, 246
 Watson, M. G., 196
 Watson, R., 193
 Weaver, Harold, 157
 Weber, Joseph, 387
 Webster, Louise (1941–1990), 188
 Weedman, Daniel, 233, 252
 Weekes, Trevor, 389
 Wegener, Alfred (1880–1930), 88
- Weiss, Edmund (1837–1917), 154
 Wells, Louisa, 194
 Wendker, Heinrich, 200
 Wendorf, Fred, 25
 Wesley, John, 246
 Wesselink, Adriaan J., 232
 Westerhout, Gart, 227, 355
 Westphal, James A. (b 1930), 199, 262–263, 326
 Weymann, Ray J., 233, 234, 238
 Wheeler, Craig, 215
 Whewell, William, 76, 246
 Whipple, Fred Lawrence (1906–2004), 101, 106, 145, 147, 148, 154, 156, 330
 White, Alice, 236
 White, N. E., 195, 220, 221
 Whitford, Albert E. (1905–2002), 270
 Whitney, Alan, 235
 Wickramasinghe, Chandra, 250
 Wiechert, Emil (1861–1928), 87
 Wien, Wilhelm (1864–1928), 79
 Wiesel, Johannes, 296
 Wigner, Eugene, 114
 Wijers, Ralph, 202
 Wilcox, John M. (1925–1983), 420
 Wild, Paul, 366
 Wildt, Rupert (1905–1976), 101, 111–112, 113–114, 165
 Wilkins, John, 245
 Wilkinson, David Todd (1935–2002), 245, 484
 Williams, Gwyn, 176
 Williams, Stanley, 123
 Willson, Richard C. (b 1937), 274, 437
 Wilsing, Johannes (1856–1943), 169, 192, 271, 304
 Wilson, Alexander, 35
 Wilson, Robert, 475
 Wilson, Robert E., 187
 Wilson, Robert W. (b 1936), 243
 Winkler, Frank, 236
 Winlock, Joseph (1826–1875), 215, 317
 Wisniewski, W. Z., 233
 Witt, Gustav (1866–1946), 140
 Wöhler, Friedrich, 249
 Wolf, Charles J. F. (1827–1918), 197
 Wolf, J. Rudolf (1816–1893), 79, 97, 210
 Wolf, Maximilian Franz J. C. (1863–1932), 139, 194, 213, 250
 Wolff, Sidney, 321, 333
 Wollaston, William, 275
 Wolszczan, Aleksander (b 1946), 160
 Woltjer, Lodewijk, 229, 233, 256
 Wood, Robert W., 278, 294, 308
 Woodard, Martin F., 263
 Woods, P. M., 212
 Woolley, Richard v. d. R. (1906–1986), 302
 Wren, Christopher (1631–1723), 315
 Wright, Thomas of Durham (1711–1786), 139, 225, 254
 Wright, William H. (1871–1959), 169, 197, 204
 Wrixon, Gerard T., 232
 Wu Xian, 12
 Wurm, Karl (1899–1975), 146
- Xenophanes, 245

500 Name index

- Yahyā ibn Abī Mansūr, 23
Yanasak, N. E., 241
Yang Wei, 12
Yapp, William, 315
Yarhil, Amos, 244
Yavaneśvara, 21
Yerkes, Charles T. (1837–1905), 346
Yi Xing, 8, 13
Young, Charles Augustus (1834–1908),
80
Young, Thomas, 277
Yü, Ch'ing Sung, 169, 271
Yukawa, Hideki, 240
Zanstra, Herman (1894–1972), 169, 204
Zatsepin, Georgiy, 388
Zeldovich, Yakov B. (1914–1987), 234, 243, 253
Zhang Heng, 13
Zhao, Ming, 187
Zhevakin, Sergei, 208
Zia Kui, 6
Zinner, Ernst, 269, 270
Zirin, Harold (b 1929), 230, 286
Zöllner, Johann K. Friedrich (1834–1882), 98, 100, 179, 268, 270,
271
Zupus, Giovanni, 97
Zwicky, Fritz (1898–1974), 202, 206, 213, 238, 244, 251

Subject index

Bold type indicates the main reference or references when a number of pages are listed

- aberration of light, *see* 'stellar aberration'
- accretion discs, 187, 188, 189, 190, 194, 195, 196, 197, 203, 220, 221, 222, 238, 252
- active galaxies, 189–190, **233–238**
- active galactic nuclei (AGN), **238**, 306, 464, 474, 481
- named
- Centaurus A (NGC 5128), 45, **236**, 237, 356
- Cygnus A, 45, **237**, 356, 357
- Virgo A (M87 or 3C 274), 45, **236**, **237**, 356
- see also* 'blazars', 'quasars', and 'Seyfert galaxies'
- active optics, **293**, 294, 295, 309, 322, 334, 341, 368
- adaptive optics, **261–262**, 285, 287, 288, 314, 332, 333, 334, 335, 472
- artificial guide stars, 261–262
- Alfonsine Tables*, **14**, **15**, 16
- Almagest* (Ptolemy), 6, 15, **19**, 22, **178**, **270**
- Andromeda nebula/galaxy (M31), **238–239**, 251
- diameter, 239
- discovery of population I and II stars, 332
- distance, 238–239
- distribution of neutral hydrogen, 239
- double nucleus, 239
- globular clusters, 229
- novae/supernova, **212–213**, 238
- radio map, 374
- spectrum, 44, 238
- spiral structure, 227, 238, 254
- supermassive black hole?, 189, 239
- anomalous cosmic rays, 435
- anomalous X-ray pulsars, **211–212**, 473
- archaeological sites
- Bighorn Medicine Wheel, Wyoming, 26
- Buena Vista, Peru, 27
- Chaco Canyon, New Mexico, 26
- Chankillo, Peru, 27
- Egyptian pyramids, 14
- Goseck, Germany, 25
- Great Zimbabwe, Africa, 28
- Jiangjumya, China, 12
- Kitora Kofun, Japan, 23, 24
- Nabta Playa, Africa, 25
- Namoratunga II, Africa, 28
- Newgrange, Ireland, 25
- Scottish standing stones, 25, 26
- Stonehenge, England, 25
- Takamatsu Zuka Kofun, Japan, 23
- Teotihuacán, Mexico, 11, 12
- Wurdi Youang, Australia, 9
- armillary sphere, 6, 8, 23, 344
- Aryabhatiya* (Aryabhata), 21
- asteroids, 139–143
- binary asteroids, 141–142
- C-type, 142, 430
- E-type, 142
- families, 140
- impact on Earth, 141, **142–143**, 152
- Jupiter Trojans, 140
- Kirkwood gaps, 139, 140
- modern survey programmes, 142–143
- named, 144
- Achilles (588), 140, 144
- Adonis (2101), 141
- Aethra (132), 139, 144
- Amor (1221), 140, 144
- Annefrank (5535), 406, 439
- Apollo (1862), 141, 144
- Astrea (5), 139, 144
- Aten (2062), 141, 144
- Brucia (323), 139, 144
- Ceres, *see* 'dwarf planets'
- Eros (433), 140, 142, 144, 406
- Flora (8), 140, 144
- Gaspra (951), 141, 142, 144, 406
- Hebe (6), 139, 144
- Hermes (69230), 141
- Icarus (1566), 141, 144
- Ida (243), 141, 142, 144, 406
- Dactyl, 141, 406
- Itokawa (25143), 142, 144, 406
- Juno (3), 139, 144
- Mathilde (253), 142, 144, 406
- Pallas (2), 139, 144
- Patroclus (617), 140, 144
- Phaethon (3200), 154
- Steins (2867), 142, 144, 406
- Sylvia (87), 142
- Vesta (4), 139, 144
- near Earth asteroids (NEAs), 141, **142–143**
- orbits, 140–141
- spacecraft intercepts, **141–142**, 414–415, 418, 430, 439
- S-type, 142
- see also* 'Kuiper belt' and 'scattered disk objects'
- astrolabe, 6–7
- astrology, 3, 14, 15, 16, 23
- Astronomia Nova* (Kepler), 29

502 Subject index

- atmospheric absorption, 273
 atmospheric turbulence, 261, 264, 265, 283, 287, 291, 308, 341, 472
 AURA (Association of Universities for Research in Astronomy), 312, 319–320, 322–323, 333, 347
 Australian Aborigines astronomy, 9
- Babylonian astronomy, 9–11
 Big Bang, 174, 235, 242–245, 461
 binary stars, 185–188, 220, 230, 469
 astrometric binaries, 185
 Procyon (α Canis Minoris), 185, 218–219
 Sirius (α Canis Majoris), 185, 218–219
 eclipsing binaries, 168, 185–188, 193, 194, 206
 Algol (β Persei), 168, 185–186
 Cen X-3 (pulsar), 206
 Her X-1 (pulsar)/ HZ Herculis, 206
 Nova DQ Herculis 1934, 193, 195
 Nova T Aurigae 1891, 193
 Nova WZ Sagittae, 193
 PSR 1913+16 (pulsar), 206
 W Ursae Majoris (contact binary), 187
 β Lyrae (semidetached binary), 168, 186–187
 δ Librae, 168
 ϵ Aurigae, 187–188
 λ Tauri, 168
 high mass X-ray binaries (HMXBs), 473
 low mass X-ray binaries (LMXBs), 203, 206, 464, 473, 476
 Cen X-4, 221
 Sco X-1, 203
 4U 1820–30, 203
 named
 ξ Ursae Majoris, 185
 spectroscopic binaries, 168, 185, 187, 194, 201, 209, 264, 284
 bi-polar outflows, 197
 BiSON ground-based solar network, 263, 288
 BL Lac objects, 56, 235–236
 black holes, 184, 188–190, 202, 203, 204, 215, 221, 479
 candidates
 V404 Cygni, 189
 A0620-00, 188–189
 Cyg X-1, 188
 in globular clusters, 484
 intermediate mass, 484
 Schwarzschild radius, 188, 189, 304
 supermassive, 189–190, 234, 238, 240, 252
 candidates in
 Cen A, 236, 431
 Cyg A, 237
 Milky Way (centre), 189
 M31, 189, 239
 M32, 189
 M87, 189
 NGC 4258, 190
 NGC 4261, 189–190
 RE J1034+396, 484
 3C 273, 234
 blazars, 235–236, 389, 390
 Bok globules, 183
 brown dwarfs, 160, 190–191
 calendar
 African, 28
 Australian Aborigines, 26
 Aztec, 12
 Babylonian, 10–11, 21
 Chinese, 12, 23
 Egyptian, 13–14
 Greek, 19
 Inca, 27
 Japanese, 23
 Maori, 27
 Mayan, 12, 24–25
 Polynesian, 27
 Roman Catholic Church, 15
 Carnegie Corporation, 375
 Carnegie Institution, 307, 310, 331, 332, 333, 335
Carte du Ciel, 266, 267, 269, 300, 301, 304, 315, 317, 337, 340
 Cassiopeia A, *see* ‘supernova remnants’
 cataclysmic variables, 191–196
 Celestial Police, 139
 Centaurs, 157–159
 Centaur upper stage, 401, 423
 Centaurus A, (NGC 5128), *see* ‘active galaxies’
 Central Mexico and the Aztecs, 11–12
 Cepheid variables, 166–167, 207–208, 210, 229, 231, 243, 255, 317, 332
 named
 δ Cephei, 207
 η Aquilae, 207
 period-luminosity relationship, 207, 208
 see also ‘RR Lyrae or cluster variables’
 Charge Coupled Devices, 262–263
 Chinese Academy of Sciences, 413
 Chinese ancient astronomy, 12–13
 clusters of galaxies, 238, 240, 244, 253, 256, 358, 370, 377, 459, 460, 464, 479
 Coma cluster, 244, 251, 253
 Local Cluster, 253
 Perseus cluster, 253, 460
 Virgo cluster, 253
 Coal Sack, 9, 26
 colliding galaxies, 251, 474
 comets, 9, 12, 16, 17, 23, 26, 31, 71, 75, 95, 98, 128, 139, 142, 143, 145–150, 151, 154, 158, 159, 192, 246, 250, 254, 266, 303, 308, 316, 412
 antitails, 147
 chemical composition, 145, 146–147, 148, 149, 150, 250
 daughter molecules, 147, 250
 fractured, 145–146, 148
 heads, 146, 147, 149
 Kreutz sungrazing comets, 146
 life, 250
 linked to meteor showers, 145–146
 modern survey programmes, 142, 143
 named, 151
 Austin, 250
 Bennett, 149
 Biela, 145–146, 151
 Borrelly, 149–150, 151, 406
 Brorsen-Metcalf, 250
 Churyumov-Gerasimenko, 142, 406
 Daniel (1907 IV), 146, 151
 Donati (1858 VI), 151, 266

- Encke, 98, 145, 147, 149, 151, 440
 Giacobini-Zinner, 148, 151, 406
 Great Comet of 1106, 146, 151
 Great Comet of 1577, 16, 17, 151
 Great March Comet of 1843 (1843 I), 146, 151
 Great September Comet (1882 II), 145, 146, 151, 266
 Great Southern Comet (1880 I), 146, 151
 Grigg-Skjellerup, 149, 151, 406
 Halley, 143, 145, 148–149, 151, 250, 308, 406
 Hartley 2, 151, 406, 412
 Kohoutek, 149, 250
 Lexell, 143, 145, 151
 Morehouse (1908 III), 146
 of 1531 (Halley's comet), 143
 of 1607 (Halley's comet), 143
 of 1680, 31, 143, 151
 of 1682 (Halley's comet), 143
 Shoemaker-Levy 9, 148, 151
 Swift-Tuttle (1862 III), 145, 151
 Tago-Sato-Kosaka, 149, 151
 Tebbutt (1881 III), 151, 266
 Tempel (1864 II), 145, 151
 Tempel 1, 150, 151, 406
 Tempel-Tuttle (1866 I), 151, 154
 Wells (1882 I), 145, 151
 Wild 2, 150, 151, 406
 Wolf, 145, 151
 nucleus, 145, 147
 dirty snowball theory, 147, 148
 flying sandbank model, 147
 orbits, 16–17, 31, 143, 145, 146, 147, 148
 origin, 145, 147–148
 Oort cloud, 148
 parent molecules, 147, 250
 resisting medium, 145
 short period, 148, 159
 spacecraft intercepts, 148–150, 412, 417, 418, 439
 spectra, 145, 146, 147
 tails, 146, 147, 148, 158
Commentariolus (Copernicus), 16
 cosmic microwave background (CMB)/microwave background radiation, 58, 243–245, 376, 388, 460, 462, 478, 484
 cosmic ray detectors and observatories
 detectors
 air fluorescence, 388
 Čerenkov, 388
 observatories (ground-based), 388, 389
 AGASA, Japan, 388
 Fly's Eye, Dugway, Utah, 388
 Pierre Auger Observatory, 388
 Volcano Ranch, New Mexico, 388
 cosmic rays, 239–241, 338, 388, 389, 408, 422, 477, 483
 GZK effect, 388
 primary, 240
 showers, 82, 240, 338, 359, 388, 389
 ultra-high energy (UHECRs), 240, 388, *see also* 'anomalous cosmic rays'
 cosmology, 241–245
 ancient, 67–68, 241
 Aristarchus, 18
 Aristotle, 15, 16, 17, 18, 19, 29, 30, 67, 86, 143, 150, 241, 249
 Chinese, 13, 241
 Copernicus, 16
 Egyptian, 13, 241
 Heracleides, 18
 Hicetas, 18
 Ibn al-Shātir, 22
 Mayan, 24
 Plato, 18
 Ptolemy, 19–20
 Pythagoreans, 17–18
 Tycho Brahe, 17
 modern, 241–245
 accelerating universe, 244
 age of the universe, 241–245
 cosmological constant, 242, 244
 critical density, 242, 244
 dark energy, 244, 245, 460
 dark matter, 226, 244, 245
 deceleration parameter, 243
 density of the universe, 242, 244
 expanding universe, 242, 243
 flatness problem, 244
 formation of heavy elements, 174
 heat death of the universe, 241
 horizon problem, 244
 Hubble constant, 238, 242–245
 inflation theory, 244
 primeval atom, 242
 see also 'Big Bang'
 Crab nebula (Taurus A), *see* 'supernova remnants'
 cross-staff, 7
 Cygnus A, *see* 'active galaxies'
 Cygnus Superbubble, 469, 479

De Revolutionibus Orbium Coelestium (Copernicus), 16, 68
De Saturni (Huygens), 30
 deferent, 19, 20
 degenerate matter, 183, 219
 detached object, Sedna, 158, 159
 double stars, 185
 Dresden codex, 24
 dwarf novae, 194
 SS Aurigae, 194
 SS Cygni, 194
 SU Ursae Majoris, 194
 U Geminorum, 194
 Z Camelopardalis, 194
 dwarf planets
 Ceres, 139, 144, 159
 Eris, 158, 159
 Haumea, 158, 159
 Makemake, 158, 159
 Pluto, *see* 'Pluto'
 early North American astronomy, 26
 Earth, 72, 83–91
 age, 86, 87, 241, 242
 asteroid impact, *see* 'asteroids, impact on Earth'
 aurorae, 83, 84, 85, 414, 420, 433, 441
 electron aurora, 420
 inverse aurora, 414

504 Subject index

Earth (*cont.*)

kilometric radiation, 414
 proton aurora, 420
 axial rotation rate variations, 87–88
 bow shock, 84, 412
 continental drift, 88–89, 90
 current sheet, 412
 density, 113
 diameter, 18
 earthquakes, 87, 89
 equatorial bulge, 86
 extremophiles, 89–91
 geomagnetic tail, 84–85
 internal structure
 core, 86–87
 crust, 86–89
 lithosphere, 89
 mantle, 87, 89
 Mohorovičić discontinuity, 87
 Wiechert–Gutenberg discontinuity, 87
 internal temperature, 86
 ionosphere, 83–84
 latitude variations, 86
 magnetic field
 magnetic pole movement, 88
 reversal, 89
 variations, 83
 magnetic reconnection, 84, 85, 412, 413
 magnetic storms, 35, 79, 80, 83, 408, 436
 magnetopause, 84, 85, 412, 416, 420, 441
 magnetosheath, 84, 85, 433, 441
 magnetosphere, 84–85, 403, 412, 419, 420, 433, 441
 mass, 31
 mid-Atlantic ridge, 88–89
 neutral sheet, 84, 85
 nutation of axis, 315, 339, 344
 plasma sheet, 84, 85
 plasmasphere, 419–420
 plate tectonics, *see* ‘Earth, continental drift’
 polar cusp, 84, 433
 polar motion, 86
 precession of equinoxes, 11, 12, 20, 21, 22, 31
 radiation belts, *see* ‘Van Allen radiation belts’
 radioactive heating, 87
 ring current, 83, 441
 shape, *see* ‘Earth, equatorial bulge’
 spinning, 15, 16, 17, 18, 19, 21
 tidal friction, 87
 tides, 9, 30
 Urey’s cold accretion theory, 87

eclipses
 lunar, 10, 11, 17, 19, 21, 24, 27, 33, 87, 92
 solar, 9, 12, 17, 18, 19, 21, 24, 39, 79, 80, 97

ecliptic, obliquity, 7, 19, 20, 22, 23

Egyptian astronomy, 13–14

Einstein’s theory of relativity, 97, 141, 173, 188, 206, 219, 241, 242, 304, 387, 479

epicycles, 16, 19, 20, 21, 22

equant, 16, 17, 19, 21, 22

Eris, *see* ‘dwarf planets’

ether, 30, 31, 153, 241, *see also* ‘comets, resisting medium’

European Science Foundation, 410

exoplanets, 52, 160–161, 248, 285

 51 Pegasi, 160
 first image, 2M1207, 160
 Fomalhaut, 160
 PSR B1257 + 12, 160
 stellar transit, HD 209458, 160
Exposition du Système du Monde (Laplace), 71
 extrasolar planets, *see* ‘exoplanets’
 extraterrestrial life, *see* ‘life’
 extreme ultraviolet sources, 56, 195, 464, 479

flare stars, 53, 198

 Luyten 726–8, 198
 UV Ceti, 198
 YZ Canis Minoris, 198

Ford Foundation, 312, 313

galaxies

 clusters of, *see* ‘clusters of galaxies’
 classification, 250–251
 distance-velocity relationship, 242, 243
 interacting galaxies, 251–252, 466
 large-scale structure of the universe, 253
 Local Group, 251, 253, 318
 named
 M32, 189, 251
 M51 (Whirlpool galaxy), 252
 M81, 252, 477
 M82, 252
 M101, 213, 255
 see also ‘active galaxies’, ‘Andromeda nebula/galaxy (M31)’, ‘Milky Way’, ‘nebulae’, ‘starburst galaxies’, ‘Triangulum nebula/galaxy (M33)’, and ‘ultraluminous infrared galaxies’
 superclusters, 253
 Local supercluster, 253
 Shapley supercluster, 253
 Galaxy Redshift Survey 2dF, 245, 303

gamma-ray
 background radiation, 480
 bursts/bursters (GRBs), 201–202, 314, 391, 437, 443, 459, 460, 462, 465, 468, 473, 479, 481, 482, 483
 GRB 030329, 202
 GRB 031203, 473
 GRB 050509B, 482
 GRB 050709, 202, 204
 GRB 050904, 482
 GRB 080916C, 465
 GRB 090510, 465
 GRB 970228, 201
 GRB 970508, 201–202
 GRB 971214, 202
 GRB 980425, 202
 see also ‘soft-gamma repeaters’
 observatories (ground-based), 389, 390
 CANGAROO, Australia, 389
 HEGRA array, La Palma, 389
 HESS, Namibia, 389
 Milagro, Los Alamos, 390
 Whipple Observatory, Mount Hopkins, 389
 globular clusters, 165, 206, 220, 225, 226, 228–229, 252, 482, 484
 ages, 243, 245

- named
 M4, 228
 M5, 228, 243
 M13, 228
 M22, 228
 NGC 6624, 219
 omega Centauri, 228, 229
see also 'Andromeda nebula, globular clusters', 'black holes, in globular clusters' 'Milky Way, globular clusters', and 'RR Lyrae or cluster variables'
- gnomon, 7–8, 13, 23
 GONG ground-based solar network, 263, 288
 Grand Tour mission, 409, 414, 447
 gravitational lensing and Einstein rings, 238
 gravity waves, detectors and observatories, 387, 388
 Greek astronomy, 17–21
- Handy Tables* (Ptolemy), 22
 Harmony of the Spheres, 18
 Haumea, *see* 'dwarf planets, Haumea'
 heavy elements, formation of, *see* 'cosmology, modern, formation of heavy elements'
 helioseismology, 263–264
 Hertzsprung–Russell colour-magnitude diagram, 170, 171, 181–183, 209, 219, 229
 Hubble constant, *see* 'cosmology, modern, Hubble constant'
 Hubble Deep Field, 472
 Hubble Ultra Deep Field, 472
 Hyades, 9, 23, 170, 225
- Indian astronomy, 21–22
 Inertial Upper Stage (IUS), 401, 423
 International Astronomical Union (IAU), 63, 159, 176, 200, 208, 270, 306, 346
 International Geophysical Year (IGY), 89, 395, 413, 439
 International Solar Terrestrial Physics (ISTP) programme, 404, 433
 International Solar Union (ISU), 176, 271, 301
 interplanetary magnetic field, 149, 420
 interstellar medium, 229–231, 240, 250, 328, 369, 380, 408, 463, 477
 absorption, 229–331
 dust, 231
 gas, 230–231
 molecules
 carbon monoxide, 230
 deuterium, 477
 hydrogen, 230, 231
 nitrogen, 466
 water vapour, 230
see also 'molecular clouds'
- Islamic astronomy, 22–23
- Japanese astronomy, 23–24
 Jet Propulsion Laboratory (JPL), 45, 249, 262, 336, 373, 395, 432, 447
 Joint Organization for Solar Observations (JOSO), 287
 Jupiter, 10, 11, 12, 16, 18, 19, 29, 30, 31, 32, 72, 78, 111–112, 115–121
 atmosphere, 111–112, 115, 117
 cloud layers, 115, 117
 clouds, 36, 113, 115
 cloud-top temperatures, 113, 115, 117
 constituents, 111–112, 113, 115, 117, 474
 pressure and temperature profile, 115, 117
 wind velocity, 36, 115, 117
 aurorae, 121, 460
 belts/zones, 115
 bow shock, 121
 density, 113–114
 differential rotation, 115, 116
 Great Red Spot (GRS), 115, 116
 helium abundance/mass fraction, 112, 117
 internal heat, 113, 114, 117
 internal structure, 113–114
 magnetic field, 119, 120–121
 magnetosphere, 118, 121
 mass, 31, 114
 orbit, 16, 17, 18, 19, 67
 polar flattening, 113, 115
 radiation belts, 120–121, 415
 radio emissions, 120
 radioactive heating, 113, 114
 rings, 120, 122
 rotation period, 115
see also 'Jupiter, differential rotation'
- satellites, 122
 Adrastea, 120, 122
 Amalthea, 115, 120, 122
 Callisto, 115, 116, 118–119, 122, 123
 life, 247
 magnetic field/sub-surface ocean, 119
 Europa, 115, 116–117, 119, 122, 123, 416
 life, 247
 magnetic field, 119
 sub-surface ocean, 117, 119, 247
 surface age, 116
 Ganymede, 115, 116, 118, 122
 atmosphere, 118, 123
 life, 247
 magnetic field, 118
 sub-surface ocean, 118
 surface age, 118
 Io, 115, 117, 118, 119–120, 121, 122, 123, 135
 flux tubes, 121
 neutral sodium cloud, 121
 volcanoes/geysers, 115, 117, 118, 119, 120
 life, 246
see also 'Jupiter, Callisto, life', 'Jupiter, Europa, life', and 'Jupiter, Ganymede, life'
- Metis, 120, 122
 orbits, 29, 115, 119, 121, 122
 Thebe, 120, 122
 sidereal period, 11
 spacecraft to, 414–416, 431–432, 447–449
 spectrum, 111–112
 synodic period, 10, 11, 12
- Kepler, solar system and the third law, 29
 Kuiper Airborne Observatory, 51
 Kuiper belt, 157–159
 classical Kuiper belt objects (KBOs), 158, 159
 1992 QB₁, 158, 159
 Haumea, *see* 'dwarf planets'
 Makemake, *see* 'dwarf planets'
 Quaoar, 158, 159
 resonance Kuiper belt objects, 158, 159

506 Subject index

- launch vehicles
 Ariane, 412, 467, 474
 Atlas, 400, 423, 436
 Delta, 423, 440, 441, 463, 475, 479, 482
 Juno 2, 432
 Pegasus, 466, 481
 Proton, 444, 454, 472
 Scout, 453
 Soyuz, 412, 445
 space shuttle
 Atlantis, 414, 462
 Challenger, 414, 423, 438, 462, 463, 471, 479
 Discovery, 405, 422, 429, 430, 442
 Thor-Able, 84, 432
 Titan Inter-Continental Ballistic Missile, 411
 Titan IVB/Centaur, 410
 Titan-Centaur, 419
 Vanguard, 395, 413
- life, 89, 91, 245–250
 Drake equation, 248
 Earth, 89–91, 248, 249–250
 extremophiles, 89–91, 248
 origin
 from comets, 250
 from meteorites, 249–250
 spontaneous generation, 249
 via chemical reactions, 249
 exoplanets, 248
 Jupiter's and Saturn's satellites, 246, 247–248
 Mars, 246–247, 248
 Moon, 245, 246
 search for extraterrestrial intelligence (SETI), 248–249
 Venus, 246, 248
- liquid mirror telescopes, 308
 Local Bubble, 463
 Lockman hole, 257, 474
 lunar mansions, 12, 21, 22, 23
 luminous blue variables, *see* 'variable stars, eruptive variables'
- Magellanic Clouds, 9, 26, 28, 207, 229, 231–232, 251, 312, 466
 Large Magellanic Cloud, 201, 210, 212, 213, 221, 226, 231–232, 468
 Magellanic Stream, 232
 Small Magellanic Cloud, 207, 231–232, 317
- magnetars, 211, 212, 473
 Makemake, *see* 'dwarf planets'
- Mars, 10, 17, 18, 19, 25, 29, 50, 68, 72, 104–110, 152, 153, 246, 247, 338, 345, 372
 Ares Vallis, 108
 atmosphere, 104–110
 carbon dioxide, 106, 107
 clouds, 104, 105, 107
 dust, 105, 107
 constituents, 107, 108
 molecular hydrogen, 466
 oxygen, 105, 106, 107, 108
 surface pressure, 106, 108
 temperature, 108
 water vapour, 105, 106, 107, 108, 110
 wind velocity, 105, 107, 108
 'canals', 37, 105
 Chryse Planitia, 107, 108
 core, 106, 108
 craters, 106, 107, 108, 109
 density, 41, 87
 Hellas basin/plain, 106, 107, 108
 life, 246, 247, 248
 magnetic field, 106, 108
 meteorite ALH 84001, 153
 Nix Olympica, 107
 ocean, 108, 109
 Olympus Mons, 107, 109
 orbit, 16, 17, 18, 19, 29, 67
 polar caps, 104, 105, 106, 107, 108, 109, 110
 radiation belts, 106
 rotation period, 104
 satellites
 Deimos, 73, 105, 107, 108
 Phobos, 73, 105, 107, 108
 spacecraft to, 396, 397, 398, 424, 426, 427, 429, 431, 438, 439, 445, 446, 447
 surface
 age, 108–109
 first image from, 107
 flash floods, 108
 lakes, 105
 lava, 107, 108, 109
 magnetic particles, 108
 seas, 105, *see also* 'Mars, ocean'
 subsurface water ice, 109, 110
 temperature, 105, 106, 108
 synodic period, 25
 Syrtis Major, 104
 Valles Marineris, 107
 volcanoes, 106, 107, 109
 water, 105, 106, 107, 108, 109, 110, *see also* 'Mars, atmosphere, water vapour'
 water ice, 105, 107, 108, 109, 110, *see also* 'Mars, surface, subsurface water ice'
- Mayan astronomy, 24–25
 Megalithic astronomy, 25–26
 Mercury, 17, 18, 19, 20, 29, 72, 97–99
 atmosphere, 98, 99
 Caloris basin, 98, 99
 craters, 98, 99
 density, 41, 87
 internal structure, 98, 99
 magnetic field, 99
 magnetotail, 99
 mass, 98
 orbit, 16, 17, 18, 19, 97
 phases, 97
 precession of perihelion, 97
 rotation period, 98, 99
 sodium tail, 99
 spacecraft to, 426–427, 429–430
 spectrum, 98
 surface, 98–99
 temperature, 98, 99
 transits, 29, 97, 98, 100
 volcanic structures, 99
 water ice, 99
 meteorites, 91, 92, 93, 94, 95, 96, 103, 142, 145, 148, 150, 152–153, 179, 241, 249–250
 Arizona Barringer crater, 152

- chondrites, 142, 152, 250
 chondrules, 152
 from Mars, 152–153
 from the Moon, 152, 153
 Murchison, 250
 origin, 148, 152
 origin of life on Earth, *see* 'life, Earth, origin, from meteorites'
- meteors, 9, 26, 153–156, 359
 heights, 153, 154
 showers, 153–154, 155
 Andromedids, 154, 155
 Geminids, 154, 155
 Leonids, 153, 154, 155
 linked to comets, 153–154, 155
 Perseids, 154, 155
 radiant, 153
 spectra, 154, 155
- Metonic cycle, 12, 19
- microwave background radiation, *see* 'cosmic microwave background (CMB)'
- Milky Way, 9, 12, 13, 26, 27, 28, 52, 56, 58, 183, 192, 208, 209, 225–232, 240, 248, 251, 355, 357, 456, 461, 463, 465, 466, 469, 473
 centre, 225, 226, 227, 357, 460, 473, *see also* 'black holes, supermassive'
 density waves, 227
 deuterium, 466, 477
 gamma-ray emitting bubbles, 465
 globular clusters, distribution, 225, 226
 location of Sun, 225, 227
 magnetic field, 231, 240
 mass, 226, 227
 movement of Sun, 226–227
 rotation, 226–227, 229, 230
 size, 225–226
 spiral arms, 227, 228, 230, 463, 482
 star streaming, 226–227
see also 'globular clusters', 'interstellar medium', and 'molecular clouds'
- modern optical interferometers, 283–285
- molecular clouds, 77, 231, 250, 377, 463
- month
 anomalistic, 11
 sidereal, 3, 28
 synodic, 10, 11, 12, 14, 19, 21, 28
- Moon, 9–19, 21–31, 33, 36, 41, 91–96
 age, 93, 96
 atmosphere, 91, 92, 94
 craters, 91, 92, 93, 94, 95, 395
 diameter, 16, 18, 19, 91
 distance, 18, 19, 91
 far side, 92, 94
 fire fountains, 93, 94
 impact rocks, breccias, 93–94, 152
 internal structure
 core, 92–95
 crust, 93–95
 mantle, 94, 95
 libration, 91, 266
 life, 91, 245, 246
 magnetic field, 92, 94, 95
 maps, 91, 94
 maria, 92, 93, 94, 96, 152
 mascons, 92, 94, 95
 meteorite impacts, 91, 93–94
 orbit, 16, 17, 18, 19, 23, 29, 31, 33, 36, 91, 95–96
 origin, theories, 95–96
 secular acceleration, 33, 36
 sidereal and synodic periods, *see* under 'month'
 South Pole–Aitken basin, 94–95
 spacecraft to, 92–95, 395, 396–397, 408, 409, 411, 421, 423, 432, 433, 434, 440–441
 surface
 age, 92–94
 ash/dust, 92
 changes?, 91
 regolith, 93, 94, 95, 152
 volcanic rock, basalts, 92, 93, 94
 water, 93, 94
 water ice, 94–95
 water vapour, 91, 95
- MUL.APIN* (Babylonian), 7, 10, 21
- NASA Deep Space Network (DSN), 249, 367, 373, 374, 399, 417, 443, 472
- NASA Outer Planet Working Group, 414
- National Geographic–Palomar Sky Survey, 267, 292, 335
- nebulae, 251, 254–256
 catalogues
 Herschel, 254
 Messier, 254
 Kant's island universes, 254
 nature of, 254–255
 spectra, 254
 spiral, 242, 254–256
see also 'Andromeda nebula/galaxy', 'Crab nebula', 'galaxies', 'Orion nebula', 'Triangulum nebula/galaxy' and 'planetary nebulae'
- Neptune, 72, 78, 111–112, 113, 114, 133–137
 atmosphere, 111–112
 clouds, 134, 135
 constituents, 111–112, 474
 density, 113, 134
 diameter, 134, 449
 discovery, 133–134
 equatorial jet, 135
 Great Dark Spot, 135
 internal heat, 114, 135
 internal structure, 113–114
 magnetic field, 137
 magnetopause, 137
 magnetosphere, 137
 mass, 134, 449
 orbit, 134, 156
 pre-discovery observations, 134
 radiation belt, 137
 radio emissions, 135
 radioactive heating, 114
 rings, 137, 138
 rotation period, 134, 135
 satellites, 138
 Despina, 137, 138
 Galatea, 137, 138
 Larissa, 135, 137, 138
 Nereid, 134, 135, 137, 138
 Neso, 137, 138

508 Subject index

- Neptune (*cont.*)
 Proteus, 136, 138
 Psamathe, 137, 138
 Triton, 123, 136, 138, 157, 290, 449
 atmosphere, 123, 135, 136
 density, 136
 diameter, 136
 discovery, 134
 geyser-like eruptions, 136
 orbit, 134, 135, 449
 polar cap, 136
 surface, 135–137
 temperature, 135, 136
 shepherd satellites, 137
 spacecraft to (Voyager 2), 447–449
 spectrum, 111–112
 neutrino observatories, 390, 391
 AMANDA, South Pole, 391
 Homestake observatory, USA, 82, 390
 Kamioka observatory, Japan, 82, 390, 391
 Sudbury neutrino observatory, Canada, 82, 391
 neutron stars, 201, 202–204, 211, 212, 215, 220, 221, 222, 387, 412, 460,
 484, *see also* ‘magnetars’ and ‘pulsars’
 Newton’s universal theory of gravitation, 30–31
 Nile floods, 13
 novae, 191–194
 early spectra, 191
 named
 CK Vulpeculae 1670, 191
 Cygni 1876 (or Q Cygni), 191
 Cygni 1600, *see* ‘variable stars, P Cygni’
 Cygni 1975 (or V1500 Cygni), (asynchronous polar), 195
 DQ Herculis 1934, (intermediate polar), 193, 195
 GK Persei 1901, (intermediate polar), 192, 193, 196
 RR Pictoris 1925, 193
 S Andromedae 1885, *see* ‘supernovae, named, of 1885’
 T Aurigae 1891, 191, 192, 193–194
 T Coronae Borealis 1866, 191, 192
 V603 Aquilae 1918, 192–193
 V841 Ophiuchi 1848, 191
 WY Sagittae 1783, 191
 WZ Sagittae 1942, 193
 see also ‘dwarf novae’ and ‘recurrent novae’
On the Length of the Year (Hipparchus), 19
 open star clusters, 170, 225, 231
 age of, 183
 optical/infrared telescopes and observatories, *see* separate index
 optical interferometry, 264–265
 optical interferometers, 283–285
 oracle bones, 12, 13
 Orion nebula, 52, 169, 175, 179, 197, 254, 265, 266, 291, 472
 photography, 265–268
 daguerreotype, 265
 dry plates, 265–266, 277
 ground-breaking photographs of:
 comets (1858), 266
 Moon (1840), 265
 Orion nebula (1880), 265
 solar corona (1851), 265
 solar spectrum (1842), 265
 stellar spectrum (1872), 265
 see also ‘Sun, sunspots, early photography’
 photographic astrometry, 266–267
 photographic photometry, 267
 spectral sensitivity of emulsions, 267
 wet collodion process, 265, 277
 see also ‘Carte du Ciel’, and ‘National Geographic–Palomar Sky
 Survey’
 photoheliograph, 265, 285, 346
 photometers
 photoelectric, 270
 photomultiplier, 270
 selenium, 270
 visual
 astrometer (John Herschel), 178, 268
 Pickering, 268, 269, 270
 Steinheil, 268
 Zöllner, 268, 270
 photometry, 268–272
 Balmer jump, 271
 colour, 270–272
 colour indexes, 271–272
 colour temperature, 271, 274
 North Polar Sequence, 269–270
 photographic, *see* ‘photography, photographic photometry’
 standard magnitude scale, 269
Planetary Hypotheses (Ptolemy), 3
 planetary nebulae, 34, 169, 179, 191, 192, 197, 204–205, 216, 226, 244,
 474
 planetary radar (Earth-based), 95, 99, 101, 126, 141
 Arecibo 300 m dish, 366
 Haystack 37 m dish, 374
 Millstone Hill 26 m dish, 374
 planetesimals, 70, 76, 77, 78, 96, 157, 159
 Pleiades, 9, 12, 21, 23, 27, 28, 170, 175, 179, 190, 254, 271
 Pluto, 72, 75, 156–157, 447
 atmosphere, 156, 157
 diameter, 156
 mass, 156
 orbit, 156, 157
 rotation period, 156
 satellites
 Charon, 74, 156–157, 346
 Hydra, 157
 Nix, 157
 search and discovery, 156
 surface, 156–157
 polars, 194–196
 asynchronous, 195
 V1500 Cygni, 195
 intermediate, 195–196
 DQ Herculis, 193, 195
 GK Persei, 192, 193, 196
 H2252-035, 195–196
 named polars
 AM Herculis (3U 1809+50), 194–195
 AN Ursae Majoris, 195
 VV Puppis, 195
 Polynesian and Maori astronomy, 26–27
Principia (Newton), 31, 68, 143, 167

- Principia Philosophiae* (Descartes), 30
 Project Vanguard, 395, 413
 protoplanetary discs (proplyds), 52, 188, 472
 protostars, 77, 474
Prutenic Tables (Erasmus Reinhold), 16
 pulsars, 205–207, 353
 discovery, 205–206
 named
 A0538–66, 221
 Cen X-3 binary, 206
 Crab pulsar NP 0532, 55, 206, 216, 366
 Her X-1/HZ Herculis binary, 206
 PSR B1257+12 millisecond pulsar, 160
 PSR 1913+16 binary, 206
 PSR 1919+21, 205
 PSR 1937+214 millisecond pulsar, 206, 366
 PSR J0737–3039 in double pulsar system, 206
 Vela pulsar PSR 0833–45, 206, 218, 373
 see also ‘anomalous X-ray pulsars’
 quadrant, 7
 Quaoar, *see* ‘Kuiper belt’
 quasars, 233, 234–235, 236, 256, 257
 highly polarized quasars (HPQs), 236
 individual
 0957+561 (gravitationally lensed), 238
 3C 9, 234
 3C 48, 234
 3C 273, 234–235
 3C 279, 235
 radio-loud quasars (RLQs), 234, 237, 238
 radio-quiet quasars (RQQs), 234
 superluminal motion, 235
 quasi-periodic (X-ray) oscillations, 464, 484
 radar, *see* ‘planetary radar’
 radio astronomy (early)
 discovery of 21 cm line, 230
 Hey, 356
 Jansky, 355
 Reber, 355–356
 radio sources (early)
 Cas A, *see* ‘supernova remnants, Cassiopeia A’
 Cen A, *see* ‘active galaxies, Centaurus A’
 Cyg A, *see* ‘active galaxies, Cygnus A’
 Sag A*, *see* ‘black holes, supermassive, Milky Way (centre)’
 Tau A (Crab nebula), *see* ‘supernova remnants, Crab nebula’
 Vel X, *see* ‘supernova remnants, Vela’
 Vir A, *see* ‘active galaxies, Virgo A’
 radio/submillimetre telescopes and observatories, *see* separate index
 radiometry, 272–274
 infrared sky surveys, 274
 of Moon and planets, 273
 of stars, 273–274
 of Sun, 272–273
 sensors
 bolometer, 272, 273, 274, 376, 377, 378, 467, 478
 cavity radiometer, 274, 437
 Crookes radiometer, 272
 lead sulphide cells, 273–274
 microwave radiometer, 274, 484
 thermocouple/thermopile, 272, 273, 274
 torsional radiometer, 272, 273
 total irradiance radiometer, 274
 rapid burster, *see* ‘X-ray bursters’
 recurrent novae
 V404 Cygni, 221
 V616 Mon, 221
 red dwarfs, 55, 160, 181, 198, 469
 red giants, 165, 169, 173, 174, 181, 182, 183, 202, 205, 210, 214, 332
 Rockefeller Foundation, 335, 342, 375
 Roman Catholic Church, 4, 14, 15, 16, 29, 30, 245, 249
 RR Lyrae or cluster variables, 207, 208–209, 239
Rudolphine Tables (Kepler), 29
 saros, 10
 Saturn, 16, 18, 19, 31, 32, 72, 78, 111–112, 114, 121–128
 atmosphere, 111–112
 clouds, 113
 cloud-top temperatures, 113
 constituents, 111–112, 474
 wind velocity, 123
 bow shock, 128
 density, 113–114
 equatorial current, 123
 internal heat, 41, 113, 123
 internal structure, 113–114
 magnetic field, 127–128
 magnetosphere, 128
 mass, 114
 orbit, 16, 17, 18, 19, 67
 polar flattening, 30, 122
 radiation belts, 128
 radio emission, 123, 125
 radioactive heating, 113, 114
 rings, 29, 30, 34, 76, 122, 125–128, 129
 A ring, 125, 126, 127, 128, 129
 B ring, 125, 126, 127, 129
 C ring, 125, 126, 127, 129
 Cassini division, 125, 126, 127, 129, 337
 D ring, 127, 128, 129
 E ring, 126, 127, 128, 129
 Encke gap, 126, 127, 129
 F ring, 126, 127, 128, 129
 fine structure, 127
 G ring, 127, 128, 129
 Keeler gap, 128, 129
 Kirkwood resonances, 126, 127
 particle sizes, 126, 127
 propeller-shaped disturbances, 128
 ring arcs, 128
 spiral density waves, 127
 spokes, 126, 127
 theory, 34, 125–126
 rotation period, 122–123, 125
 satellites, 129
 Anthe, 128
 Atlas, 126, 129
 Calypso, 123, 129
 Daphnis, 128
 Dione, 121, 123, 124, 126, 127, 128, 129, 337
 Enceladus, 122, 124, 125, 126, 127, 128, 129, 289

510 Subject index

satellites (*cont.*)

- atmosphere, 125
 - plumes of water ice, 125, 128
 - surface age, 124
 - Epimetheus, 123, 124, 128, 129
 - Helene, 123, 129
 - Hyperion, 122, 124, 129, 316
 - Iapetus, 121, 123, 124, 129, 337
 - Janus, 123, 124, 128, 129
 - life, 246, *see also* 'Titan, life'
 - Methone, 128
 - Mimas, 122, 124, 126, 127, 128, 129, 289
 - Pallene, 128
 - Pan, 127, 129
 - Pandora, 126, 129
 - Phoebe, 122, 129, 317
 - Prometheus, 126, 129
 - Rhea, 121, 123, 124, 127, 128, 129, 337
 - Telesto, 123, 129
 - Tethys, 121, 123, 124, 126, 127, 128, 129, 337
 - Titan, 30, 121, 123–125, 128, 129
 - atmosphere, 123–124
 - methane, 123, 124
 - nitrogen, 123, 124
 - surface pressure, 123
 - temperature, 123, 124
 - water, 474
 - life, 248
 - surface
 - ethane, 124
 - lakes, 124–125
 - methane, 124, 125
 - temperature, 123, 124
 - shepherd satellites, 126, 127, 128
 - spacecraft to, 409, 410, 411, 431, 432, 447, 448, 449
 - spectrum, 111–112
 - white spots, 122, 123
- scattered disk objects, 158, 159
- Sedna, *see* 'detached object, Sedna'
- sextant, 7, 23, 315
- Seyfert galaxies, 233, 238, 459, 464, 469, 476, 479, 482
 - NGC 1068, 233
 - NGC 4151, 53, 233, 476
 - Type 1, 233
 - Type 2, 233, 236
- Shapley–Curtis debate, *see* 'universe, Shapley–Curtis debate'
- Sidereus Nuncius* (Galileo), 29
- Sloan Digital Sky Survey (SDSS), 234, 245, 253, 299, 300
- soft gamma repeaters, 210–211
 - SGR 0526–66, 210–211
 - SGR 1806–20, 211, 412
 - SGR 1900+14, 210–211
- solar nebula, 41, 71, 78, 95, 148, 152, 416
- solar system
 - age, 241–242
 - Descartes' vortex theory, 30
 - heliosheath, 449
 - Kepler's structure of solar system, 29
 - origin and evolution, theories, 71, 76–78
 - Bickerton, 76
 - Buffon, 71
 - Chamberlin and Moulton, 76
 - Jeans, 76
 - Kant, 71
 - Kuiper, 76–77
 - Laplace, 33, 71, 76
 - Urey, 77
 - von Weizsäcker, 76
 - size, 20
 - structure, 67–71
 - termination shock, 449
- solar telescopes, *see* 'solar observatories and telescopes' in separate index headed 'Optical/infrared telescopes and observatories'
- sounding rocket research (early), 53, 83, 188, 414
- sounding rockets
 - Aerobee, 188, 414
 - V2, 414
 - Viking, 414
 - WAC Corporal, 414
- South America and the Incas, 27
- Southern Cross, 15, 28, 314
- spacecraft, *see* separate index
- spectroheliograph, 274–275, 286, 338
- spectroheliokinematograph, 286
- spectrohelioscope, 275
- spectroscopic parallax, 166, 167, 332
- spectroscopy, 275–279
 - diffraction grating spectroscopy, 277
 - diffraction gratings
 - blazed, 278
 - concave, 277
 - échelle, 278
 - reflection, 277
- Fraunhofer lines
 - discovery, 275
 - early interpretation, 275–276
- Kirchhoff and Bunsen, 275–276
- multi-object spectrograph, 278
- objective prism spectroscopy, 277
- prism spectroscopy, 275, 277
- theory, 276–277
- spun-cast mirrors, 294, 295, 299
- starburst galaxies, 252–253, 369
- star catalogues, 176, 178–179, 180–181
 - Abd al-Rahman al-Sūfi, 22
 - Argelander, *Bonner Durchmusterung (BD)*, luminosities, 268–269
 - Argelander, proper motions, 178
 - Argelander, *Uranometria Nova*, 178
 - Auwers-Bradley, proper motions, 178
 - Bessel, 178
 - Bode, double stars, 178
 - Bradley, 178
 - Cannon and Pickering, *Henry Draper Catalogue*, spectra, 176, 178
 - Chinese, 176
 - Eratosthenes, 18
 - Flamsteed, 178, 315
 - Gill and Kapteyn, *Cape Photographic Durchmusterung (CPD)*, 266
 - Gould, *Uranometria Argentina*, 178, 300
 - Herschel, John, luminosities, 178
 - Herschel, William, double stars, 178
 - Hipparchus, 176, 178
 - Hipparcos (ESA), 178
 - Jackson and Stoy, *Cape Photographic Catalogue*, 341

- Müller and Kempf, *Potsdamer Durchmusterung (PD)*, luminosities, 178, 268, 269, 270
- Pickering, Edward, *Harvard Photometry Catalogue (HPC)*, 269
- Pickering and Bailey, *Revised Harvard Photometry Catalogue*, 269
- Pickering and Fleming, *Draper Memorial Catalogue*, spectra, 175, 178, 179, 277
- Ptolemy, *Almagest*, 6, 15, 19, 22, 178, 270
- Russell, parallaxes, 178
- Schlesinger, *General Catalogue of Stellar Parallaxes*, 178
- Schwarzschild, *Göttinger Aktinometrie*, luminosities, 269
- Secchi, spectra, 175, 178
- Seidel, luminosities, 268
- Thome et al., *Cordoba Durchmusterung*, 300
- Timocharis and Aristillus, 176
- Tycho catalogue (ESA), 470
- Tycho-2 catalogue (ESA), 178, 470
- Tycho Brahe, 178
- U.S. Naval Observatory
 UCAC2 catalogue, 179
 USNO B1.0 catalogue, 179
- Ulugh Beg, 7, 23
- Vogel and Scheiner, radial velocities, 178
- Yale Parallax Catalogue, 185
- see also* *Alfonsine Tables*, *Prutenic Tables* and star catalogues in Table 3.2 of main text, in addition to those listed above
- star clusters, *see* 'open star clusters'
- stars
 general
 atmospheres, 165–166, 175, 176, *see also* 'stars, general, evolution'
 diameters, 170, *see also* 'neutron stars' and 'white dwarfs'
 discovery of giants and dwarfs, 170
 distances, 166–167
 dust discs/shells, 52, 77, 160, 199, 285
 β Pictoris, 160, 466, 474
 Fomalhaut, 160
 Vega, 52, 77, 160
 energy production, 173–174
 B²FH paper, 174, 215
 carbon cycle, 39, 173–174
 heavy elements, 174, 242
 proton-proton cycle, 173–174
 triple-alpha process, 174
 evolution, 179, 181–184
 Bok globules, 183
 Hayashi tracks, 183, 196
 heat transportation, 172, 173, 183
 helium flash, 183
 Heney, LeLevier and Levee tracks, 183
 Lockyer's theory, 179
 Öpik's theory, 183
 Ritter's theory, 179
 Russell's theory, 181–182
 Schönberg and Chandrasekhar's theory, 183
 Vogel's theory, 179
 Zöllner's theory, 179
 formation, 196, 197, *see also* 'stars, general, dust discs/shells'
 giants, 168, 170, 171, 173, 174, 183, 202, 205, 214
 internal structure, 170–173
 ionisation, 165, 169
 magnetic fields, 167, *see also* 'magnetars', 'polars' and 'pulsars'
 masses, 167–168, 172, *see also* 'stars, general, mass-luminosity relationship'
 mass-luminosity relationship, 171, 172, 187, 219
 population I and II stars, 165, 213, 256
 proper motion, 166, 178, 185, 225, 226
 rotation, 168–169, *see also* 'pulsars'
 temperatures, 169, 171, 172, 173, 174, 178, 179, 181, 182, 183
 winds, 197, 198, 205, 478
- individual
 61 Cygni, 166, 266
 Aldebaran, 26, 28
 Altair, 168, 284, 285
 Antares, 9, 13, 170
 Arcturus, 9, 170, 264, 273
 Betelgeuse, 174, 264, 284, 474
 Mira, 210
 Rigel, 26, 27, 273
 Sirius, 13, 25, 26, 28, 168, 172, 174, 273, *see also* 'binary stars, Sirius'
 Vega, 27, 52, 77, 160, 166, 168, 169, 265, 271, 277
 α Herculis, 273
- spectra
 Am-type, 167, 168
 Ap-type, 167, 168
 Be-type, 200, 201, 203, 221, 222
 c-type, 170, 179
 L-type, 175, 191
 Pickering lines, 169
 T-type, 190, 191
- spectral classification, 174–176, 177–178
 Harvard system, 175–176, 177–178
 MK or Yerkes system, 176
 Secchi's system, 175
see also, in particular, 'binary stars', 'star catalogues', and 'variable stars'. Numerous other types of stars, like 'neutron stars', 'pulsars', 'red dwarfs', 'red giants', 'white dwarfs', etc. are listed elsewhere in this index
- Steady State theory, 242, 243
- stellar aberration or aberration of light, 166
- stellar dust discs, *see* 'stars, general, dust discs/shells'
- Steward Observatory Mirror Laboratory, 294, 299
- Sub-Saharan Africa, 28
- Sun
 age, 241, 242
 central temperature, 79
 chromosphere, 80, 82, 165, 361, 435, 436, 442, 450
 convective layer/zone, 263
 corona
 holes, 81, 404, 435
 loops, 81, 440, 442
 mass ejections (CMEs), 81, 84, 416, 419, 434, 435, 436, 440, 441
 temperature, 80, 82
 waves, 436
 X-ray bright points, 435
 distance, *see* 'Sun, parallax'
 eclipses, *see* 'eclipses, solar'
 faculae, 80, 82
 flares, 79, 80, 81, 82, 83, 84, 264, 356
 gamma-ray emission, 431
 heat
 production, 79, 80, 82
 transportation, 79
 hydrogen and helium most abundant elements, 79, 165
 internal structure, 82, 263–264

512 Subject index

Sun (*cont.*)

- location in Milky Way, *see* 'Milky Way, location of Sun'
- M regions, 80, 81
- magnetic field, 80–82, 167
 - magnetic carpet, 82
- magnetic reconnection, 82
- microflares, 434, 450
- neutrino anomaly, 82
- oblateness, 434
- oscillations, 263–264
- parallax, 19, 33, 68
- photosphere, 79, 80, 81
- plasma, 80, 83, 84, 85
- polar coronal jets, 440
- polar plumes, 436
- prominences, 76, 79, 81, 152, 265, 274, 276, 435
- radio emission, 80, 81, 356
- radiometry, 272, 273
- rotation, 79
 - differential rotation, 79
- solar constant, 82, 273, 274, 404, 437
- solar irradiance, *see* 'Sun, solar constant'
- solar moss, 442
- solar wind, 81, 82, 84, 85, 94, 121, 128, 132, 137, 148, 149
- spectrum, 79–80
 - discovery of helium, 276, *see also* 'spectroscopy, Fraunhofer lines' and 'Sun, sunspots, spectra'
- sunspots, 12, 79–80, 82, 263, 265, 274
 - cycle, 79, 80, 82, 263
 - early photography, 285
 - magnetic fields, 80
 - Maunder Minimum, 82
 - radio emission, 80
 - spectra, 80
 - Spörer Minimum, 82
 - temperature, 79
- surface or effective temperature, 79, 272–273
- tachocline, 263
- ultraviolet emission, 80, 81, 84
- X-ray emission, 80, 81, 82, 84
- sundial, 7–8, 13, 23
- supergiants, *see* 'variable stars, eruptive variables'
- superluminal motion, *see* 'quasars, superluminal motion'
- supernovae, 13, 174, 202, 203, 206, 212–215
 - Type I, 202, 213, 214–215, 244
 - Type II, 174, 213, 214, 215
- named
 - in IC 4182, 213
 - of 185, 13, 212
 - of 393, 212
 - of 1006, 212
 - of 1054, 13, 26, 206, 212, 215, 216
 - of 1181, 212
 - of 1572 (Tycho's), 212–213, 216
 - of 1604 (Kepler's), 212–213, 216
 - of 1885, S Andromedae, 212–213
 - of 1895, Z Centauri, 213
 - of 1909, Wolf's 'nova', 213
 - SN 1987A, 213–214
 - SN 1998bw, 202
 - SN 2003dh, 202

- supernova remnants, 53, 54, 203, 206, 211, 215–218
 - Cassiopeia A, 217–218
 - Crab nebula, 53, 215–216
 - CTA 1, 465
 - G10.0–0.3, 211
 - Kepler's star, 216–217
 - N49 in Large Magellanic Cloud, 210, 211
 - Tycho's star, 216–217
 - Vela, 218
 - 1987A, 214
- Systema Saturnium* (Huygens), 30
- T Tauri stars, 77, 167, 196–197, 285
- telescopes, *see* separate indexes 'Optical/infrared telescopes and observatories' and 'Radio/submillimetre telescopes and observatories'
- The Face of the Moon* (Baldwin), 92
- The Realm of the Nebulae* (Hubble), 251
- Titius-Bode series, 134, 139
- Toledo Planetary Tables* (Ibn al-Zarqällu), 14
- Traité de Mécanique Céleste* (Laplace), 33
- Trans-Neptunian Objects, 157–159
- Triangulum nebula/galaxy (M33), 251, 255
- Two Micron All Sky Survey (2MASS), 253, 323, 330
- ultraluminous infrared galaxies, 474, 481
- United States
 - Air Force, 143, 287, 294, 322, 330, 432
 - Army, 287, 364, 395, 413, 432
 - Congress, 249, 320, 329, 333, 334, 345, 382, 460, 462, 470
 - Department of Defense (DoD), 56, 325, 365, 366, 373
 - National Academy of Sciences, 44, 317, 333, 378, 382, 410
 - Space Science Board, 432
 - National Research Council (NRC), 319, 382, 423, 481
 - National Science Foundation (NSF), 288, 299, 319, 320, 321, 322, 323, 333, 334, 352, 365, 366, 377, 378, 379
 - Senate, 395
- universe
 - accelerating, 244
 - age, 241–245
 - expanding, 242, 243
 - geocentric, 17, 18, 20, 23
 - heliocentric, 16, 18, 21, 23, 29
 - infinite, 13, 15, 17, 225, 229, 241, 245
 - large scale structure, 253
 - anisotropy, 253
 - Great Wall, 253
 - Sloan Great Wall, 253
 - Shapley-Curtis debate, 255
 - see also* 'cosmology'
- Uranus, 33–34, 72, 78, 111–112, 113, 114, 128–133
 - atmosphere, 111–112
 - clouds, 130
 - constituents, 111–112, 474
 - wind velocity, 130
 - bow shock, 132
 - density, 113
 - diameter, 129
 - discovery, 33–34, 128
 - naming the planet, 129, 130
 - pre-discovery observations, 130

- equatorial jet, 130
- helium abundance, 51
- internal heat, 114
- internal structure, 113–114
- magnetic field, 132
- magnetosphere, 132
- magnetotail, 132
- mass, 130
- orbit, 33, 128, 129, 133, 134, 156
- plasma sheet, 132
- polar flattening, 130
- radiation belts, 132
- radio emissions, 132
- rings, 130, 131–132, 133
 - discovery, 51
- rotation period, 130
- satellites, 133
 - Ariel, 130, 131, 132, 133
 - Cordelia, 130, 133
 - Miranda, 130, 131, 132, 133
 - Oberon, 130, 131, 133
 - Ophelia, 130, 133
 - Puck, 130, 133
 - Titania, 130, 131, 133
 - Umbriel, 130, 131, 132, 133
- shepherd satellites, 130
- spacecraft to (Voyager 2), 447–449
- spectrum, 111–112
- USSR Council of Ministers, 439
- Van Allen radiation belts, 84, 85, 413, 420, 435, 439
- variable stars, 196, 201, 207, 210
 - eruptive variables, 196–201
 - Be stars/ γ Cassiopeiae variables, 200–201
 - supergiants, 198–200
 - luminous blue variables, 198–200
 - P Cygni, 199–200
 - η Carinae, 198–199
 - R Coronae Borealis type stars, 200
 - RY Sagittarii, 200
 - see also* ‘flare stars’, ‘T Tauri stars’ and ‘Wolf-Rayet stars’
 - pulsating variables, 207–210
 - long period variables, 210
 - Mira (o Ceti), 210
 - R Geminorum, 210
 - β Cephei/ β Canis Majoris variables, 209
 - δ Scuti variables, 209–210
 - see also* ‘Cepheid variables’, ‘RR Lyrae or cluster variables’
 - see also* ‘cataclysmic variables’
- Venus, 9, 10, 12, 18, 19, 24, 27, 28, 31, 72, 99–104
 - Aphrodite Terra, 102, 103, 443
 - atmosphere, 100, 101
 - circumpolar collar, 102
 - constituents, 101, 102, 103
 - double-eyed vortices, 103
 - south polar vortex, 103
 - surface pressure, 101, 102
 - temperature, 102
 - ultraviolet absorbers, 103
 - wind velocity, 102, 103
 - see also* ‘Venus, clouds’
 - Beta Regio, 102, 103
 - clouds, 100, 102
 - cloud-top height, 101
 - cloud-top temperature, 101
 - sulphuric acid, 102, 103
 - water vapour, 101
 - density, 41, 87
 - diameter, 99
 - Diana Chasma, 102
 - distance, 373
 - Ishtar Terra, 102, 103
 - Lakshmi Planum, 102
 - life, 246, 248
 - magnetic field, 101
 - Maxwell Montes, 102
 - orbit, 16, 17, 18
 - phases, 10, 99
 - radiation belts, 101
 - radio emission, 101
 - rotation period, 100, 101
 - spacecraft to, 396, 399, 423, 424, 426, 427, 432, 433, 443–445
 - spectrum, 101
 - surface
 - age, 102, 103
 - craters, 101, 102, 103
 - images from, 102
 - lava flows, 102, 103
 - map, 101, 102
 - tectonic activity, 102, 103
 - temperature, 101, 102
 - volcanic rock, 102
 - volcanoes, 100, 103
 - pancake domes, 103, 104
 - Rhea Mons, 102
 - Theia Mons, 102
 - synodic period, 10, 24
 - terminator, 99
 - transits, 99–100, 265
 - water, 101
- Virgo A, *see* ‘active galaxies’
- Vulcan, 97
- water clock, 8
- white dwarfs, 183, 194, 195, 196, 202, 203, 205, 214, 215, 218–219, 220, 464, 479
 - discovery, 219
 - magnetic, 195–196
 - named
 - 40 Eridani B, 218–219
 - Procyon B, 218–219
 - Sirius B, 218–219
 - spectral classification, 177, 219
- Wolf-Rayet stars, 197–198, 252
 - ζ Puppis, 169
- Wolter-type X-ray telescopes, 453, 460, 469, 479, 484
- X-ray background radiation, 256–257
- X-ray bursters, 219–220
 - 4U 1820–30, 219, 220
 - rapid burster MXB 1730–335, 220

514 Subject index

- X-ray bursters (*cont.*)
 - Type I bursts, 220
 - Type II bursts, 220
- X-ray sources (early)
 - Crab nebula, 53
 - Cyg X-1, 188
 - Sco X-1, 53
- X-ray transients, 220–222
 - Cen X-2, 220
 - hard transients, 221–222
 - A0538-66, 221
 - V0332+53, 222
 - soft transients, 220–221
 - A0620-00, 221
 - Cen X-4, 220–221
 - GS2023+338 (V404 Cygni), 221
- year
 - anomalistic, 11
 - sidereal, 11, 19, 21, 154
 - tropical, 12, 13, 19, 21, 24, 154
- zig-zag function, 11, 21
- zodiacal light, 26, 308, 474