

Index

Aarseth, S., 113	Bellovary, J., 163	Cerro Paranal, 130–132, 137
accretion event, 144–147, 173	Beloborodov, A., 139	Chandrasekhar, S., 6, 111
active optics, 131, 133	Binney, J., 95	Chandrasekhar limit, 6
adaptive optics, 131–138, 146, 148, 165, 179	black body radiation, 43	Chiu, H.-Y., 55
Agol, E., 175	black hole, rotating, 103	Christiansen, W., 45
Alicanto, 130, 145	Blandford, R., 102, 113	CND, circumnuclear disk, 121, 122, 124, 168
Allen, D., 119, 120, 123, 124, 148	Blandford–Znajek mechanism, 103	coalescence of colliding stars, 8, 9, 63, 64, 144
ALMA, Atacama Large Millimeter Array, 176	Blitz, L., 94	COBE, Cosmic Background Explorer, 94
alternatives to black hole, 110	Bolton, J., 48	Colgate, S., 8, 9, 62, 63
Ambartsumian, V., 83, 84, 87, 93, 98, 116, 180, 181	boson, 111, 112	Columbia University, 10, 42, 81
Arp, H., 55	boson star, 112	Compton wavelength, 112
Backer, D., 76, 148	Brown, R., 74, 75, 147	continuum radiation, 4, 7, 8, 43, 48–51, 70, 73, 74, 79, 85, 101, 109, 116, 118, 119, 122, 150, 160, 171, 177
Baganoff, F., 165	Brown, W., 144	cosmological constant, 157
Bahcall, J., 53	bulge, disk galaxy spheroid, 3, 70, 71, 76, 93, 94, 117, 152–155, 158, 166, 167, 169	Curtis, H., 21, 99
Baker, S., 4	Burbidge, G.R., 56–60	Cygnus A, 52, 57, 83, 101, 102, 114
Balick, B., 74, 75, 147	Burkert, A., 174	dark matter, 11, 42, 157, 172
bar model for gas motions, 93–95	Burton, M., 124	de Sitter, W., 24, 33, 38
bar, figure rotation, 90, 92	Burton, W.B., 47, 93–95, 121	de Vaucouleurs, G., 89, 92, 93, 97
barred spiral galaxy, 83, 89–93, 114	Caltech (California Institute of Technology), 5, 7, 52, 54, 56, 73, 120, 137	
Barthel, P., 121	Cape Photographic Durchmusterung, 14	
Becklin, E., 71, 73, 76, 77, 121, 140, 168	central molecular zone, 167	
Begelman, M., 164	Cepheid variables, 17–19, 22, 177	
Bell Labs, 43		

194 Index

dense stellar system, 8, 62, 63, 111	feedback, 98, 155–157, 159–161, 164, 181	Hale, G.E., 14
Diamond, P., 108	Fermi Bubbles, 171, 173	halo stars, 38, 41
dissipation, 61	Fermi Large Area Telescope (LAT), 171	Harvard University, 44, 45
Doeleman S., 175	fermion, 111, 143	Hazard, C., 52
Doppler boosting, 100	Ferrarese, L., 154	Heisenberg Uncertainty Principle, 112
Doppler shift, 43	Field, G., 149, 163	Herrnstein, J., 108
Dressler, A., 150, 151	Finkbinder, 172	Herschel, W., 16
duty cycle, 145	FitzGerald, G., 27	Hertzprung, E., 19
Dwingeloo radio telescope, 45, 47, 52, 76, 84, 160	frame dragging, 103	Hewish, A., 52
dynamical evolution of stellar systems, 61, 62, 111	Friedmann, A., 42	Hills, J., 144, 161
Eckart, A., 126, 138	Galilean transformation, 26–28	Hindman, J.V., 45
Eddington, A., 32, 33, 37, 145	Galileo Galilei, 2, 15, 29	Hipparcos satellite, 41
Eddington limit, 145, 156, 162, 163, 169, 171	gamma rays, 170	Hoffman, W., 78
Einstein, A., 23, 25, 28, 29, 31, 33	gas flow in bar potential, 91	hot spots, 101
Eisenhauer, F., 141	gas motion on periodic orbits, 90	Hoyle, F., 60
Ekers, R., 73, 74, 79, 80, 119	Gatley, I., 121	Hubble, E., 18, 22, 42, 89
electron scattering, 170	Gebhardt, K, 154	Hubble law, 7, 8, 52, 54, 57
elliptical galaxies, 58, 67, 83, 99, 100, 105, 150, 153–155, 166	General Relativity, 5, 6, 23, 25, 31–33, 36, 42, 145, 147	Hubble Space Telescope, 132, 133, 150
elliptical orbits, 4, 22, 96, 116, 128, 141	Genzel, R., 77, 123–126, 137–139, 146, 148, 180	Huntley, J., 95
elliptical streamlines, 93–96	Gezari, S., 163	Iguchi, T., 82
Emonts, B., 160	Ghez, A., 126, 135, 137–139, 146, 148, 168, 174, 180	Inoue, M., 108
Equivalence Principle, 29, 30, 32	Gill, D., 14	interstellar dust, 2, 3, 23, 24, 42, 43, 45, 50, 69–71, 76–80, 119, 121, 123, 172, 177
European Southern Observatory (ESO), 117, 124, 131, 139	Gingerich, O., 115	inverse Compton emission, 172, 173
event horizon, 35–37, 64, 103, 148, 162, 175, 176, 178, 180	globular star clusters, 19, 21, 38, 41, 62, 177	iron line at 6.4 KeV, 170
Ewen, H., 44, 45	Goss, W.M., 79, 80	IRS 7 region, 76, 77, 118
Faber–Jackson relation, 154	Great Debate, 21	IRS 16 region, 77, 118–120
Fabian, A., 157, 159	Greenbank interferometer, 75, 76	Jahnke, K., 157
Falcke, H., 175	Greenhill, L., 108	Jansky, K., 43
far-infrared emission, 78	Greenstein, J.L., 54, 55, 64	Jeans, J., 124
Feast, M., 41	Groningen, 12–14, 16, 18, 22, 23, 25, 38, 45, 74, 79, 115, 177	Jeans equation, 124–126, 138, 140, 151, 152
	Grossman, M., 31	jet formation, 102
	Güsten, R., 121, 122	jet formation by disks, 103
		jet model, 99–102
		jets in Seyfert galaxies, 105
		jets, relativistic, 103

jets, superluminal, 105	Lorentz, H., 27	molecular clouds, 80, 81, 116, 164, 167–171
Jodrell Bank, 45	Lorentz transformation, 27, 28	Moran, J., 108
Kaifu, N., 82, 95	Low, F., 76	Morley, E., 27
Kant, I., 16, 22, 38	Lynden-Bell, D., 9, 10, 65, 66, 73, 74, 114, 115, 149, 158, 178, 179	Morris, M., 126, 168, 174
Kapteyn, J.C., 12, 14–16, 18–24, 39, 42, 44, 50, 115, 119, 147, 177, 181	Lynds, C.R., 59	Morton, D.C., 6
Kapteyn Universe, 16, 20, 115		Moscow, 5
Kato, T., 82	M31, 150–153	Mount Wilson Observatory, 19
Keck telescopes, 131, 132, 135–138, 141, 146	M32, 150, 153, 163	Mulder, W., 95
Kepler’s laws of planetary orbits, 36, 46, 119, 140, 142, 143, 147, 152	M82, 10, 59, 60, 84, 97, 99, 173	Muller, C.A., 45, 46
Kerr, F.J., 47	Macció, 157	National Radio Astronomy Observatory, NRAO, 74, 79
Kerr, R., 103	Mach, E., 31	near-infrared emission, 69, 73, 79, 95, 118, 119, 166
Kerr solution, 103	Mach’s principle, 31	neon line at 12.8 microns, 77, 123
Kerr–Westerhout map of Galaxy, 47	Mackey, M., 52	Neugebauer, G., 71, 73, 76, 78, 140
Kormendy, J., 150, 151	Magorrian, J., 154	neutral hydrogen 21-cm line, 42, 44–46, 48, 49, 51, 52, 66, 69, 73, 81, 84, 87, 90, 93, 121, 146, 160, 177
Koyama, K., 171	Maiolino, R., 160	neutrino, 111
Kwee, K.K., 46	Makai, N., 108	neutrino star, 111–113, 143
	Massachusetts Institute of Technology (MIT), 87	neutron star, 7, 65, 110–112, 118, 171
	Mathews, T., 52, 54	Newcomb, S., 31
	Mathewson, D., 85, 107	Newton, I., 15, 26
	Mauna Kea, 129–131, 137, 176	Newtonian dynamics, 25, 26
	Maxwell, J., 27	Newtonian gravity, 15
	Maxwell’s equations, 25–28	NGC 1068, 58, 105
	McGee, R., 48	NGC 4258, anomalous arms, 85, 87, 88, 108, 180
	megamasers, 108	NGC 4258, anomalous arms as jets, 107
	Melia, F., 175	NGC 4258, black hole, 106, 107, 110, 112–114, 121, 143, 149
	Merritt, D., 154	NGC 4258, rotation velocity in nuclear disk, 109
	Meyer, L., 174	nonthermal emission, 43
	Michell, J., 35	
	Michelson, A., 27	
	Michelson–Morley experiment, 27, 28	
	mid-infrared emission, 71, 76, 77, 79, 123	
	mini-spiral, 79, 80, 116, 119, 121–123, 143, 148	
	Miyoshi, M., 108	
	modified Newtonian dynamics, 28	

196 Index

Oort, J.H., 12, 24, 38–52, 59, 66, 69, 71–73, 78, 82, 84–87, 92, 93, 97, 107, 115–117, 119, 123, 128, 146, 177, 180, 181	resolving power, 52, 132, 133, 146	Shapley, H., 18–22, 41, 42, 99, 177
Oppenheimer, J.R., 111	Rice University, 4	Shaver, P., 56
Ostriker, J.P., 6, 115	Richstone, D., 150, 151	Shimmons, A., 52
Owens Valley interferometer, 74	Rieke, G., 76, 116, 123	Shklovsky, I., 44, 57, 100
	Riemann, B., 31	Shu, F., 87
	Roberts, D., 80	singularity, 5, 37, 61, 111, 148, 180
	rotating massive disks, 65	
	Rougoor, G.W., 46–48, 66, 72, 87, 92, 93, 97	Slater, T., 172
	runaway coalescence, 63, 64	Soldner, J.G. von, 32
Palenzuela, C., 113	Russell, H.N., 18	Soltan, A., 158
paradox of youth, 114, 115, 126, 143	Ryle, M., 51, 52, 57, 101, 102	speckle imaging, 133, 136–138
Pele, goddess of fire, 129, 130, 145, 165, 173–175		Spergel, D., 94
Penrose, R., 5	Salpeter, E., 64, 65	Spitzer, L., 4, 8, 9, 61, 62
Phinney, S., 120, 126	Sandage, A., 52, 55, 59, 60	Sramek, R., 76, 148
Pickering, E., 16	Sanders, R., 64, 87, 95, 120, 127	star streams, 16
Planck, M., 25	Saslaw, W., 8, 62, 113	Stark, A., 169
Poincaré, H., 27, 34	Scheuer, P., 102	stellar collisions, 3, 8, 60–65, 67, 72, 111, 144, 161
Potsdam Observatory, 34	Schödel, R., 140, 141	stellar orbits, 129
Prendergast, K., 10, 87	Schmidt, M., 7, 46, 52–56, 64, 115	stimulated emission, 107
Princeton University, 4–6, 10, 18, 149, 150	Schwarz, U., 79	Stone, M.C., 8
Principe eclipse expedition, 33	Schwarzschild, K., 34, 35	Su, M., 172
Purcell, E., 44, 45	Schwarzschild, M., 4, 150	Sullivan, W., 42
	Schwarzschild radius, 35–37, 55, 63, 64, 112, 143, 163, 174–176	Sunyaev, R., 169
quantum mechanics, 25	Schwarzschild solution, 35	supermassive stars, 60, 63, 65
quasars, quasi-stellar radio sources, 7–10, 53, 55–68, 83, 100, 104, 105, 114, 118, 148, 149, 157, 158, 160, 161, 163, 164, 166, 178, 179	Scoville, N., 81, 95, 97, 116	supernovae, 6, 9, 48, 51, 57, 63, 65, 67, 74, 75, 85, 87, 99, 116, 117, 149, 154, 155, 167, 168, 173
	Seeliger, H. von, 15, 32, 34	synchrotron emission, 55, 57, 63, 74, 86, 100, 102, 172, 173
	Serabyn, E., 123, 148	
	Seyfert, C., 10	
	Seyfert galaxy, 10, 58, 65, 68, 105, 106, 158, 166	3-kiloparsec arm, 49, 69, 84, 85, 87, 88, 95, 96, 116
Reber, G., 43	Sgr A*, compact radio source at Galactic Center, 4, 75–80, 114, 118–121, 123, 124, 126, 128, 137–140, 145, 147, 148, 165, 168–171, 173, 175, 176	tidal disruption of stars, 163, 164
redshift, 7–9, 30, 36, 42, 52, 54–59, 105, 149, 157, 158, 160, 161, 164		Tonry, J., 153
Rees, M., 9, 63, 75, 102, 105, 113, 115, 156, 164, 178		Townes, C., 77, 148
Reid, M., 76		Trautmann, D., 112
		Tremaine, S., 152

Tupper, G., 112	van Woerden, H., 48	Wilson, A., 106
two star streams, 38	Very Large Array (VLA), 73, 79, 80, 101, 105, 121	WMAP haze, 172, 173
Ulvestad, J., 106	Very Large Telescope (VLT), 131, 132, 137, 142, 146	WMAP (Wilkinson Micro-wave Anisotropy Probe), 172
University of Cambridge, 5, 6, 9, 13, 51, 52, 57, 63, 101, 102, 156, 157, 159, 160, 164, 178	Viollier, R., 112	Wollman, E., 77
University of Groningen, 13, 38, 73	Virgo A jet, 100	Woltjer, L., 59, 61
University of Oxford, 5, 95	Volkoff, G., 111	working surface, 102
University of Texas, 103	Volonteri, M., 163, 164	Wright, T., 15
University of Utrecht, 14, 44	Wardle, M., 166	X-ray echos, 169
Valtonen, M., 113	water vapor maser line, 107–110, 114, 143, 150	X-ray emission, 165, 169
van de Hulst, H., 44, 45	Werner, M., 121	X-ray flares, 166
van der Hulst, J.M., 121	Westerbork Radio Synthesis Telescope, WRST, 50, 73, 74, 85, 107, 183	Yale Observatory, 38
van der Kruit, P.C., 84–86, 88, 93, 107	Westerhout, G., 46, 47	young stars, 3, 6, 7, 115, 116, 119–121, 123, 125, 126, 128, 137, 139, 143, 144, 146–148, 165, 170, 175
van Gorkom, J., 79	Wheeler, J., 5, 35	Yusef-Zadeh, F., 80, 166
van Maanen, A., 22	white dwarf, 6, 7, 112, 178	Zeldovich, Y., 64
	Whitelock, P., 41	