

## INDEX

- 1968 AA, 418, 419, 644  
Ablation, 476, 477, 481  
Absorption bands, 51-53, 58-64  
Accretion (asteroids, also grains), xix, xx,  
115, 214-221, 225-236, 247-256, 306,  
308, 320, 325, 327, 331, 362, 401,  
403, 404, 474, 475, 477, 543, 564,  
655, 657  
Accretion temperature, 233, 234, 236,  
442, 443  
588 Achilles, 410  
Adams, J. B., 50-53, 59, 61, 64, 69, 70,  
77, 92, 93, 111, 115, 306, 482, 562,  
566  
145 Adeona, 45  
Adonis (1936 CA), 418, 419, 427, 428,  
440, 465, 644, 646, 647  
132 Aethra, 420  
Aethra family, 437  
911 Agamemnon, 410  
Age (*see under* Asteroid; Meteorite; etc.)  
Ahmad, I. I., 88, 89, 123, 129  
1404 Ajax, 410  
Ajne, B., 361, 362  
Aksnes, K., xv, 648-653  
Albedo (*see under* Asteroid; Grains)  
719 Albert, xviii, 415, 420, 427  
Albert-type asteroids, 423, 425, 427, 428  
Alexander, E. C., Jr., 432, 445  
Alexander, M. A., 365, 366, 373, 379,  
383, 387  
Alexander, W. M., 366, 371  
Alfvén, H., vii, xvi, xix, xx, 23, 154, 175,  
205, 209, 213-223, 244, 247, 249, 264,  
291, 306-309, 311, 315-317, 319, 326,  
327, 335, 337, 348-351, 353, 360-362,  
404, 405, 473-479, 485, 486, 543, 544,  
560, 566, 574, 605, 657, 658  
Alfvén streams, 348-350, 658  
887 Alinda, 23, 415, 419, 425, 427, 641,  
642, 644, 657, 658  
All Sky Camera Network (Czechoslo-  
vakia), 480  
Allen, C. W., xv, 36, 37, 48, 50, 67, 76,  
259, 262, 365, 371, 379, 386, 390, 393  
Allen, D. A., 41-44, 46, 50, 562, 654, 656  
Allen, H. J., 395, 396  
Aller, L. H., 365, 371, 379, 380, 386, 387  
1221 Amor, xviii, 16, 17, 19, 419, 483,  
484, 526, 641, 644  
Amor objects, xvii, 418, 643-647  
29 Amphitrite, 63  
Amplitude (*see* Lightcurve)  
Amplitude-aspect relationship, 128,  
135-139, 148-153, 656  
Anahita stream, 350  
1173 Anchises, 410  
Anders, E., 36, 37, 44, 52, 64, 115, 214,  
217, 221, 222, 225, 227, 228, 236,  
239, 244, 251, 256, 259, 262, 263,  
281, 291, 306, 313, 314, 403, 429-446,  
459, 460, 479-487, 566, 622, 630, 657,  
658  
Anderson, J. D., 562, 577-583, 588, 589,  
658  
1172 Æneas, 410  
965 Angelica, 415  
1583 Antiochus, 410  
Apollo (1932 HA), xvi, xviii, 418, 419,  
428, 440, 465, 526, 644, 646  
Apollo asteroids, xvii, xx, 53, 417-419,  
423, 425, 427, 428, 439-441, 449, 455,  
457, 458, 473, 476, 543, 598, 643-648,  
653, 658  
Apollo mission data and material, 115,  
216, 240, 309, 392, 441, 474, 489,  
539, 544, 554, 570-574  
Arc jet, 491  
Arcadia family, 347  
Archer, J. L., 528, 536  
Arecibo dish, 171  
Arend, S., xxvi  
Arend-Rigaux, 410, 414, 416, 417, 424,  
427  
197 Arete, 34, 38  
Arnold, 341, 343, 347

- Arnold, J. R., 53, 64, 175, 177, 179, 180, 306, 311, 314, 337, 342, 343, 348, 349, 353, 354, 357, 358, 361, 362, 434, 435, 438, 440, 444, 448, 450, 458, 479, 485
- d'Arrest, 410, 424, 492
- Arrhenius, G., vii, xvii, xx, 115, 213-223, 247, 249, 306, 308, 309, 311, 327, 335, 353, 362, 404, 405, 459, 473-479, 485, 543, 544, 560, 566, 574, 658
- Ash, M. E., 19, 21, 165, 171
- Ashbrook, J., xxvi
- Ashbrook-Jackson, 410
- Aspect angle, 79, 87, 122, 137, 148, 150-152
- Asteroid
- age, xx, xxiii, 288-290, 437, 438, 441, 595
  - albedo, 41-44, 47-50, 52, 53, 59, 67-71, 75-77, 88, 100, 104, 105, 107, 111, 112, 141-146, 155, 158, 266, 287, 289, 290, 306, 391, 437, 474, 482, 562, 563, 596, 599, 603, 607, 625, 652
  - belt, xiii, xiv, xvii, xxii, xxiii, 44, 52, 75, 112, 177-181, 188-192, 198-204, 231, 233, 236, 255, 263, 266-270, 273, 284, 288, 290, 299, 306, 317, 353-355, 366, 369, 370, 374, 389-393, 404, 405, 418, 434-438, 441, 442, 448, 451, 452-457, 465-468, 473, 476, 479, 483-486, 505, 513, 527, 529, 533-537, 562-565, 572, 595-615, 622-624, 633-637, 641, 657
  - capture, 399-405
  - comet evolution (*see* Evolution)
  - comparison with comets, meteorites (*see under* Comet; Meteorite)
  - comparison with Venus and Mercury, xvi, 42, 167-170
  - composition, v, xxiv, 51-53, 59, 63, 67-79, 115, 116, 213, 219, 236, 416, 474, 482, 486, 641
  - debris, xxi, xxii, 115, 262, 264, 272, 281, 367-370, 434-438, 456, 596
  - density (*see under* Density)
  - distribution, xix, xx, 57, 173, 177, 183, 187-195, 198-209, 213-215, 247-250, 263-295, 225-229, 234, 307, 337-340, 344, 349, 351, 356, 359-361, 367, 390-393, 413, 469, 474, 475, 639
  - evolution (*see* Evolution)
  - experiments (*see* Experiments)
  - families (*see also* Asteroid, groups), xviii, xix, 53, 63, 173, 177-181, 200-206, 313, 337-352, 429, 435-439, 448, 451, 469, 479-484, 595, 598, 601-604, 655, 658
  - flux, xxii, 46, 49
  - formation, xix, xx, 220, 221, 225-237, 258, 448, 456, 460, 480-483, 486, 489, 543, 574
  - fragmentation, xviii, xx, xxiii, 37, 53, 162, 179, 215, 220, 221, 225, 229-233, 247, 251, 263-295, 297-314, 325-327, 362, 403, 437, 438, 447, 473, 480-482, 486, 566, 595, 654, 655
  - groups (*see also* Asteroid, families), xvii-xix, 75, 173, 265-290, 305-314
  - internal constitution, 305-314
  - laboratory work (*see* Laboratory work)
  - lightcurves (*see* Lightcurve)
  - magnetospheres, 567-570, 573, 574
  - magnitude (*see* Magnitude)
  - mass, xvii, xxi, 14, 33-39, 42-95, 197, 215, 225-233, 236, 247-250, 262, 297-307, 391, 392, 403, 404, 423-425, 437-441, 461, 465, 466, 474-477, 528, 562, 564, 577-595, 602, 603, 607, 615, 640
  - mass distribution, 263, 269, 270, 273-291, 597-603
  - melting (*see* Melting)
  - Meteoroid Detector (A/MD) (*see under* Pioneers F and G)
  - meteors (*see* Comet, -meteor-asteroid interrelations)
  - missions (*see under* Space missions)
  - models, 45-50, 67, 80-90, 111, 133-137, 141-146, 147-152, 155, 158-161, 170, 225, 228, 247-250, 306, 320, 362, 365-367, 370-372, 423-428, 486, 574, 590, 596, 599, 622, 625
  - names, xiv, 654
  - pole determination (*see* Axes orientation)
  - poles, 133-139, 151, 161, 205, 257, 258
  - ring (*see also* Asteroid, belt), xvii, xix, 33, 39, 228, 229, 434, 450, 457
  - rotation (*see* Rotation period)

- roughness, 42, 43, 47-50, 79-90, 111, 153, 168, 169, 287, 385
- semimajor axes, xvi-xx, xxiii, 52-57, 63, 174, 177, 183, 184, 188, 192, 194, 202, 207, 214, 259, 328, 331, 333, 337, 338, 425, 434, 473, 481, 568, 571
- shape, xvi, 42, 43, 47, 50, 53, 117, 119, 128, 136, 141, 145-154, 155, 162, 257, 258, 325, 382-385, 441, 485, 562, 607, 655-658
- size, xv, xvii-xx, xxiii, 45-52, 71, 72, 76, 192, 213, 214, 225, 258-261, 297-303, 306, 344, 399, 475, 485, 536, 545, 562, 604, 652, 654
- skin (surface layer), 220, 476, 477
- smoothness, 90, 151, 153, 382-385, 657, 658
- spacecraft-thrust beam angle, 510, 511
- spotted, 47, 119, 141-146
- streams (*see* Jetstreams)
- structure, xxiv, 213, 221, 474-477
- surface (*see also* Asteroid, composition; Chemical composition; Chemical nature)
- dark, 49, 77, 80-82, 86, 88, 90-92, 141, 143, 145, 149, 151
- light, 49, 50, 86, 88, 141-145
- Telescope, 656
- texture, xvi, xxiv, xxv, 50, 67-79, 91, 92, 95, 98, 103-105, 117, 153, 221, 257, 287, 382, 383, 474-477, 545, 551, 655
- theories, hypotheses, 154, 213-223, 367, 379-381, 423, 455, 457
- Asteroidal meteors (*see* Comet, -meteor-asteroid interrelations)
- 5 Astraea, 45
- Astrographic Catalogue (AC), AGK2, AGK3, 5, 6
- Astrometric observations, xiii, 3-6, 658
- Astronomical Circular, Acad. Sci., U.S.S.R., xv
- Astronomical constants, astronomical unit determination, xiv, 16-19, 658
- Asunmaa, S., 216, 217, 219, 222
- 36 Atalante, 437
- Atlas/Centaur launch vehicle, xxiv, 494, 495, 499, 507-510
- ATS launch vehicle, 497
- Audouze, J., 219, 220, 222
- Axes orientation (*see also* Asteroid, poles), xiv, xvi, 117, 127, 128, 133-139, 141, 146, 151, 153, 207, 231, 257-262, 655, 656
- Axon, H. J., 309, 311
- Ayers, W. G., 395, 396
- 324 Bamberga, 45, 48
- Backscatter effect, 75, 76, 82, 88, 382, 384, 385
- Baldanza, H., 305, 308, 309, 311, 312
- Baldwin, B., 370, 371, 395, 396
- Baldwin, R. B., 595, 604
- Bandermann, L. W., 12, 154, 297-303, 363, 365, 367-374, 377, 382, 386-388
- Bangs, L., 385, 386
- Banovich, R., 436, 443
- Barber, T. A., 501
- Bardwell, C. M., 10
- Barker, J. L., 444
- Barnard, E. E., 25, 27, 29, 30, 33-39, 41-44
- Barth, C. F., 307, 309, 312
- Bartz, D. R., 505, 511
- Basalt powders, 76, 115
- Basaltic achondrite (*see under* Meteorite)
- Bauschinger, J., 18, 21, 33, 37, 208-210
- Baxter, D. C., 216, 315, 316, 319-326, 657
- Baxter, G. P., 308, 312
- 1672 1935 BD, 415
- Beard, D. B., 365, 372
- Bec, A., 20, 21
- Beck, A. J., 269, 291
- Becker, D. G., 395, 396, 564, 566
- Beckmann, P., 83, 89
- Beeson, D. E., 364, 374
- 1474 Beira, 415, 427
- Bell, C. C., 585, 586, 592
- Bell, L., 79, 89
- Belt (*see under* Asteroid)
- Bender, D. F., 484, 503-511, 527, 528, 536, 563
- Benson, R. A., 557, 560
- Beresford, R. H., 80, 89
- Berg, O. E., 366, 371, 372, 563, 566
- Bernstein, I. M., 305, 307, 309, 311, 312
- Bernstein, W., 567, 574
- Bertaux, J. L., 374, 375
- 1580 Betulia, 419, 440, 480, 481, 644
- Beyer, M., 128, 129, 135, 137, 139
- Bhandari, N., 476, 478, 481, 485
- Bhat, S., 476, 478
- Biela, 310, 411, 417, 424, 426, 427

- Binary (asteroid) (*see also* 624 Hektor),  
xvi, xviii, 155-163
- Binsack, J. H., 573, 574
- Bird, M. L., 219, 222
- Blackbody, 42, 47, 395
- Blackwell, D. E., 379, 382, 386
- Blamont, J., 374, 375, 461, 464
- Blodgett, K. B., 252, 256
- Bobrovnikoff, N. T., 54, 59, 64
- Böhme, S., 18, 21
- Bohn, J. L., 366, 371
- Boltzmann (H-theorem, equation), 319,  
328-330
- Bond albedo, 41, 43, 45, 48, 49
- Bonner Durchmusterung, xiii  
1477 Bonsdorffia, 415
- Borrelly, 411, 424
- van den Bos, W. H., xxvi, 133, 136, 139
- Boss General Catalogue, 133, 136, 139
- Bourke, R. D., 484, 503-511, 565
- Bouška, J., 468, 469
- Bowell, E., 105, 113, 114
- Boyle-Marriotte ideal gas law, 333
- Brandt, J. C., 364, 372
- Bratenahl, A., vii, 7, 38, 65, 180, 543,  
561-566
- Breakup (*see* Asteroid, fragmentation;  
Meteorite, fragmentation)
- Brecher, A., 44, 77, 222, 305-314, 657
- Briggs, R. E., 395, 397
- Brightness phase relation, 117
- Brooks 2, 410
- Brooks, D. R., 527-537, 562
- Brosen, 411, 417
- Brouwer, D., xviii, 11, 20, 21, 174, 175,  
177, 180, 202, 203, 209, 337, 340,  
342-344, 348, 352
- Brouwer groups (families), 63, 173-175,  
205, 337, 340-344, 346, 348
- Brown, H., 52, 65, 595, 596, 598, 604
- Bruman, J. R., 364, 372
- Brunk, W. E., vii
- von Brunn, A., 33, 37, 39
- Burbank, P. B., xxii
- Burchi, R., 127, 131, 134
- Burns, J. A., xviii, xx, 257-262, 656
- Burns, R., 70, 76
- Buseck, P. R., 306, 312
- Cailliatte, G., 134, 135, 137-139
- Cain, D. L., 583
- Calder, W. A., 117, 130
- California Institute of Technology, 649,  
652
- Callisto, 170, 405
- Cameron, A. G. W., 255, 256, 420
- Camichel, H., 26, 27, 29
- Cape Photographic Durchmusterung, 10
- Captured asteroids (*see under* Asteroid)
- Carter, N. L., 222, 432, 444
- Cassidy, W., 75, 77
- Catalina Observatory (154-cm reflector),  
vii, xvii, 3, 4, 98
- Catalogs (asteroid), xiv, xv
- Ceplecha, Z., 395-397, 440, 444
- 1 Ceres  
albedo, 116, 266, 625  
ephemerides, 6, 17, 21  
lightcurve, 123  
magnitude, 123  
mass, xvii, xxi, 34-38, 236, 305  
observations, xiii, 38, 45, 48, 54, 59,  
61, 63, 170, 656  
perturbations, 38  
phase coefficient, 88-90  
polarization, 76, 92, 95, 96, 99, 111  
shape, size, xv, 25, 28, 30, 33, 36,  
37, 41-44, 68, 88, 111, 171, 228,  
231, 305, 433, 437, 570-573  
space mission, 486, 487, 504, 505,  
508, 528, 529, 532, 533, 535,  
536, 568, 589  
temperature, 68, 234
- Cerro Tololo Observatory, 59, 159
- 313 Chaldaea, 45, 49
- Chandrasekhar, S., 155, 156, 162
- Chang, C. S., 120, 130, 134, 137, 139,  
140
- Chang, Y. C., 120, 130, 134, 137, 139,  
140
- Chapman, C. R., xvi, 30, 51-65, 70, 77,  
115, 171, 328, 330, 335, 460, 482,  
562, 563, 655
- Chatelain, A., 309, 312
- Chebotarev, G., 11
- Chemical composition (asteroids, comets,  
meteorites), xxiv, 91, 92, 111-113, 305,  
306, 429-433, 442, 447, 448, 460
- Chemical nature, properties, constitution  
(asteroids, comets, meteorites), 213,  
461, 476, 477, 482, 657, 658
- 334 Chicago, 20
- Chondrites, 162, 309, 395, 396, 429-432,  
439-443, 447-460, 481, 482, 486
- Chondrules, xx, 218, 219, 251-256
- Christophe, M-L., 432, 444
- 1373 Cincinnati, 415
- Cincinnati Observatory, xv, 9-11

- Circle, R. D., 365, 373, 379, 383, 387
- Clay, D. R., 216, 223
- Clemence, G. M., 20, 21, 174, 175, 177, 180, 202, 203, 209
- Close-approach asteroids, Earth crossers (*see under Earth*)
- Code, A. D., 461, 462, 464, 466, 469
- Coffeen, D., 76, 77
- Colburn, D. S., 240, 241, 243-245, 259, 262
- Collision (also collision hypotheses and theories), xvii-xx, 53, 75, 162, 180, 215, 216, 225, 229-233, 247-249, 258-264, 269-291, 297-311, 315-335, 353, 356, 357, 362, 364, 369, 370, 374, 396, 416-420, 426, 429, 431, 437-439, 441, 456-459, 468, 480-483, 486, 564, 622, 656-658
- Colombo, G., 364, 373
- Color (color indices), xvi, 47-58, 61-64, 67-75, 88, 119, 123-126, 146, 173-175, 257, 482, 633, 655
- Comas Solá, 411
- 1882-III Comet, 311
- Comet
- asteroid evolution (*see Evolution*)
  - asteroid material, 115, 461-469, 627, 628
  - cloud, xxi, xxiii, 412, 413, 448
  - comparison with asteroids, 117, 118, 122
  - dead, xx, 53, 452, 453
  - debris, xxiii, 365, 367-370, 378, 391, 423, 424, 433, 440, 442
  - decay, 414-417
  - density, 448
  - evolution (*see Evolution*)
  - flux, 628
  - formation, xix, 316, 461-469
  - groups, 359
  - hypotheses, 367, 369
  - Jupiter group, xix, 407-412
  - mass, 459, 460, 474-476
  - meteor-asteroid interrelations, 395, 429-460, 476
  - meteor population, xxii, xxiii, 456, 564, 565
  - mission, 475, 489, 490, 499, 500, 605
  - models, 95, 112, 395, 413, 416, 423-428, 454-458, 461-463, 466, 468, 655-658
  - motion, 315, 412
  - nuclei, xx, 23, 310, 311, 317, 399, 417, 423-428, 455, 457, 460-469, 561-566, 595, 643, 656, 658
  - orbits, 12, 23, 359, 370, 396, 423-428, 433-440, 447-460
  - origin, vii, xix, 218-221, 311, 359, 396, 418, 419, 423-428, 433-440, 447-460, 465-469
  - particles, 369, 613
  - size, 395
  - surface structure, v, 424
- Commensurability gap, 180, 188, 337, 434, 435, 440, 468, 480, 481
- Comparison (asteroids with comets, meteorites) (*see under Comet; Meteorite*)
- Composition (asteroids) (*see under Asteroid*)
- Condensations (original), xix, xx, 657
- Constants (related to coordinate system), 15, 20, 21
- Constants (related to Earth's motion), 17, 20, 21
- Cook, A. F., xvi, 155-163, 395, 396
- Cooling rates (planetary), 430-433, 459
- Coon, R. E., 383, 387
- Core-mantle model, 423-428
- Coronis family (also stream), 174, 201, 204, 349, 350
- Counter glow, xxi, xxii, 269, 363-371, 374, 389-391, 596, 602, 603, 607
- Cour-Palais, B. G., 269, 291, 371, 372
- Gowling, T. G., 328, 330, 335
- Coyne, G. V., 148, 154
- Cratering event, 83, 115, 179, 433, 439
- Craters, 288, 456
- Crimean Astrophysical Observatory, 12, 639, 640
- Crossover, 408-411
- Crozaz, G., 219, 220, 222, 392, 393
- Cunningham, L. E., 645
- 1950 DA, 419, 440, 644
- Daedalus, 657, 658
- Dalton, C. C., xxii
- D'Amico, J. C., 309, 312
- Danby, J. M. A., 331, 335
- Daniel (comet), 410, 424
- Danielsson, L., 216, 220, 348, 353-362, 657
- Dauvillier, A., 310, 312
- 511 Davida, 122, 134
- Davis, L., Jr., 261, 262
- De Carli, P. S., 432, 444

- Deerwater, J., 269, 291  
 De Felice, J. C., 309, 312  
 Degassing, 465, 477, 481  
 Deimos, xxiii, 399-404  
 Delsemme, A. H., 461-464, 466, 467, 469  
 Denone stream, 349, 350  
 Density  
   asteroid, 33-39, 42, 44, 72, 77, 80, 155-157, 160-162, 233, 234, 251-255, 305, 313, 474, 582, 583, 589-593, 654, 655  
   number density, xvii-xix, xxii, 52, 111, 177, 179, 181, 214, 216, 226, 248-250, 259, 260, 273, 274, 279, 282, 286, 319-321, 325, 332-334, 353, 355-360, 365-370, 374, 389-393, 438, 439, 448, 485, 564, 595-607, 622-625, 655  
 Desiderata family, 437  
 Determinations of masses (and other fundamental constants) (*see also* Constants), xv, xvii, xix, 25-37, 41-44, 48, 49, 68, 69, 77, 111, 112, 155, 160, 251, 254, 255, 259, 302, 305, 390-392, 403, 404, 439, 474, 562, 563, 568, 595, 652, 654  
 Dewhirst, D. W., 379, 386  
 Diameters (asteroids) (*see* individual asteroids)  
 Diameters (Barnard) (*see* Barnard)  
 Diameters (infrared), 25-31, 41-44, 48, 50, 654  
 1437 Diomedes, 410  
 Discovery (asteroid), xiv, 643-648  
 Diskmeter, 27, 29  
 Distances (aphelion or perihelion), xvii, xxii, 181, 208-210, 310, 311, 338, 351, 354, 355, 365, 366, 381, 413-420, 425-428, 433-436, 439, 441, 465-468, 481, 540, 565  
 Distances (geocentric and heliocentric), xiii, xiv, xvii, xx-xxiv, 10, 16, 26, 169, 170, 183-186, 188, 190, 192, 197, 200-203, 206, 207, 250, 257, 365-368, 390, 391, 415, 416, 419, 443, 461-463, 466-469, 508, 569, 570, 598, 599, 625, 627, 641, 642, 647-652  
 Distribution (*see under* Asteroid; Dust; Orbit distribution)  
 Divari, N. B., 365, 371, 372  
 Divine, T. N., 269, 291  
 Dixon, M. E., 5, 6  
 Doan, A. S., 430, 444  
 Dohnanyi, J. S., xvii, xx, xxii, 36, 37, 186, 249, 262-295, 298-303, 307, 312, 313, 316, 370, 372, 393, 437, 439, 441, 444, 456, 458, 566, 595-598, 604, 622, 623, 625, 630, 657  
 Dollfus, A., xv, 25-33, 37, 38, 43, 44, 67, 76, 91, 93-116, 482, 654  
 Donn, B., 383, 386, 462, 464, 466, 469  
 Doppler shift (tracking), 15, 166-169, 577-585, 588-592  
 Dora family, 347  
 Douglas-Hamilton, D. H., 414, 421  
 Drever, J. I., 219, 222  
 Driver, J. M., 511, 528, 536  
 Dubin, M., vii, 12, 44, 374, 485, 486  
 Dudley Observatory, 637  
 Duffner, G., 365, 371, 379, 380, 386  
 Dugan, D. W., 517  
 Duke, M. B., 219, 222, 460  
 Duncombe, R. L., 34, 37  
 Dungey, J. W., 568, 574  
 Dunkelmann, L., 364, 374  
 Dunlap, J. L., xvi, 92, 93, 119, 128, 130, 134, 139, 140, 147-156, 159, 162, 257, 262  
 Dust (*see also* Grains)  
   asteroid, cometary, xx, 377, 391  
   chemical components, 377, 383  
   cosmic, 95, 111, 476  
   distribution, 319-322, 325, 363-382, 385, 562  
   interplanetary, xxi, 52, 363-388, 490  
   model, 377-385  
   origin, 369, 370, 377  
   size, 278-281, 288, 297-303, 325, 353, 363, 377-385  
   surfaces, xv, 44, 657  
 Dworetzky, M., 365, 371, 379, 380, 386  
 Dwornik, S., 501  
 Dyal, P., 240, 243, 244, 572, 574  
 Dziembowski, C. V., 365, 372, 379, 380, 382, 385, 386  
 1948 EA, 418, 419, 440, 644, 647  
 1953 EA, 418, 419, 644, 647  
 Earth  
   age, 240, 447, 477  
   -associated dust, 234, 236, 363-369, 374, 390-393  
   atmosphere, xxii, 70, 74, 75, 260, 313, 363, 383, 442  
   crossers (close-approach asteroids), xx, xxi, 38, 52, 180, 311, 396,

- 417, 423, 434, 438, 439, 447-458, 473-477, 481, 482, 540, 565, 566, 598, 641-650  
 distance, 367  
 gravity (*see* Gravitational effects)  
 magnetic field, 571  
 mass, xvii, 23, 236, 639, 640  
 -Moon system, 221, 476, 477  
 orbit, 44, 159, 288, 366, 370, 389-393, 453, 460, 482, 505-509, 565  
 rotation, 250  
 samples (also rocks), 42, 43, 67, 71, 72, 221, 239, 434, 482, 655  
 terrestrial planets (*see under* Planets)
- Eberhardt, P., 220, 222
- Eccentricity, xvi-xx, xxiii, 45, 52, 136, 174, 177, 181, 183, 198-200, 203, 210, 250, 259, 270, 321, 332, 333, 354, 355, 415, 418, 419, 427, 429, 434, 435, 468, 473
- Edwards, G., 305, 308, 310-312
- 13 Egeria, 63
- Eichhorn, H., 5, 6
- Ejection, 177; 448
- Electric propulsion systems (*see* Propulsion)
- Elford, W. G., 370, 372
- Elsässer, H., 379, 382, 386
- Elsea, A. R., 307, 311, 312
- Elvira streams, 350
- Encke, 365, 409, 410, 414, 416, 418, 424, 426, 427, 440, 441, 461, 466, 499
- Englehart Observatory, xv
- Eos family, 201, 204
- Ephemerides (asteroids), xv, xxvi, 3, 9-11, 17, 21, 173, 434, 437, 579, 628, 639-642, 645, 647, 654
- Ephemeris, xiv, xv, 197, 510, 527, 540, 549, 553, 579, 596, 639, 640, 653, 655
- Epstein, S., 219, 223, 255
- 163 Erigone, 45
- Eriphyla streams, 350
- 433 Eros  
 amplitude-aspect relation, 128  
 close approach, 15-20, 180, 311, 656  
 composition, 486  
 coordinates of rotation axis, 133-136, 139  
 distance, 419, 499, 500  
 ephemerides, 641  
 light variation, 125, 151, 419, 657  
 magnetic field, 569-572  
 magnitude, 125  
 missions, 474, 479, 483, 484, 487, 494, 499, 500, 505-525, 540, 541-560, 583, 641  
 model, 137  
 motion, 19, 133  
 observations, 7, 641, 644, 658  
 orbit, 33, 419, 484, 525, 565  
 origin, 418, 483  
 polarization, 99  
 scientific instruments for missions, 514, 515  
 semimajor axis, 188  
 shape, size, xv, xvi, 136, 147, 550, 566
- Eros-type (family, group), 15, 16, 174, 473-477, 483
- Erosion, 247, 249, 263, 264, 273-275, 278, 279, 284, 287-290, 297-299, 302, 391, 392, 455, 596
- Euchen, A. T., 251, 256
- Eucrites, 480
- 247 Eukrate, 437
- 15 Eunomia, 45, 122, 127, 128, 134, 151, 569
- 31 Euphrosyne, 20
- 52 Europa, 20
- 79 Eurynome, 63
- 27 Euterpe, 45, 533
- Everson, J. E., 219, 222, 223
- Evolution (comet-asteroid and asteroid-meteor), v, xix-xx, 213, 311, 356, 395-397, 413-421, 424-446, 461-469, 475, 476, 486
- Experiments (asteroid), 213-223
- Explorer satellites and measurements, xxii, 573, 615, 649
- Explosion (also explosion hypothesis), 213, 298-300
- 1971 FA, xiv, xvi, 644, 647, 653
- Families (*see under* Asteroid)
- Farrington, O. C., 308, 312
- Fassio, F., 252, 253, 256
- Faye (comet), 410
- Fenner, M. A., 216, 222
- Fesenkov, V. G., 365, 372
- Fichera, E., 125, 130
- Field, G. B., 382, 386
- 1099 Figneria, 415
- Filice, A. L., 52, 64
- Filippov, A. F., 297, 303
- Finkelman, R. B., 219, 222

- Finlay (comet), 411  
 Finsen, W. S., 133, 136, 139  
 Fireballs (*see also* Meteorite), xxiii, 395, 396, 440, 442, 449-455, 458, 459  
 Fireman, E. L., 309, 312  
 Fischer, H., 54, 57  
 Fish, R. A., 239, 244, 250  
 Fitzgerald, R. W., 219, 222  
 Fix, J., xvi, 141-146  
 FK4, 5, 19, 640  
 Fleischer, R. I., 239, 430, 444  
 Fletcher, E. E., 307, 311, 312  
 8 Flora, 45, 88, 92, 95, 99, 134, 641  
 Flora family (also Flora streams A, B, C), 174, 175, 181, 201, 204, 207, 337, 342, 348, 349, 353-362  
 Focus, J., 26, 100, 114  
 Fokker-Planck equation, 319  
 Forbes, 410, 427  
 Formation (*see under* Asteroid; Comet; Jetstreams; Particles; Planets; Solar system)  
 19 Fortuna, 45  
 Fortuna family (group), 343, 347  
 Forward, R. L., 537, 585-593, 658  
 Fossil nuclide hypothesis, 239  
 Fragmentation, breakup (*see under* Asteroid; Meteorite)  
 Francis, M. P., 19, 22  
 Franklin, F. A., 158, 162  
 Frazer, J. Z., 219, 222, 223  
 1093 Freda, 415  
 Fredericksson, K., 220, 222  
 Freeman, J. W., 216, 222  
 Fresnel laws, 71, 657  
 Fricke, W., 18, 21  
 Fricker, P. E., 306, 312, 430, 438, 444, 459  
 Friedlander, A. L., 522, 526, 543, 546, 560  
 Friichtenicht, J. F., 395, 396  
 Fuchs, N. A., 252, 256  
 Fujita, H., 219, 222, 223  
 Fujita, Y., 33, 35, 36, 38, 130, 265, 291, 596, 601, 604, 623, 631  
 Future work (programs), viii, xxv, 6, 18, 21, 29, 50, 53, 59, 64, 112, 113, 155, 159-162, 174, 175, 335, 360, 381, 383, 416-420, 426, 428, 440, 442, 469, 479-484, 575, 642, 653-659  
 1969g (comet), 462  
 Gagne, G., 384, 387  
 Galilean satellites, 49, 50  
 148 Gallia, 437  
 Ganapathy, R., 217, 222, 390, 393, 432, 441, 444, 445  
 1036 Ganymed, 168, 405, 415, 427, 437  
 Garbury, M., 70, 77  
 Garlick, G., 107, 114  
 Gatewood, G. D., 6  
 Gault, D. E., 270-272, 291, 298, 301, 303, 392, 393, 456, 458  
 Gauss, C. F., 18, 35  
 Geake, J. E., 104, 105  
 Gegenschein (*see* Counter glow)  
 Gehrels, T., vii, viii, xiii-xxvii, 30, 33, 36-39, 44, 48, 50, 56, 59, 64, 65, 67, 76, 77, 79, 88, 89, 91, 93, 97, 98, 112, 115, 117, 119, 120, 120, 122, 126-128, 130, 131, 134, 138-140, 144, 145, 147, 154, 155, 156, 158, 162, 170, 171, 173, 175, 177, 180, 185-187, 194, 197, 199, 202, 206, 207, 258, 261, 262, 265, 267, 291, 292, 337, 338, 342-344, 348, 352, 359, 362, 407, 412, 418, 420, 435, 440, 441, 444, 482, 485, 536, 562, 566, 596, 604, 623, 625, 631, 637, 647, 648, 653-659  
 Geiss, J., 220, 222  
 680 Genoveva, 415  
 Geocentric dust cloud (GDC), 363-365  
 1620 Geographos  
   capture, 483  
   coordinates of rotation axis, 134  
   distance, 419, 429, 430  
   lightcurve, xvi, 125, 147, 149, 151  
   magnitude, 125  
   mission, xxiv, xxv, 483, 526, 543  
   model, frontispiece, xv, 153  
   observations, 644  
   origin, xx, 418, 465  
   reflectivity, 149  
   shape, xvi, 147, 657, 658  
   semimajor axis, 188  
 Giacobini-Zinner, 411, 424, 426  
 Giclas, H. L., 122, 130, 644, 646  
 Giese, R. H., 365, 372, 379, 380, 382, 385, 386  
 Giessen University, 494  
 Gill, J. R., viii, xiii-xxvii  
 Gillett, F. C., 44, 365, 370, 372  
 Gindilis, L. M., 365, 372  
 Gisela stream, 350  
 Giuli, R. T., xx, 247-250  
 Glossary, 661, 662



- Gold, T., 460
- Goldstein, J. I., 239, 244, 306, 312, 430, 431, 438, 444, 459
- Goldstein, R. M., 69, 77, 165-171, 657
- Goldstone radar, 168, 170, 171
- Goles, G. G., 239, 244
- Googe, W. D., 5, 6
- Gopalan, K., 455, 458
- Gordon, R. B., 307, 308, 310, 312
- Grains (*see also* Dust; Particles)
- albedo, 80, 86, 379
  - accretion, 216, 218
  - capture, 216
  - clumping, 76, 657
  - collision, 247, 328-330, 353, 362
  - interplanetary, 382, 385
  - interstellar, 369, 374, 377, 382, 385
  - irradiation, 219-221
  - mass, 213-216, 308, 319-321, 326, 327, 335
  - model, 320, 321, 328
  - orbit, 325, 330, 353, 362
  - origin, 423, 429, 369, 566
  - reflection, 71
  - shape, 261, 328
  - size, 325, 326
  - surfaces, 308-310
- Grand Tour (*see under* Space missions)
- Gravitational effects, xvi, xxii, 33, 34, 39, 43, 90, 156, 215, 219, 221, 229, 231, 247-252, 255, 260, 279, 287, 313, 315, 316, 319, 320, 326-331, 364, 369, 374, 476, 477, 486, 492, 543, 549-556, 585-593, 658
- Gravity gradiometers, 585-593
- Graybody (gray reflectors), 42, 54
- Greenberg, J. M., 385, 386
- Greenstadt, E. W., 487, 516, 543-560, 565-575
- Greenstein, J. L., 82, 89, 261, 262
- Griffith, O. K., 383, 387
- Grigg-Skjellerup, 410
- 1362 Griqua, 22, 415
- Groeneveld, I. (*see* Houten-Groeneveld, I. van)
- Groeneveld, T. P., 307, 311, 312
- Grogler, N., 220, 222
- Ground-based observations (*see* Observations)
- Groups (*see under* Asteroid)
- Grün, E., 564, 566
- G-type stars (comparison with asteroids), 54
- Gudehus, D., 365, 371, 379, 380, 386
- Günther, A., 6
- Gylden, H., 364, 372
- Gyldén-Moulton gegenschein (counter-glow) hypothesis, 364
- Haack, U., 219, 220, 222, 392, 393
- Hair, M., 219, 220, 222, 392, 393
- Halajian, J. D., 81, 86, 89
- Hale Observatories, 45, 50
- Hall, C. F., vii
- Hall, H., 539-541
- Halley's comet, 499
- Hallgren, D. S., 383, 387
- Halos (comet), 461, 462
- Hämeen-Anttila, K. A., 83, 84, 89
- Hamid, S. E., 416, 421
- Hampshire, W. F., II, 527-537, 562
- Hamy, M., 25, 27, 29
- Han, D. W., 507, 511
- Hanner, M. S., 377-388
- Hanor, J. S., 219, 222
- Hapke, B. W., xv, 44, 67-80, 89, 90, 115, 116, 250, 306, 482
- Harkness, W., 18, 21
- 40 Harmonia, 63
- Harrington, 410
- Harrington-Abell, 410
- Harris, D., 67, 77, 593, 634, 637
- Hartmann, A. C., 225, 232, 237, 259, 262, 263, 280, 291, 307, 312
- Hartmann, W. K., xvi, xix, xxvi, xxvii, 162, 225, 226, 232, 237, 250, 259, 262, 263, 271, 279, 280, 287, 291, 307, 312, 403, 404, 595, 604
- Hartung, J. B., 392, 393
- Harvard Observatory, 93, 99
- Harwit, M., 369, 370, 372, 383, 387, 467, 469
- Harwood, M., xxvi, xxvii
- Harzer, P., 39
- Haser, L., 462, 464
- Haughey, J. W., viii, xiii-xxvii
- Haughey, L. C., 364, 374
- Haupt, H., 122, 130
- Havnes, O., 413, 420
- Hawkins, G. S., 291, 338, 348, 352, 354, 362, 371, 372, 396, 595, 598, 604
- Hayashi contraction (sun), 243, 252
- Hazards (*see under* Spacecraft)
- Heating (asteroids, meteorites) (*see also* Melting), 239-245, 396, 397, 460, 476, 482

- 6 Hebe, 45, 120, 121, 134, 437, 569  
 Hebe family, 437  
 108 Hecuba, xviii  
 Hecuba family, xviii, 347  
 624 Hektor, xvi, xviii, 119, 122, 128, 134, 147, 151, 155-163, 410  
 699 Hela, 420  
 Helios (*see under* Space missions)  
 Hellyer, B., 265, 280, 291, 298, 303, 566  
 Hemenway, C. L., 383, 387  
 225 Henrietta, 415  
 Henyey, L. G., 81, 82, 89  
 880 Herba, 415  
 Herget, P., xv, 9-12, 33, 36, 38, 177, 180, 187, 194, 197, 199, 202, 206, 207, 267, 292, 337, 338, 342-344, 348, 352, 359, 362, 418, 420, 435, 444, 562, 566, 623, 631, 645  
 Hermes (1937 UB), 419, 440, 465, 644, 646, 651  
 Hertha stream, 350  
 Hertz, H. G., 33, 34, 37, 38, 42, 43, 655  
 Hertzsprung, E., 121, 130  
 Herzog, G. F., 390, 393, 439, 444  
 46 Hestia, xviii  
 Heymann, D., 431, 432, 439, 444, 445, 455, 458  
 944 Hidalgo, xviii, xx, 20, 23, 188, 409, 411, 415-417, 641, 657  
 153 Hilda, xviii, 468  
 Hilda family (group), 20, 36, 173, 174, 188, 190, 408, 415, 420, 450, 453, 465, 473, 484  
 898 Hildegard, 420  
 Hill, G. W., xxiii, 20, 21  
 Hill, M. L., 309, 312  
 Hills, H. K., 216, 222  
 Hills, J. G., xviii, xix, 225-237, 404, 658  
 Hinks, A. R., 18, 21  
 Hirayama families, xviii, 53, 63, 173, 174, 263, 264, 337, 342, 353, 434, 436, 484  
 Hirayama, K., xviii, 177, 180, 263, 291, 337, 352, 353  
 Hodge, P. W., 364, 371, 372  
 Hoffleit, D., 371, 372  
 Hohmann transfer, 505  
 Holland, A. C., 384, 387  
 Holmes, 410  
 Honda-Mrkos-Pajdušáková, 411, 427  
 Hoover, G., 50  
 Horak, H. G., 83, 89  
 Horsewood, J. L., 505, 511  
 Hörz, F., 392, 393  
 Houck, T. E., 461, 464, 466, 469  
 Houten, C. J. van, vii, xvii, 9-11, 36, 38, 120, 126-128, 130, 144, 145, 147, 154, 173-175, 177, 180, 183-186, 187, 194, 197, 199, 202, 206, 207, 209, 265, 267, 291, 292, 337, 338, 342-344, 347, 348, 351, 352, 359, 362, 407, 412, 418, 420, 435, 444, 562, 566, 596, 601, 604, 623, 631, 655  
 Houten-Groeneveld, I. van, xvii, 9-11, 33, 36, 38, 119, 120, 122, 126-128, 130, 144, 145, 177, 180, 187, 194, 197, 199, 202, 206, 207, 265, 267, 291, 292, 337, 342-344, 346, 348, 351, 352, 359, 362, 407, 418, 420, 435, 444, 562, 566, 596, 601, 604, 623, 631  
 Hover phase (*see* Stay time)  
 Howard, J., 269, 291  
 Huebner, W. F., 414, 420, 467, 469  
 Hughes Research Laboratory, 494  
 Hugon, M., 25, 29  
 Hulst, H. C. van de, 365, 372, 379, 382, 387  
 434 Hungaria, xviii  
 Hungaria group, 173, 174, 178-180, 418, 434-437, 483, 484  
 Hunt, G. R., 52, 64  
 Hunter, R. B., xvii, xxvi, 408, 412  
 Huruhata, M., 135, 140  
 Hutchison, P. B., 364, 374  
 Hydrogen embrittlement, 305-311  
 10 Hygiea, 20, 505, 508, 569  
 Iapetus, 158  
 1566 Icarus  
 albedo, 48, 68  
 close approach, 170, 473  
 color, 56, 655  
 coordinates of rotation axis, 134  
 density, 38  
 lightcurve, 119-122, 125, 128, 441, 656  
 magnitude, 125  
 motion, 19  
 observations, 4, 643-645, 647, 651

- orbit, 428, 641, 642  
 origin, xx, 418, 419, 465  
 polarization, 95, 98, 112, 654  
 radar, 165, 168, 170, 642, 656  
 reflectivity, 170  
 rotation period, 37, 215  
 semimajor axis, 188  
 shape, size, 48, 68, 170, 656, 658  
 space missions, xxiv, 543
- Imaging photopolarimeter**, 633-637
- Impact** (also *impact environment*), xvii, 35, 53, 67, 74, 95, 104, 111, 112, 115, 251-253, 258, 259, 262, 269-272, 278, 279, 302, 308, 363, 366, 377, 388, 401-404, 433, 434, 448, 449, 457, 458, 482, 554, 595, 596, 601-604, 607-615
- Impact detectors** (*see* *Sensors*)
- Inclination** (asteroids, also *grains*), xvi, xvii, xix, xxiii, 52, 144, 148-153, 160, 174, 177, 183, 187, 191-194, 199, 202-206, 208, 210, 259, 270, 332, 333, 338-342, 346, 349, 355, 367, 369, 415, 429, 434, 435, 579, 647
- Infrared diameters** (*see* *Diameters*)
- Infrared flux**, 41, 43, 46, 49
- Infrared observations**, xv, 45-47, 69, 381, 383, 385, 473, 563, 656
- Ingalls, R. P.**, 165, 171
- Ingham, M. F.**, 365, 371, 372, 379, 380, 382, 386, 387
- Institute of Theoretical Astronomy (ITA)**, Leningrad, xv, 9, 11, 12, 409, 654
- Interferometer**, 25, 29
- Internal constitution** (*see under* *Asteroid*)
- International Astronomical Union**, vii, xiii, xv, 654
- Interplanetary bus**, 518, 519, 544, 547, 555, 558, 559
- Interplanetary dust** (*see under* *Dust*)
- Interplanetary grains** (also *particles*) (*see under* *Grains*; *Particles*)
- Interplanetary light**, 363, 364, 367, 369, 371
- Interstellar extinction curve**, 382
- Interstellar matter**, 447
- 85 Io**, 343, 405
- Io family**, 174, 183, 201, 204, 343, 344, 347
- Ion engine**, 491, 494, 496, 497, 503-505, 529, 535, 555, 556, 558, 559
- 794 Irenaea**, 415
- 7 Iris**, 45-47, 95, 96, 99, 111, 123, 126, 134, 569
- Irvine, W. M.**, 79, 80, 82, 84, 86, 90, 145, 146
- Irving, J. H.**, 493
- Isard, J. O.**, 219, 222
- Itzen, B. F.**, 507, 511
- 1627 Ivar**, 419, 483, 484, 644
- Jacchia, L. G.**, 370-372, 395, 396
- Jackson, E. S.**, 20, 22
- Jacobi constant**, 52, 54, 56, 57, 364
- Jacobi ellipsoid**, 155, 156, 162, 324
- Jaeger, R. R.**, 310, 312, 429, 431, 438, 444
- Jain, A. V.**, 310, 312
- Jameson, R. F.**, 372, 380, 387
- Janina streams**, 350
- Jardetsky, S.**, 156, 162
- Jeans, J. H.**, 325, 326
- Jeffers, H. M.**, 645
- Jeffery, P. M.**, 390, 393
- Jet Propulsion Laboratory**, 511, 566, 583, 652
- Jetstreams** (asteroid streams) (*see also* *Meteor, streams*), xix, xx, 53, 173, 175, 180, 181, 197, 205-208, 213, 216, 220, 247-250, 253, 309, 316-362, 469, 562, 564, 657, 658
- Johnson** (comet), 410
- Johnson, E. W.**, 309, 312
- Johnson, F. I.**, 507, 511
- Johnson, H. L.**, 118, 130
- Johnson, K. R.**, 260, 262
- Johnson, T. V.**, xvi, 48-65, 69, 70, 77, 92, 93, 111, 115, 146, 305, 306, 460, 482, 485, 562, 566, 655
- Johnson, W. A.**, 54, 64
- Jones, J.**, 265, 280, 291
- Jones, S.**, 395, 397
- 664 Judith**, 415
- 3 Juno**  
 albedo, 68, 266, 625  
 coordinates of rotation axis, 134  
 diameter, xv, 25, 28, 68  
 ephemerides, 17, 21, 41, 42  
 lightcurve, 123  
 magnitude, 123  
 mass, 34, 35  
 mission, 505, 583  
 observations, xiv, 45  
 radar, 170  
 radius, 569

- reflectivity, 59, 61, 63  
 semimajor axis, 569
- Jupiter**  
 albedo, 88  
 asteroid belt, xvii, xviii, 404, 405  
 -asteroid ratio, 188  
 close approach, 413-420, 425-428  
 color, 633  
 comet group, xix, xx, 407-412, 427, 450-452  
 commensurabilities (*see* Commensurability gap)  
 lagrangian points (*see* Lagrangian points)  
 mass, 18, 20, 22, 35, 250, 408, 640  
 mission, 404, 405, 499, 533-537  
 orbit, xviii, xx, xxiii, 20, 209, 210, 407-411, 425, 428, 460, 565  
 perturbations, xviii, 11, 14, 20, 180, 260, 369, 396, 408, 413-418, 434, 435, 439, 440, 452, 453, 457, 479, 481, 641  
 Pioneer F and G missions (*see under* Pioneers F and G)  
 satellites, xxiii, 20, 48, 49, 95, 100, 115, 170, 213, 233, 402-405  
 spectrum, 54, 57
- Kaiser, T. R., 371, 372, 395, 397  
 Kamp, P. van de, 364, 372  
 Kaufman engine, 494, 496  
 Kaula, W. M., 260, 262, 402, 403  
 Kazan Observatory, xv  
 Keays, R., 390, 393, 441, 444  
 Keil, K., 220, 222, 240, 241, 244, 245, 259, 262  
 Kendall, M. G., 359, 362  
 KenKnight, C. E., 44, 91, 93, 460, 633-637  
 Kennard, E. H., 255, 256  
 Kennedy, G. C., 222  
 Kent, J., 33, 36, 38, 130, 265, 291, 596, 601, 604, 623, 631  
 1134 Kepler, 415, 427, 437  
 Kepler, J., xiii  
 Kepler's equation, 529, 533, 534  
 Kerker, M., 383, 387  
 Kerridge, J. F., 371, 372  
 Kessler, D., xxii, 269, 291, 367, 371, 373, 374, 564-566, 595-605, 613, 627, 628, 631  
 Kiang, T., xvii, 22, 39, 174, 175, 187-195, 208-210, 291, 485
- Kilston, S., 365, 371, 379, 380, 386  
 Kinard, W. H., 269, 291, 607-615  
 Kirkwood gap, xviii, 179, 188, 458  
 Kitamura, M., 51, 57, 64  
 Kitt Peak (213 cm reflector), vii, 159  
 Klemola, A. R., 413  
 Klepczynski, W. J., 20, 22  
 Kline, D., 309, 312  
 Knox, R., Jr., 308, 312  
 Kokott, W., 291  
 Kolopus, J. L., 309, 312  
 Konheim, A. G., 365, 373, 379, 383, 387  
 König, A., 5, 6  
 Kopal, Z., 257, 258, 260, 262  
 Kopff (comet), 410, 492  
 Kordylewski, K., 363, 365, 373  
 Kowal, C. T., 185, 417, 420, 649, 654  
 Kox, H., 6  
 Krassa, R. F., 374, 375  
 Kresák, L., xvii, 175, 187, 188, 194, 197-210, 371, 373, 396, 397, 414, 420, 440, 444, 468, 469  
 Krinov, E. L., xxvi, xxvii  
 Kristian, J., 5, 6  
 Krug, W., 133, 134, 137, 140  
 Kuiper, G. P., vii, 27, 30, 33, 35, 37, 38, 56, 119, 120, 122, 126-128, 146, 257, 260, 262, 264-266, 291, 399, 402, 403, 413, 420, 485, 596, 601, 604, 623, 631  
 Kunin, J., 59, 64
- 1950 LA, 419, 644  
 Laakso, P., 83, 84, 89  
 Laboratory work, 30, 31, 74, 81, 85-88, 91, 92, 95-116, 147-154, 208, 372, 383, 384, 395, 655, 657  
 Labs, D., 58, 64  
 Lacis, A. A., xvi, 141-146  
 Lacrimosa stream, 350  
 Lacroute, P., 6  
 39 Laetitia, 45, 49, 127, 134, 137, 143-146, 151  
 1006 Lagrangea, 415  
 Lagrangian points, xix, 185, 653, 654  
 Lal, D., 219, 220, 222, 223  
 Lamb, V., 107, 114  
 Lambert's law, 90, 137, 141-146  
 Lancet, M. S., 436, 443  
 Langmuir, I., 252, 256  
 Langton, N. H., 371, 373  
 Larimer, J. W., 214, 222, 251, 256, 443, 444  
 Larson, E. E., 573, 575

- Laudate, A. T., 383, 387  
 Laul, J. C., 217, 222, 223, 390, 393, 441, 444  
 Launch date selection, 506-509, 516-526, 535, 547, 548, 558, 560  
 Launch vehicle (*see* Spacecraft)  
 Launch window, xxiv, 522, 526, 540, 541, 544, 549, 560  
 Lautman, D. A., 364, 373  
 Lecacheux, J., 26  
 Leckrone, D., 365, 371, 379, 380, 386  
 68 Leto, 45  
 Leveau, G., 35, 38  
 Levin, B. F., 462, 464  
 Levin, B. J., 306, 312, 480, 485  
 Liang, S. S., 216-219, 222, 476, 478  
 Lick Observatory, 25  
 Lieske, J. H., 19, 20, 22  
 Life-support system, 539, 540  
 Lightcurve (or light variation), xvi, 27, 29, 46, 47, 50-53, 59, 65, 79, 87, 135, 137, 138, 147-155, 159-162, 173-175, 257, 372, 418, 419, 441, 474, 655, 656  
 Lightcurve inversion, 141-146  
 Liller, W., 46, 48, 50, 93, 130  
 Lillie, C. F., 461, 464, 466, 469  
 Lind, A. C., 385, 387  
 Lindblad, B. A., xvi, xix, 216, 220, 337-355, 357, 358, 362, 404, 405, 657  
 Lipschutz, M. E., 214, 222, 310, 312, 429, 431, 438, 444  
 Little, S. J., 479, 487  
 1959 LM, 419, 440, 644  
 Loeb engine, 494  
 Lommel-Seeliger law, 85, 146  
 Lord, H. C., 309, 312  
 Lorell, J., 583  
 Lorin, J. C., 219, 220, 222  
 Lost City meteorite, xxii, 158, 162, 396, 449, 455, 480, 482, 486  
 Love, L., 361  
 Lovering, J. F., 571, 574  
 Low, F. J., 41  
 Lowell Observatory, 646  
 Lowrey, B. E., 482, 485  
 Lucretia stream, 350  
 Lukoc, C. F., 5, 6  
 Lumme, K., 83, 84, 89  
 Lunar Orbiter projects, 499, 615  
 110 Lydia, 122, 126  
 Lyman- $\alpha$  radiation, 374, 462, 463, 466  
<sup>1</sup> Lynds, C. R., 651, 652  
 Lyot, B., 76, 77, 91-93, 96, 100, 103, 115, 116  
 $\alpha$ -Lyrae, 58  
 Lytleton, R. A., xx  
 McAdoo, D., 261  
 McCord, T. B., xvi, 50-65, 69, 70, 77, 92, 93, 111, 115, 305, 306, 312, 482, 485, 562, 563, 566, 655  
 McCracken, C. W., 366, 371, 373  
 McCrosky, R. E., xxii, xxvii, 158, 395-397, 440, 445, 449, 458, 459, 486  
 McDonald Asteroid Survey (MDS), xvii, 33, 146, 183, 197, 250, 263-268, 282, 290, 306, 369, 403, 653  
 McDonald Observatory, 117, 265  
 Macdougall, D., 219, 222, 476, 478  
 McElfresh, T. W., 365, 373, 379, 383, 387  
 McEvily, A. J., 307, 313  
 McNesby, J. R., 463, 464  
 MacQueen, R. M., 383, 387  
 Magnetic fields (magnetic interaction, magnetism) (*see under* Meteorite)  
 Magnetospheres (*see under* Asteroid)  
 Magnitude (brightness), xiii, xv, xviii-xx, 12, 27, 29, 30, 33, 36, 65-69, 117, 122-125, 128, 136-139, 149, 159, 160, 173, 180, 181, 185, 187, 190, 191, 197-199, 202, 203, 206, 207, 257, 267-269, 287, 362, 390, 391, 414, 417, 418, 437, 461, 462, 465, 468, 469, 562, 563, 596, 598, 628, 633, 639, 642, 647, 652, 655  
 Makover, S. G., 11  
 Mann, H. M., 380, 384, 388  
 Manned asteroid mission (*see under* Space missions)  
 Manuel, O. K., 432, 445  
 Marcus, A. H., 271, 279, 280, 287, 292, 460, 595, 596, 604  
 Maria family, 174  
 Mariner data, 15, 20, 366, 403, 499, 503, 510, 557  
 Mariner Venus Mercury mission, 562  
 Marinus, S., viii  
 Mars  
 accretionary phase, 403  
 craters, 231, 233, 402-404, 596  
 crossers, xvii, xix, xx, xxiii, 177-180, 188, 190, 403, 404, 473, 481-484, 486, 487, 513, 526, 527, 598, 653  
 distance from Earth, 499  
 mass, 18-20, 35, 250  
 mission, 490, 492, 522, 539, 541, 543

- orbit, 39, 427, 428, 434, 435, 483, 565
- origin, 403, 404
- perturbations, 418
- radar, 165
- rotation, 250, 460
- satellites, xxiii, 399-405
- surface, 95, 100, 102, 103, 448
- temperature, 234
- Marsden, B. G., xvii, xxiv, 22, 23, 162, 180, 311, 409, 412-428, 453, 459, 461, 463, 464, 565, 566, 639-643, 645, 647, 648, 652, 655, 657, 658
- Marcy, A. C., 513-526, 546-548, 558, 565
- Mass (*see under* Asteroid; Grains)
- Mass determination, 14, 15, 19, 20
- Mass distribution (*see under* Asteroid)
- 20 Massalia, 45, 49, 68, 120, 122, 126, 134, 505, 508
- Mathilda family, 347
- Matson, D. L., xv, 43, 45-50, 61, 63, 64, 654, 656
- Matthews, H. F., 534
- Matthews, M. S., viii, xxvi, xxvii
- Maurette, M., 219, 222, 392, 393
- Mazor, E., 439, 445, 460
- Medea family, 174, 201, 204
- Megill, L. R., 620, 631
- Meinel, A. B., vii
- Meissinger, H. F., 515, 516, 528, 543-560, 565
- Mellick, P. J., 242, 246, 439, 440, 444
- 18 Melpomene, 45, 437
- Melting (*see also* Heating), 74, 233, 234, 239-242, 251, 259, 413, 460, 477
- 1647 Menelaus, 410
- Mercury
  - age, xix, xx
  - albedo, 88
  - comparison with asteroid, xvi, 42
  - mass, 15, 19, 48, 49, 229
  - mission, 490, 492
  - polarization, 95, 100, 111
  - radar, 165-169
  - rotation period, 167, 169, 250
  - surface, xix, xx, 88, 168-170
  - temperature, 234
- Merrill, J. E., 160, 162
- Merxia family, 347
- Metcalf method, 3
- Meteor
  - age, xix, 442
  - asteroidal (*see* Comet, -meteor-asteroid interrelations)
  - class A and C, 395, 486
  - comet relations (*see* Comet, -meteor-asteroid interrelations)
  - flux, 379
  - luminosity, 295
  - model, 416
  - Moon collisions (*see under* Moon)
  - observations, xxi, 395, 397, 439, 646
  - orbits, 337, 338, 354, 370, 371, 396
  - origin, xxi, 115, 395-397, 418, 442, 454
  - population, xxi
  - radar, 363
  - streams, 315-317, 338-340, 348, 353, 354, 359, 360, 395, 396, 416, 438, 562, 565
- Meteorite
  - age, 392, 429-432, 438, 439, 449-451, 454-458, 481, 482
  - albedo, 77
  - basaltic achondrite, 52, 59
  - Cape York, 310-313
  - collision (also collision theory), 75, 305, 313, 314, 431, 438, 439, 456
  - color (also color index), 51, 52, 64, 73-75
  - comparison with asteroids and asteroid families, xx, 51-53, 64, 74, 75, 91, 92, 117, 118, 122, 213, 214, 218, 221, 429-446, 476, 479, 655, 657, 658
  - comparison with comets, xx, 221, 476, 657, 658
  - composition, vii, 67, 213, 217-219, 251, 256, 305-310, 397, 447, 448, 477
  - density distribution, 162, 393
  - finds, 595, 598
  - flux, 390
  - formation, 52, 307-310
  - fragmentation (breakup), 313, 397, 403, 431, 432, 447-449, 456-458, 543, 596
  - Gibeon, 310, 311
  - groups, 429-433
  - Lost City (*see* Lost City meteorite)
  - magnetic field, magnetic interaction, magnetism, 567-575
  - material (samples), 67, 71, 72, 74, 104, 391, 658

- metallic, 61, 305-307  
 observations, xix, xxiii, 363, 371, 395, 396, 429, 432, 479-482  
 orbits, xxii, xxiii, 418, 433, 439, 479-482  
 origin, xx, 115, 229, 233, 252, 306, 308, 311, 429, 432-439, 442, 443, 447-460, 479, 486  
 parent bodies, xx, 220, 239-245, 263, 307, 429-438, 443, 448, 460, 479-483, 566, 643  
 Příbram (*see* Příbram)  
 reflectivity curves, 51-54  
 shape, 155, 396  
 Sikhote-Alin, 310  
 sizes, 429, 430, 474  
 stony (*see* Meteorite, basaltic achondrite)
- Meteoroids (also population density), xxi-xxiii, 288, 290, 315, 316, 370, 371, 374, 395, 453, 474-476, 486, 550, 566, 595-604, 607, 608, 613-615, 624, 625, 627, 629  
 9 Metis, 45, 126, 134  
 Meudon Observatory, 26, 29, 104  
 Michela family, 174, 201, 204, 206-208, 344, 346  
 Micrometeoroids (also micrometeorites), 52, 269, 353, 429  
 Micrometer (filar), 25-30  
 Mie theory, 379, 380, 382, 384, 385, 657  
 Mihalov, J. D., 240, 244, 573, 574  
 Miller, D. C., 462, 464, 466, 467, 469  
 Miller, T. W., xxvi, xxvii  
 Miller, W. C., 648  
 Millman, P. M., 363, 371, 373, 439, 445, 480, 485  
 Miner, E., 67, 77, 117, 119-121, 130  
 Mineralogical studies, 86, 115, 476, 486  
 93 Minerva, xviii  
 Minor Planet Center, xv, 9-12, 654  
 Minor Planet Circulars (MPC), xv, 9, 409, 639  
 Minor planets (*see* Asteroid)  
 Mission dates (*see* Launch date selection)  
 Missions (*see* Space missions)  
 Mitra, S. K., 371, 373  
 Models (*see under* Asteroid; Meteor)  
 Monte Carlo orbits (calculations), 270, 437, 439, 450-453, 480, 483, 485  
 Montgomery, J., 365, 371, 379, 380, 386  
 Moon  
   age, xix, 447, 477  
   comparison with asteroids, xvi, xx, 42, 48, 49, 52, 68, 69, 73-76, 80, 81, 85-92, 158, 159, 309, 433, 441, 442, 482, 486  
   craters, 231, 233, 392, 404, 430, 432, 477, 596  
   formation, 239, 240  
   mass, 229, 231, 233  
   -meteor collisions, 364, 441, 442  
   mission, 216, 220, 392, 474, 475  
   orbit, 449  
   origin, 399, 402, 404  
   phase relation, 56  
   polarization, 76, 95, 100, 102, 103, 112  
   radar, 165  
   regolith, 52, 95, 103, 104, 111-113, 217, 219  
   reflectivity, 33, 91, 92  
   samples, 67, 71, 73, 75, 91, 92, 103-105, 107, 115, 116, 239, 447, 460, 477, 544, 572-574, 657  
   size, v, 214, 215, 474, 477  
   surface, 67-71, 75, 217-221, 390-392, 570-573, 655  
   temperature, 234, 478  
 Moore, H. J., 270, 272, 291, 292, 298, 301, 303  
 Moran, P. A. P., 359, 362  
 Morgan, J. W., 118, 217, 222, 441, 444  
 Morris, E. C., 364, 373  
 Moulton, F. R., 364, 373  
 Mount Hopkins Observatory, vii  
 Mount Palomar 122 cm Schmidt, 647, 649  
 Mount Palomar 508 cm reflector, 27, 60  
 Mount Wilson 152 cm reflector, 59-62  
 Moutsoulas, M. D., 573, 574  
 Müller, G., 122, 130  
 Müller, O., 460  
 Muller, P., 25, 29  
 Murdock, T. L., 41  
 Murphy, J. K., 5, 6  
 Murray, B. C., 50, 52, 65  
 Musen, P., 10, 12  
  
 Nairn, F., 187, 194, 293, 295  
 Names (asteroid) (*see under* Asteroid)  
 NASA, vii, viii, 282, 371, 494, 556, 607, 634  
 Nash, L. K., 308, 312  
 National Science Foundation, vii  
 Naumann, R. J., xxii, 269, 291  
 192 Nausikaa, 45, 61

- Neckel, H., 58, 64  
 Nelson, H. G., 307-309, 312  
 Neptune, 30, 413, 492, 654  
 Neste, S. L., 617-631  
 659 Nestor, 410  
 Neugebauer, M., 216, 223  
 Neugebauer, P. V., 33, 37  
 Neujmin 1 and 2, 410, 414, 416, 417, 424, 427, 451, 453, 454  
 Newcomb, S., 20  
 Newell, H. E., v  
 Ney, E. P., 41, 43  
 Nice Observatory, 10  
 Nicholson, S. B., xxvi, xxvii, 645  
 Niehoff, J. C., 513-526, 546, 558, 565  
 Nininger, H. H., 310, 312-314  
 Nongravitational effects, xix-xxii, 23, 315, 390, 414-428, 461, 463, 475  
 1625 The NORC, 415  
 Norwood, V. T., 585, 586, 593  
 Noteboom, E., 18, 22  
 Nuclear electric power plants, 490, 491, 498, 499  
 Nuevo Laredo (achondrite), 460  
 Null, G. W., 19, 22  
 44 Nysa, 45, 134, 151  
 Nysa family, 174, 175, 197, 201, 204, 206-208, 342, 344, 346, 349
- OA0 (Orbiting Astronomical Observatory), 461  
 OART (Office of Advanced Research and Technology), 500, 501  
 Obliquity, 48, 257, 260  
 Observations (asteroids), viii, xiii, xiv, xxi-xxvi, 3-12, 22, 25-27, 30, 34, 35, 44-50, 58, 65-80, 83, 86-89, 92, 93, 111, 112, 115-122, 126, 128, 138, 139, 141-145, 148, 151-155, 159-162, 194, 198, 202-205, 213, 214, 218-221, 225, 229, 257-268, 281, 286, 287, 290, 354, 359-371, 374, 377-385, 388, 389, 395, 396, 413, 414, 416, 433, 439, 449-451, 457-459, 463, 465-468, 475, 476, 480, 481, 484, 510, 511, 596, 602, 603, 607, 634, 639-652, 655, 656, 658, 659  
 Occultation (asteroid), 27, 30  
 475 Ocllo, 420  
 1143 Odysseus, 410  
 Ogawa, H. S., 567, 574  
 Ogilvie, R. E., 239, 244, 430, 444  
 Öhman, Y., 543, 560
- Okabe, 463, 464  
 Oke, J. B., 58, 64  
 Olinda (1860) comet, 310  
 Oliver, J., 365, 371, 379, 380, 386  
 O'Mara, B. J., 379, 387  
 O'Neal, R. L., 607-615  
 Oort, J. H., 412, 413, 420, 441, 448  
 Öpik, E. J., xxii, xxiii, xxvii, 177, 180, 292, 400-402, 413, 417, 420, 427-429, 432-434, 438, 445, 447-449, 452, 453, 455, 459, 463, 483, 485, 648  
 Opposition effect, 38, 67, 75, 76, 79, 85, 117, 122, 126, 127, 184, 185  
 Optical Science Center, University of Arizona, vii  
 Orbit (asteroid, also grains), vii, xvi-xviii, xxii, xxiii, 3, 23, 33, 34, 52, 53, 161, 168, 177, 187-190, 194, 197-203, 208, 209, 214, 247-250, 257, 289, 310, 315, 320-322, 325, 327-330, 333, 337, 338, 344, 346, 349, 351, 353-362, 365, 392, 396, 399, 401, 414-418, 423, 427, 433-435, 438, 456-458, 467-469, 474-476, 481, 482, 596, 640-651  
 Orbit distribution, 457, 595  
 Orbital elements, orbital characteristics (asteroids), xiv-xviii, 9-12, 45, 53, 174, 177-180, 183, 198, 200, 203-206, 208, 213, 247, 260, 263, 264, 335-338, 340, 344, 348, 351, 353-356, 418, 465-469, 473-477, 505, 527, 541, 565, 641, 642, 649-651, 654  
 Orbital selection effect (*see* Selection effect)  
 Orientation of rotation axes (*see* Axes orientation)  
 Origin (asteroids), vii, viii, xix, 180, 213, 218, 263, 289, 300, 301, 395-397, 423, 425, 427, 428, 447-460, 465-469, 483, 486, 543, 574, 596, 657, 658  
 Orthopyroxene (Mg-rich), 59  
 Oscillations, 198, 200, 202, 203  
 OSSA (Office of Space Science and Applications), 501  
 Oterma, 409, 410, 468  
 Owen, R. W., 367, 369, 373, 379, 380, 387  
 Owings, D., 76, 77, 128, 130, 134, 138, 140, 257, 262
- Paddack, S. J., 457, 459  
 2 Pallas  
 albedo, 68, 69, 266, 625



- diameter, xv, 25-28, 38, 44, 68  
 distance, xiv, 122, 480, 481  
 ephemerides, 17, 21  
 lightcurve, 123  
 magnitude, 123  
 mass, 34-36  
 mission, 505, 583  
 observations, xiv, 45, 48, 59, 61, 93  
 orbit, 434, 435  
 perturbations, 262  
 polarization, 93, 95, 96, 99  
 radar, 170  
 reflectivity, 54, 61, 63, 306
- Pallas family, 437  
 372 Palma, 415
- Palomar-Leiden Survey (PLS), xvii, 9, 10, 33, 174-187, 190, 194-210, 263, 267, 268, 282, 290, 337-339, 342-345, 349, 359, 403, 404, 418, 469, 562, 623, 655
- Parent bodies (*see under* Meteorite)
- Paris Observatory, 25
- Parkhomenko, E. I., 242, 244
- Parkin, C. W., 240, 243, 244, 572, 574
- Parry, C. G., 572, 575
- 11 Parthenope, 63
- Participants of the Colloquium, 663-664
- Particles (*see also* Dust, Grains)  
 creation, formation, 247, 250, 275-286, 290  
 interplanetary, 382, 385  
 size, xxii, xxv, 63, 71, 72, 251-256, 259, 278, 281, 287, 297-303, 313, 314, 353, 622-626
- Partridge, R. B., 368, 372
- Patashnick, H., 383, 387
- 617 Patroclus, 410
- Pawlowia family, 347
- Peale, S. J., 364, 373-375
- Pearce, G. W., 573, 575
- Pedersen, J. C., 385, 386
- Pedersen, N. E., 385, 386
- Pellas, P., 219, 220, 222
- Penetration sensors (*see* Sensors)  
 554 Peraga, 634
- Pereyra, Z. M., 417
- Perrine-Mrkos, 411, 426
- Perturbations (*see also under* Jupiter), xxiii, 23, 38, 180, 181, 197-199, 229, 249, 313, 316, 317, 322, 369, 370, 416, 418, 425, 434-438, 640
- Peterson, A. W., 383, 387
- Petford, A. D., 379, 386
- Petri, W., 20, 22
- Pettingill, G. H., 165, 171
- Petty, A. F., 617-631
- Phase angle, xvii, xxiv, 10, 45-48, 53, 56, 63, 67, 71, 74, 79-87, 92, 95, 104, 105, 112, 119-122, 126, 127, 136, 138, 144, 145, 148-153, 159, 160, 184, 185, 257, 633, 655, 656, 658
- Phase function, 46, 75, 79-90, 121, 122, 126, 127, 173, 184-186, 385, 562
- Philipp, H. R., 382, 387
- Phobos, xxiii, 48-50, 399-405, 437
- 25 Phocaea, 45
- Phocaea family (also region), 174, 178, 179, 437
- Photometric astrometry, xiii, xiv, 123, 128, 134, 138, 139, 153, 159, 640, 655, 656
- Photometric beat phenomena, xvi, 257
- Photometric properties, xvi, 81, 83, 89
- Photometry (also infrared), xiii-xvi, xxiii-xxv, 27, 45-50, 54-58, 65, 79, 89, 91, 116-131, 137, 146, 161, 259, 364, 367, 388, 418, 420, 655-657
- Pialli, G., 305, 308, 309, 311, 312
- Piazzi, G., xiii
- Pic-du-Midi Observatory, 100
- Pierce, D. A., 21, 22
- Pigeonite, 59
- Pilcher, L. S., 585, 586, 593
- Pioneer spacecraft, xxiv, 366, 557, 609-612, 615, 624, 627
- Pioneers F and G  
 asteroid belt penetration experiment, 607-615  
 asteroid-meteoroid detector (A/MD), 617-631  
 missions, xxiii, xxiv, 534-536, 562, 563, 619, 633-637
- Piotrowski, J., 566
- Piotrowski, S., 229, 237, 264, 270, 280, 281, 292, 298, 303, 595, 596, 604, 622, 623, 631
- Pittich, E. M., 466, 468, 469
- Pitts, S. W., 517
- Planetesimals, 215, 221, 399, 474, 475, 477
- Planetoids, 165, 225-237, 255, 513
- Planets  
 albedo, 88  
 capture, 483  
 cooling rate, 430, 432  
 formation, v, 240-242, 249, 474, 475, 477

- heating, 240-243  
 mass (determination), 13-20, 475  
 missions (*see* Space missions)  
 model, 83-85  
 orbits, 10, 11, 19, 315  
 origin, xix, xx, 574  
 rotation, 215  
 semimajor axes, 214  
 terrestrial, 180, 215, 225, 228-235, 413  
 Plasma engine, 491, 497  
 Pluto Orbiter mission, 499  
 Poincaré body, 136  
 Poisson's equation, 156, 359-361  
 Polarization  
   curves, 67, 76, 79, 89, 91, 92, 95-116, 145, 385, 654  
   experiments, 633, 634  
   observations, measurements, xvi, xxiv, 68, 89-116, 302, 363, 377-388, 474, 563, 634, 640, 656, 657  
   radar techniques, 168  
   starlight, 261  
 Pole direction (*see* Axes orientation)  
 Poles (*see under* Asteroid)  
 Pons-Winnecke, 410  
 Population index, 285, 286  
 Population model, 264, 265, 270, 275, 279, 281, 283  
 Porter, J. G., xxvi, xxvii  
 Posen, A., 395-397  
 Poupeau, G., 219, 220, 222  
 Powell, B. N., 306, 313  
 Powell, R. S., 365, 373, 379, 383, 386, 387  
 Poynting-Robertson effect, 249, 290, 317, 365, 369, 389, 391, 392, 564, 599  
 Prairie Network meteoroids, 374, 440, 449-455, 458, 459, 480, 485, 486  
 Prendergast, K. H., 260-262  
 884 Priamus, 410  
 Příbram, 418, 426, 449, 451, 455, 480, 481  
 Price, P. B., 239, 244  
 Pringle, R., Jr., 258, 262  
 Probststein, R. F., 252, 253, 256  
 Proper elements, xviii, 346, 351  
 Propulsion  
   chemical, xxiv, 490, 492, 494, 495, 517-521, 526, 534-536, 549  
   nuclear electric, xxiv, 487, 490, 491  
   solar electric, xxiv, 487, 490-509, 516-529, 535, 547-551  
   Provin, S., 91, 93, 96, 115  
   16 Psyche, 45, 63, 569  
   Putilin, I. I., xxvi, xxvii  
   1537 1940 QA, 415  
   Rabe, E., xiv, xvii, xix, 13-23, 38, 407-412, 654, 658  
   674 Rachele, 45  
   Radar measurements (asteroids, dust), xvi, xxi, xxii, 165-171, 363, 641, 642, 656  
   Radius function, 225-230, 232, 236  
   Rainville, L. P., 165, 171  
   Rajan, R. S., 219, 220, 222  
   Rajogopaln, A. S., 476, 478  
   Raleigh, C. B., 432, 444  
   Recht, A. W., 54, 64  
   Reeves, H., 219, 220, 222  
   Reflection spectra, 54, 64  
   Reflectivity curves (also effect, spectral reflectivity), 33-36, 51-54, 58-65, 71, 72, 77, 79, 81, 88, 111, 115, 128, 147, 150, 151, 305, 306, 372, 482  
   Reflectivity (surface), xv-xvii, 28, 79, 83, 86, 92, 93, 141-146, 460, 562, 596, 625, 656  
   Regoliths (*see under* Moon)  
   Reid, A. M., 219, 220, 222, 223  
   Reinmuth 1 and 2, 410  
   Renzema, T. S., 383, 387  
   1204 Renzia, 437, 480  
   Resistojet, 491, 497  
   Resonances, xviii, 22, 178-180, 188, 425, 481  
   Revelstoke (chondrite), 455  
   Revolution period, 174, 414  
   Reynolds, J. A., 239, 244  
   Ribbe, P. H., 432, 445  
   Richardson, F. F., 563, 566  
   Richardson, R. S., xxvi, xxvii, 645, 648  
   Richter, N. R., 373, 385, 387  
   Ring asteroids (*see under* Asteroid)  
   Ring, J., 364, 373  
   Roach, D. V., 432, 445  
   Roach, F. E., 137, 140, 147, 154, 371, 373, 379, 381, 383, 387, 388, 571, 574, 620, 631  
   Roach, S. A., 359, 362  
   Robertson, H. P., 290, 292  
   Rocket engines, fuel (*see also* Propulsion), 540  
   Roemer, E., xiv, xvii, xx, 3-7, 37-39, 48-50, 79, 89, 91, 93, 98, 112, 115, 119, 130, 139, 140, 168, 170, 171,

- 257, 262, 413, 417, 418, 420, 433, 440, 441, 444, 445, 642-648, 658
- Roosen, R. G., 39, 269, 292, 363-377, 389, 390, 393
- Rosa stream, 350
- Rösch, J., 25, 29
- Rosenberg, D. L., 91, 93
- Rosenhagen, J., 133-140
- Rotation axes, axes alinements (*see* Axes orientation)
- Rotation period (asteroids, grains), xvi, xx, 12, 37, 42-45, 47, 49, 53, 56, 59, 93, 117, 123-128, 133-139, 155, 166, 170, 173-175, 188, 194, 213-215, 249, 250, 262, 313, 330, 474, 545, 655
- Roth, G. D., xxvi, xxvii
- Roughness (*see under* Asteroid)
- Roy, N. L., 564, 566
- Russell, H. N., 18, 22, 141, 145
- Safranov, V. S., 460
- Sagan, C., 89, 93
- Salisbury, J. W., 52, 64
- Sandage, A., 5, 6
- Sandakova, E. V., 55, 64
- Sandig, H. U., 365, 373
- Santa Barbara Research Center, 637
- 80 Sappho, 45
- Satellite observations, 363, 374, 383, 385
- Sather, R. E., 130, 134, 139, 140
- Saturn
  - mass, 20, 23, 641
  - mission, 499
  - orbit, 413, 453
  - rings, 315, 330
  - satellite system, 213, 214, 402, 405
  - Trojans, xviii, 185, 654
- Saturn I rocket, xxiv, 494, 495
- Sauer, C. G., 511
- Saunders, P. M., 83, 90
- Savin, C. R., 269, 291
- Scattering properties, 50, 80, 82-85, 88, 89, 107, 111, 377-385, 657
- Schatzman, E. L., 317
- Schaumasse, 411, 426
- Schild, R. E., 58, 64
- Schmeidler, F., 20, 22
- Schmidt, T. A., 379, 386
- Scholl, H., 20, 22
- 1235 Schorria, 437
- Schramm, D. N., 239, 240, 244
- Schrutka-Rechtenstamm, G., 133, 135, 137, 140
- Schubart, J., xv, xvii, 10, 19, 22, 33-39, 42-44, 77, 413, 421
- Schubert, G., 240, 244, 305
- Schwartz, G., 395-397
- Schwartz, K., 240, 241, 244, 245, 259, 262
- Schwassmann-Wachmann, 1 and 2, 409, 410, 424, 468
- Searle, A., 364, 373
- Secretan, L., 371
- Seed bodies, 226, 227, 236
- Sekanina, Z., xx, 414-418, 421-428
- Selection effect, xxi-xxiii, 180, 181, 197-210, 339, 349, 362, 397, 459, 565, 596, 598, 599, 601, 624, 658
- Sellen, J. M., Jr., 567, 574
- Sellers, G. A., 219, 222
- Semimajor axes (*see under* Asteroid)
- Sensors (impact detectors), xxi, 363, 549, 553, 556, 563, 564, 585-587, 607-614, 617-631
- SERT 1 and 2, 494, 497, 498
- Shankland, T., 71, 77
- Shao, C.-Y., 395-397
- Shape (*see under* Asteroid)
- Shapiro, I. I., 19, 21, 165, 171
- Shapiro, S. I., 364, 373
- Sharonov, V. V., 266, 292
- Shatzel, A. V., 347
- Sheaffer, Y., 370, 371
- Shkarofsky, I. P., 567, 575
- Shoemaker, E. M., 270, 272, 291, 299, 301, 303
- Short, J. M., 239, 244, 306, 312, 430, 431, 444
- Siedentopf, H., 379, 386
- Sikhote-Alin (*see under* Meteorite)
- Silver, L. T., 460
- Silvester, A. B., 126, 131
- 1317 Silvette, 415
- Simonenko, A. N., 480, 485
- Singer, S. F., vii, 248, 249, 365, 367, 368, 371, 373, 377, 382, 387, 399-405, 460
- Sinkankas, J., 219, 222
- Sinkankas, M., 222
- 1009 Sirene, 420, 427
- Size (*see under* Asteroid; Comet; Dust; Grains; Particles)
- Skin (*see under* Asteroid)
- Skopinski, E., 76
- Skylab, 539
- Slaughter-Bernham, 645, 646, 648
- Smith, A. J., 434, 435, 445
- Smith, B. A., 48, 50

- Smith, B. F., 240, 244, 437, 445  
 Smith, L. L., 367, 369, 373, 379, 380, 387  
 Smith, W. B., 19, 21, 165, 171  
 Smithsonian Astrophysical Observatory (SAO), xv, xxii  
 Smithsonian Astrophysical Observatory Star Catalog, 4-6  
 Smoothness (*see under* Asteroid)  
 Snyder, C. W., 216, 223  
 Sobel, H., 382, 386  
 Soberman, R. K., 500, 617-631, 634  
 Solar corona, 379, 382  
 Solar electric propulsion (*see under* Propulsion)  
 Solar interference (Eros mission), 523, 525, 526, 547, 548  
 Solar nebula (*see also* Solar system, origin), vii, xix, 52, 225, 228, 229, 234-236, 239, 240, 251-256, 413, 442, 443, 447, 460, 482, 486  
 Solar parallax, 16, 18, 19  
 Solar spectrum, 47, 54, 58, 463  
 Solar system  
   age, xx, xxiii, 259-261, 428, 433, 489  
   evolution, v, 243, 259, 260, 325, 486  
   exploration, v, vii, 243, 367, 370, 374, 487, 489-501, 543, 544, 574  
   formation, v, xxiii, 52, 53, 221, 327, 378, 412, 465, 475, 477, 543, 544, 585  
   history, v, 474, 486  
   magnetic fields, 571  
   observations, 4, 49, 58, 59, 76, 215, 249, 250, 306, 315-317, 389, 453, 457, 486  
   origin, vii, xix, 52, 53, 221, 240, 327, 399, 418, 428, 447, 448, 453, 460, 461, 543, 544, 561, 585, 658  
   radar, 166  
 Solar-type comparison stars, 655  
 Solar wind, 76, 115, 313, 545, 551, 567-575  
 Sonett, C. P., 239-245, 259, 262, 573, 574  
 Soo, S. L., 252, 256  
 Southworth, R. B., xvii, xix, 337-354, 362, 365, 373, 396  
 Spaak, G., 27  
 Space missions, probes  
   asteroid, v, viii, xxiii-xxv, 6, 113, 115, 221, 448, 479-486, 489, 490, 496-499, 503-537, 561-566, 571, 574, 577-583, 588-590, 627, 628, 629, 643, 656, 658, 659  
   Grand Tour, 404, 500, 510  
   Helios, 385  
   manned asteroid, 539-541  
   multiple flyby, 527-537  
   other, xxi, xxiii-xxv, 367, 379, 390, 405, 473-478, 489-501, 516, 533, 535, 539-541, 588, 659  
   Pioneer (*see under* Pioneers F and G)  
   target orbits, 506-510, 528, 529, 534, 536, 537, 577, 578, 585, 589-592, 658  
 Space shuttle, xxv, 499, 547  
 Spacecraft, vehicle  
   capabilities, 500, 527, 530-536  
   chemical rocket motor, 490-492  
   designs, 25, 500, 544, 547, 550, 553-560  
   electric, 489-501  
   Explorers and Pegasus (*see* Explorer satellites and measurements)  
   gradiometer, 586-588  
   hazards, xxii, 371, 389, 393, 537, 564, 595-607  
   junk, xii-xv, 646, 649-652  
   magnetometers, 573, 574  
   mass, 504, 509  
   Pioneer (*see* Pioneer spacecraft)  
   propulsion (*see* Propulsion)  
   television, xxv, 546, 549, 552-558, 562, 563  
   TOPS vehicle (*see* TOPS vehicle)  
   Viking (*see* Viking mission)  
 Spagnolo, F. J., 86, 89  
 Spectral reflectivity (*see* Reflectivity curves)  
 Spectrophotometric studies, xvi, 51-65, 388, 655  
 Spectrum, 54, 69-71, 86, 305, 381, 563, 564  
 Spencer Jones, H., 18, 22  
 Spotted (*see under* Asteroid)  
 Stacey, F. O., 572, 575  
 Staley, D. O., 549, 550, 560  
 Stay time (hover phase), 521-526, 543, 548-553, 556-558, 573  
 Stecker, T. P., 382, 387  
 Stefanik, R. P., 466, 469  
 Steigerwald, E. A., 307, 309, 311, 312  
 Steigmann, G., 107, 114  
 Stein, W. A., 41, 43  
 Stephens, H. G., 365, 373

- Stephenson, G. B., 130  
 Steward Observatory (229 cm reflector), 642  
 Sticking coefficient, 226, 236, 313, 320  
 Stobbe, J., 128, 131, 133, 135, 136, 139, 140  
 Stochastic process (model), 263, 290  
 Stoddard, L. G., 137, 139, 140, 147, 154, 571, 574  
 Stokes' law, 253, 255  
 Stone, M. L., 165, 171  
 Stracke, G., 11, 33, 34, 38  
 Strangway, D. W., 573, 575  
 Strength (cohesive), 424, 426, 476  
 Structure (*see under* Asteroid)  
 Struve, G., 34, 35, 38  
 Struve, O., xxvi, xxvii, 647, 648  
 Stuhlinger, E., 489-501, 561  
 Stumpff, K., 79, 90  
 Stumpff, P., 34, 38  
 Subbotin, M. F., 11  
 Suess, H. E., 220  
 Summers, A. L., 306, 312, 430, 438, 444  
 Sun (*see* Solar)  
 Surface (*see* Asteroid, composition; Asteroid, skin; Asteroid, texture; Chemical composition; Chemical nature)  
 Surface gravity (*see* Gravitational effects)  
 Surface reflectivity (*see* Reflectivity (surface))  
 Surface texture (*see* Asteroid, surface; asteroid, texture)  
 Surveyor project, 499, 554  
 882 Swetlana, 415  
 Symon, K. R., 258, 262  
 Synodic period, 121, 123  
 Szebehely, V., 364, 374
- Taft, E. A., 382, 387  
 Tamkane, A. S., 476, 478  
 Target orbits (*see under* Space missions)  
 814 Tauris, 415  
 Taylor 1916 I (comet), 310  
 Taylor, G. I., 252, 256  
 Taylor, G. J., 431, 432, 445  
 Taylor, H. P., Jr., 98, 112, 115, 219, 223  
 Taylor, R. C., xvi, 37-39, 48, 50, 79, 89, 91, 93, 117-131, 134, 138-140, 170, 171, 257, 262, 418, 420, 440, 441, 444  
 1749 Telamon, 410  
 Tempel 1 and 2, 410, 417, 424, 427  
 Tempel-Swift, 410, 417
- Temperature (*see* Heating; Melting; Thermal radiation, conductivity)  
 Tempesti, P., 126, 131, 134, 138, 140  
 Tera, F., 239, 244  
 Terrestrial planets (*see under* Planets)  
 Terrestrial rock, samples (*see under* Earth)  
 Teska, T. M., 93  
 Tetelman, A. S., 305, 307-309, 311, 313  
 24 Themis, 20  
 Themis family, 174, 175, 201, 204, 349  
 778 Theobalda, 415  
 Thermal radiation, conductivity (*see also* Heating; Melting), 41, 43, 44-49, 233, 234, 459, 460, 562  
 17 Thetis, 63  
 Thomas, G. E., 374, 375  
 Thompson, W. B., 319-326  
 Thor-Delta launch vehicle, xxiv  
 279 Thule, xviii, 173, 174, 188, 415, 420, 655  
 Titan launch vehicles, xxiv, 499, 507-509, 518-522, 526, 547, 558  
 Titius-Bode, xiii  
 Titulaer, C., 107, 114  
 Tokyo Observatory, 10  
 Toluca (meteorite), 430  
 Tombaugh, C. W., 646, 648, 654, 659  
 Tomita, K., 418  
 TOPS vehicle, 500, 557  
 1685 Toro, 170, 419, 440, 483, 526, 644, 656  
 Trageser, M. B., 586, 593  
 Trajectory geometry, 516-518, 523, 525, 529-537, 547-553, 603, 612, 613, 628, 658  
 1208 Troilus, 410, 411  
 Trojans  
   clouds, 412  
   librations, xix, 407-409, 412, 415, 420  
   lightcurves, xvi, 155, 173, 174  
   mass, 36, 412  
   mission, 473, 484, 513, 536, 537  
   observations, xxvi, 53, 647, 653, 654  
   orbits, xix, 188, 190, 408, 423, 450, 453  
   origin, xix, 412  
   Neptune, Saturn, xx, 185, 654  
   phase function, 92, 185, 239, 655  
 Truelsen, J., xix, 216, 220, 250, 309, 315, 316, 319, 327-335, 353, 362, 657  
 Tsiolkovskiy equation, 492  
 T Tauri, 239-245, 259

- Tuček, K., 420, 421  
 Turner, G., 445  
 Tuttle-Giacobini-Kresák, 410
- 1960 UA, 418, 419, 644, 647  
 1963 UA, 420, 427  
 Una family, 347  
 1508 1938 UO, 415  
 Uranus, xiii, 213, 460, 492  
 Urey, H. C., vii, 239, 244, 250, 362, 402, 430, 442, 445, 460, 461, 462, 464, 466, 469, 479, 486, 487  
 U.S. Naval Observatory, 10, 96, 402
- Valda family, 347  
 Van Biesbroeck, G., 5, 6, 33, 36, 38, 130, 133, 265, 291, 596, 601, 604, 623, 631  
 Van Horn, H., 75, 77  
 Van Schmus, W. R., 431, 432, 445  
 Vanýsek, V., xx, 465-469  
 Vedder, J. F., 369, 371, 374  
 Velas 5, 6, 7, and 8, 497  
 Velocities, xix, xxii, xxiii, 75, 111, 115, 168, 213-216, 247, 249, 251, 253, 255, 259, 263, 264, 269, 270, 289, 297, 313, 320-323, 327-330, 357, 360, 391, 393, 433-441, 473, 476, 477, 481, 483, 484, 563, 601-604, 612, 613, 643, 645, 647, 651, 652  
 Venkatavaradan, V. S., 476, 478
- Venus  
 mass, 19, 20  
 mission, 490, 499  
 perturbations, xx, 457  
 radar, 165, 168, 169  
 rotation, 169, 460  
 surface, 88, 168, 170  
 temperature, 234, 236
- Verniani, F., 395, 397  
 612 Veronika, 415  
 Vesely, C. D., xiv, xvi, 133-139, 257, 550
- 4 Vesta  
 albedo, 47-49, 68, 70, 75, 111, 115, 116, 276  
 close approaches, xiv, 38, 170  
 color, 88, 119, 123  
 composition, 52, 54, 58, 59, 68, 69, 75, 77, 305, 306  
 coordinates of rotation axis, 138, 258, 261  
 density, 36, 37, 77, 305, 306  
 diameter, xv, 25-30, 44, 46-50, 68, 111, 305, 499  
 ephemerides, 17, 21, 41-43, 641  
 lightcurve, 121, 123, 143-145  
 magnitude, 123  
 mass, 33-37, 305, 306  
 mission, 505-508, 532, 583  
 models, 46-49  
 observations, xiv, 45, 474  
 opposition effect, 126  
 phase effect, function, 46-49, 123  
 polarization, 95, 96, 99, 111  
 reflectivity, 62, 63, 91, 92, 453, 460, 625  
 rotation, 59, 123, 127, 474  
 shape, 258, 261  
 spectrum, 69
- Vesta family, 174, 201, 204  
 Veverka, J., 29, 38, 48, 50, 61, 65, 69, 79-93, 99, 115, 116, 131, 145, 261, 654  
 Vickers, R. S., 543, 546, 560  
 de Vico-Swift, 410  
 12 Victoria, 126  
 Vignetting, 192, 195  
 Viking mission, spacecraft, 501, 534-536  
 1310 Villigera, 437  
 Vogel, D. C., 365, 373, 379, 383, 387  
 Volcanism (volcanic cinders), 82, 86, 477  
 Voshage, H., 310, 313, 429, 430, 432, 445  
 Vsekhsvyatskij, S. K., 414, 421
- van der Waals (force), 76  
 Wai, C. M., 460  
 Walker, G., 107, 114  
 Walker, R. M., 219, 220, 222, 240, 245, 392, 393, 430, 444  
 Wang, R. T., 385, 386  
 Wänke, H., 115, 220, 223, 432, 445, 481, 485  
 886 Washingtonia, 415  
 Wasserburg, G. J., 239, 244  
 Wasson, J. T., 429, 430, 445, 460  
 Watson, F. G., xxvi, xxvii, 51, 52, 54, 65, 133, 135, 137, 139, 140, 292  
 Weaver, A. B., vii  
 Wedekind, J. A., 272, 291, 301, 303  
 Weeks, R. A., 309, 312  
 Wehner, G. K., 91, 93  
 Weinberg, J. L., vii, 364, 371, 374, 379, 381, 384, 385, 388, 637  
 Wells, E., 75, 77  
 Wetherill, G. W., 259, 262, 264, 270, 289, 292, 311, 313, 429, 438-440, 445-460, 479, 485, 566, 601, 604

- Whipple (comet), xx, xxii, 288, 290, 292, 410, 424
- Whipple, F. L., vii, xx-xxii, xxvii, 89, 93, 219, 249, 251-256, 311, 313, 317, 363, 365, 369, 370, 374, 389-397, 413, 414, 421, 433, 442, 445, 446, 459, 461, 464, 466, 469, 486, 598, 605
- 931 Whitemora, 415
- Widmanstätten patterns (structure, figures), 240, 306, 307, 429
- Widorn, T., 79, 88, 90, 91, 93
- Wilkening, L., 219-223, 476, 478
- Williams, D. P., 307-312
- Williams, H. P., 585, 586, 592
- Williams, J. G., xx, 177-181, 362, 435, 440, 455, 457, 459, 481, 566
- 747 Winchester, 415
- Wirtanen, 410
- Wise, M., 630
- 717 Wisibada, 415
- Witt, G., 18, 22
- Wlotzka, F., 220, 223
- van Woerkom, 177, 180
- Wolf, 410
- Wolf, M., xiii
- Wolf method, 3
- Wolff, C., 364, 371, 373, 374
- Wolf-Harrington, 410
- Wolstencroft, R. D., 369, 372, 374
- Woo, C. C., 219, 222
- Wood, H. J., 131, 257, 262
- Wood, J. A., 162, 239, 244, 251, 256, 306, 313, 429, 432, 446, 459
- Woodson, P. E., III, 365, 373, 379, 383, 387
- Woolum, D., 219, 220, 222, 392, 393
- Wright, R. W., 371, 372
- Wrobel, J. R., 528, 536
- Wyse, A. B., xxvi, xxvii
- 1947 XC, 644
- Yakhontova, N. S., 11
- Yale Catalogue Zones, 10, 21
- Yantar (U.S.S.R.), 494, 497
- Yen, C. L., 511
- Yeomans, D. K., 414, 421, 426, 428
- Yerkes Observatory, 25
- Young, J., 67, 77, 117, 119-121, 130
- von Zack, F. X., 34, 38
- Zahringer, J., 460
- Zech, G., 19, 22
- Zellner, B. H., 37-39, 48, 50, 79, 89, 91, 93, 98, 99, 112, 115, 119, 130, 139, 140, 170, 171, 257, 258, 262, 418, 420, 440, 441, 444, 446
- Zessewitsche, W., 133, 135, 139, 140
- Zimmerman, E., 365, 371, 380, 386, 397
- Zimmerman, P., 458
- Zodiacal cloud, dust, xxi, 259, 365, 374, 389-393
- Zodiacal experiment, 633, 634
- Zodiacal light, xxi, 363, 371, 374, 377-379, 382-385, 627, 657
- Zond 2 (U.S.S.R.), 494, 497
- Zones, 188-194
- Zook, H. A., 367, 374