

# 2004 ASTRONOMY MAGAZINE INDEX

## Subject index

### A

absolute zero, 2:18  
Alaska tour, *Astronomy's*, 1:76–78  
Altair (star), 8:16  
amateur telescopes. See names of specific amateur telescopes; telescopes, amateur  
Andromeda Galaxy, 10:14  
Apollo 11 (spacecraft), mission accused of being a hoax, 7:48–53  
Aram Chaos (Mars), 11:30  
archaeoastronomy, 11:18  
Arcturus (star), 2:73  
Argyre impact basin (Mars), 10:30  
artwork, astronomical  
  artist Russell Crotty, 12:90–91  
  evolution of space art, 7:78–81  
  types of, 7:78–81  
  what space art is, 7:78–81  
asteroids  
  See also names of specific asteroids  
  collisions with Earth, 12:38–43  
  Don Quijote mission, 10:28  
  inside Mercury's orbit, 2:42–46  
  reddening of, 8:32  
  showers of, Earth struck by, 11:24  
astrology, 12:50–56  
Astronomical League, 8:84–87  
*Astronomy's* tours. See tours, *Astronomy's*  
astrophotography  
  25 greatest photos, 2:34–41  
  aurorae, photographing, 3:84–88  
  of Bill and Sally Fletcher, 9:74–79  
  CCD images, 2:84–89  
  colors in, 2:72–73  
  at Mauna Kea, Hawaii, 8:80–83  
  mistakes, 4:74–78  
astro-shed, building, 11:72–73  
Atlas 8 amateur telescope, 5:86–89  
atoms, temperature at which stop moving, 2:18  
AU Microscopium (star), 11:32  
aurorae, viewed during *Astronomy's* Alaska tour, 1:76–78  
Aveni, Anthony, 11:18  
Aziz, Ra'ad Ali Abdul, 12:80–83

### B

Barnard, E. E., 8:70–75  
Big Dipper (asterism), temperature of stars in, 6:71  
binoculars, Japan Telescope and Binocular Show, 2:80–83  
black dwarf stars, time takes for white dwarfs to turn to, 12:74–75  
black holes  
  in center of Milky Way, imaging of, 7:30  
  cloaked by gases, 2:32  
  clouds of dust around, 11:24  
  jets shot from poles of, 11:24  
  smallest known, 4:25  
  supermassive, 3:36–41  
Blue Moon, frequency of, 12:75  
Tycho Brahe, 1:73  
brown dwarf stars, 10:26. See also names of specific brown dwarf stars  
Bug Nebula (NGC 6302), 8:26  
Bunge Crater (Mars), 12:34

### C

C153 (spiral galaxy), 4:26  
C/2001 Q4 (NEAT) comet, 5:70–74  
C/2002 T7 (LINEAR) comet, 5:70–74  
Caldwell Catalog, 10:72  
Callisto (Jupiter's moon), water below surface of, 7:34–41  
Canada-France-Hawaii Telescope (CFHT), 8:34–41  
Cancer (constellation), 3:76–79  
Canis Major dwarf galaxy, 2:32  
Canon 10D digital camera, 9:84–87  
careers in astronomy, areas of study for, 11:71  
Cassini (spacecraft)  
  approaching Saturn, 7:26

  discoveries about Saturn's radiation belts, 11:28  
  images of Saturn, 10:38–43  
  mission to Saturn, 1:34–41  
  Phoebe flyby, 9:46–49  
Cassiopeia A (supernova remnant), jets in, 12:30  
Cassiopeia (constellation), 11:15  
CCD (charge-coupled device) cameras  
  amateur discoveries using, 6:78–82  
  images, 2:84–89  
Celestron, advanced series telescopes, 8:88–91  
Centaurus A (galaxy). See NGC 5128  
CFHT (Canada-France-Hawaii Telescope), 8:34–41  
Chandra X-ray Observatory, elements found on Moon (Earth's) by, 1:27  
charge-coupled device. See CCD (charge-coupled device) cameras  
Chicxulub (crater on Yucatan Peninsula, Mexico), 8:28  
Cocoon Nebula (IC 5146), 2:12–13  
colors, of celestial objects, 2:72–73  
comets  
  history of, 5:36–41. See also names of specific comets  
  nitrogen found in, 1:30  
Comet Temple 1, Deep Impact probe encounter with, 12:32  
Comet Wild 2, 3:30  
Comet Wild 2, Stardust flyby, 4:24  
cosmology, uncertainty in beliefs, 7:16  
Crotty, Russell, 12:90–91

### D

Deep Impact probe, encounter with Comet Temple 1, 12:32  
Deneb (star), 8:16  
Don Quijote (asteroid mission), 10:28  
Dunham, David W., 3:80–83  
dust, denseness of, 7:77  
dust disks, commonness of, 6:28  
dust jets, near solar system, 6:24  
dwarf stars. See black dwarf stars; white dwarf stars;  
  brown dwarf stars

### E

Earth, tilt of, 2:73  
eclipses, lunar  
  of October 27, 2004, 10:50  
  what would look like from MNOon, 4:66  
education, astronomy, 11:82–85  
Egypt, observing Venus transit of Sun from, 10:76–81  
Einstein, Albert, reference frames concept, 5:18  
elements, origin of heavier elements, 5:68–69  
Entabeni, South Africa, observing Venus transit of Sun from, 10:76–81  
Epsilon Indi B (brown dwarf star), 1:28  
eSTAR ("intelligent agent" computer program), 2:27  
Eta Carinae (star), 2:24  
Europa (Jupiter's moon), water below surface of, 7:34–41  
expeditions, to observe astronomical events, 8:14  
extrasolar planets. See planets, extrasolar  
extraterrestrial life  
  See also SETI  
  and intelligence on Earth, 9:18  
  long vs. short messages to, 12:36

### F

Fan, Xiaohui, 8:20  
Far Ultraviolet Spectroscopic Explorer (FUSE)  
  satellite, 9:26  
fireballs, 5:76–79  
Fletcher, Bill and Sally, 9:74–79  
FUSE (Far Ultraviolet Spectroscopic Explorer)  
  satellite, 9:26

### G

Galactic Habitable Zone (GHZ), 4:22  
galactic winds, 4:26  
galaxies  
  See also names of specific galaxies  
  closest to Milky Way, 2:32

  consuming other galaxies, 1:27  
  early lives of, 10:28  
  mini-galaxies, 7:28  
  oldest and farthest known, 5:30  
Galilei, Galileo, 1:73  
gamma-ray bursts  
  general information, 1:42–47  
  low power, 11:28  
  mass extinction possibly caused by, 1:28  
  nearby, 9:26  
  and supernovae, 10:44–49  
  and X-ray flashers, 2:30  
gamma rays, source of glow, 6:26  
Ganymede (Jupiter's moon), water below surface of, 7:34–41  
Geminga (neutron star), 10:26  
Genesis capsule, 10:24  
GHZ (Galactic Habitable Zone), 4:22  
Gingerich, Owen, 5:22  
globular clusters  
  in Large Magellanic Cloud (LMC), 10:26  
  possibly remains of destroyed dwarf galaxies, 11:28  
Gould's Belt, star formation in, 9:40–45  
gravitational lenses, multiple images produced from, 3:72  
gravitational microlensing, 7:30  
Gravity Probe B space mission, 3:28

### H

Hartmann, William, 6:16  
Hawaii tour, *Astronomy's*, 1:79–81  
HD 44179 (Red Rectangle) (nebula), 8:30  
HD 81809 (star), 8:30  
heat shields, inflatable, 1:26  
Hellas impact basin (Mars), 10:22  
Hermes (asteroid), 1:30  
Hubble Space Telescope (HST)  
  deepest images of cosmos taken, 6:26, 7:70–73  
  lack of replacement for, 11:46–52  
  why can't fix using International Space Station, 8:70–75  
human space-flight plan, 5:48–51

### I

Iapetus (Saturn's moon), 8:28  
IC 5146 (Cocoon Nebula), 2:12–13  
inflatable heat shields, 1:26  
intelligence, on Earth, 9:18  
International Space Station (ISS)  
  cupola built for, 12:30  
  force required to reach, 6:71  
  why can't fix Hubble Space Telescope using, 8:78  
interplanetary travel, history of desires/dreams about, 1:48–52  
interstellar space, Voyager 1 (spacecraft) entering, 2:27  
Iraq, amateur astronomy in, 12:80–83  
ISS. See International Space Station

### J

J1004+4112 object, 4:26  
Japan Telescope and Binocular Show, 2:80–83  
jets  
  in Cassiopeia A (supernova remnant), 12:30  
  whether shape nebulae, 3:29  
Jim's Mobile, Inc. (JMI) RB-66 binoscope, 2:90–93  
Jupiter  
  core of, whether solid, 10:67  
  loss of spots possible, 7:28  
  observing, 4:70–73

### K

Konus' Maksutov Cassegrain Motormax-130 HM amateur telescope, 4:84–86  
Kuiper Belt, migration with Neptune, 3:29

### L

Large Magellanic Cloud (LMC)  
  globular clusters in, 10:26  
  halo of RR Lyrae-type variable stars, 1:26

Leo (constellation), 4:16  
Leonid meteor shower, November 14, 1833, 9:66–67  
Levy, David, 4:18  
light pollution, 6:38–43  
LMC. See Large Magellanic Cloud  
Lodriguss, Jerry, 2:20  
loneliness, combating, 7:17  
Lowell Observatory (Flagstaff, Arizona), 6:84–87  
lunar Alps (Montes Alps), 11:74–75  
Lunar Orbiter missions, digitizing photos from, 6:25  
Luxor, Egypt, observing Venus transit of Sun from, 10:76–81  
LX200GPS-SMT telescope, Meade, 7:88–91

## M

M33. See Pinwheel Galaxy  
M42. See Orion Nebula  
M64 (galaxy), 5:30  
M67 (star cluster), 3:70–71  
M81 (galaxy), 5:20  
M82 (galaxy), 5:20  
M87 (galaxy), 8:28  
Maiz-Apellániz, Jesús, 10:14  
Maksutov-Cassegrain amateur telescopes, 4:84–86, 10:82–85  
map of universe, 2:27  
Mare Tranquillitatis (lunar mare), 7:82–83  
Marino, Lori, 9:18  
Mars  
See also names of individual rovers  
Aram Chaos, 11:30  
Argyre impact basin, 10:30  
artist's depictions of, 4:38–43  
Bunge Crater, 12:34  
dust on, smell of, 8:78  
Hellas impact basin, 10:22  
ice on, near equator, 6:25  
Marte Vallis, 8:32  
Meridiani Planum  
basaltic sandstone found in, 8:32  
"blueberries" on, 9:26  
methane on, 7:28  
moons of, whether large enough to eclipse Sun, 8:78–79  
Olympus Mons (volcano), 6:25  
Oudemans Crater, 9:28  
Pot of Gold (martian rock), 9:28  
Razorback site, 10:30  
rocks possibly altered by water, 11:30  
Shalbatana Vallis, 12:34  
spiral canyons in polar caps, 7:32  
Tharsis (volcanic bulge), 11:30  
Tiu Vallis, 8:32  
water on, streaks as possible evidence of, 6:66–69

Marte Vallis (martian outflow channel), 8:32  
Mattei, Janet, 9:16  
Mauna Kea, Hawaii, astrophotography at, 8:80–83  
McNeil's Nebula, 7:30  
Meade LX200GPS-SMT telescope, 7:88–91  
Mercury  
asteroids inside orbit of, 2:42–46  
MESSENGER probe flyby, 5:28  
Meridiani Planum, 5:42–47  
basaltic sandstone found in, 8:32  
"blueberries" on, 9:26  
MESSENGER probe, Mercury flyby, 5:28  
Messier Marathons, 3:20  
meteors and meteorites, craters from, 8:28  
methane, on Mars, 7:28  
Methuselah Planet, 6:44–49  
Milky Way Galaxy  
additional spiral arm, 8:30  
age of, 12:34  
Barnard's atlas of, 8:70–75  
center of, black hole in, 7:30  
Galactic Habitable Zone (GHZ), 4:22  
galaxy closest to, 2:32  
mini-galaxies, 7:28  
Montes Alps (lunar Alps), 11:74–75  
Montes Apenninus (lunar mountain range), 1:82–83  
Moon (Earth's)  
See also eclipses, lunar; names of individual lunar probes  
Apollo 11 mission, accused of being a hoax, 7:48–53

Blue Moon, frequency of, 12:75  
elements found on via X-ray observation, 1:27  
Mare Tranquillitatis, 7:82–83  
Montes Alps, 11:74–75  
Montes Apenninus, 1:82–83  
names of surface features, 12:84–89  
orbit of, 12:16  
origin of, 7:42–47  
plans to send probes to in 2008–2009, 6:24  
moons, differentiating from stars and planets, 3:72–73  
Motormax-130 HM amateur telescope, 4:84–86

## N

N44F (star-forming region), 12:28  
NASA, human space-flight plan, 5:48–51  
near-Earth objects, tracking, 12:75  
nebulae, whether jets shape, 3:29  
Neptune  
core of, whether solid, 10:67  
difference in appearance from Uranus, 5:30  
new moons discovered, 11:28  
neutrinos, 3:49–53  
neutron stars, frequency of collisions/merging, 3:30  
Next Hubble Space Telescope. See Very Large Space Telescope (VLST)  
Next-Next Generation Space Telescope. See Very Large Space Telescope (VLST)  
NGC 1569 (galaxy), 5:32  
NGC 300 (spiral galaxy), 7:24  
NGC 4402 (galaxy), 9:28  
NGC 5128 (Centaurus A) galaxy  
consumption of other galaxies, 9:22  
globular clusters in, 11:28  
NGC 6302 (Bug Nebula), 8:26  
NGC 7129 (reflection nebula), 5:28  
nitrogen, found in comets, 1:30  
northern lights. See aurorae

## O

observation, via slooh.com web site, 3:18  
Olympus Mons (martian volcano), 6:25  
150K amateur telescope, TAL's 3:90–93  
Opportunity (Mars rover), 1:104–105  
basaltic sandstone found by, 8:32  
landing on Meridiani Planum, 5:42–47  
reaches former sea, 6:26  
orbital speed, 1:73  
Oregon Star Party, 9:80–83  
Orion (constellation), 2:74–79  
Orion Nebula (M42)  
observing, 2:19, 4:14  
stars in, formation of, 10:28  
Orion's Atlas 8 (amateur telescope), 5:86–89  
Orion StarBlast (amateur telescope), 1:84–87  
Oudemans Crater (lunar crater), 9:28  
Ozzie awards, Astronomy wins, 2:6

## P

Paolucci, Michael, 12:20  
Pasachoff, Jay, 1:20  
penetrators, 8:26  
Phoebe (Saturn's moon), Cassini flyby, 9:46–49  
photography, astronomical. See astrophotography  
photons, detecting, 2:26  
Pinwheel galaxy (M33), 3:26, 28  
planetaria, 7:84–87  
planets  
age of, 6:44–49  
differentiating from stars and moons, 3:72–73  
earthlike, 8:42–47  
extrasolar, with masses like Uranus or Neptune, 11:20  
ring systems around, 5:68  
snowflake-like formation, 3:42–47  
youngest known, 9:26  
Pot of Gold (martian rock), 9:28  
professional telescopes. See telescopes, professional  
pulsars, double, 4:25

## Q

quadruple quasar, 10:26  
questions about astronomy, silly, 1:16

## R

Razorback site (Mars), 10:30  
RB-66 binoscope, 2:90–94  
RCW 49 (star-forming region), 9:24

Red Rectangle (HD 44179) (nebula), 8:30  
reference, frames of, 5:18  
right ascension, 10:66–67  
robotic-controlled telescopes, 5:80–83  
rockets, sounding, 11:26  
RR Lyrae-type variable stars, halo of in LMC, 1:26

## S

Saturn  
See also names of moons orbiting Cassini (spacecraft), 1:34–41, 7:26  
approaching Saturn, 7:26  
discoveries about Saturn's radiation belts, 11:28  
images of Saturn, 10:38–43  
mission to Saturn, 1:34–41  
Phoebe flyby, 9:46–49  
core of, whether solid, 10:67  
new moons discovered, 11:28  
observing, 1:88–92  
radiation belts of, 11:28  
wind speed on, 11:71  
X rays detected from, 6:26  
Sayh al Uhaymir 169 (meteorite), 11:26  
Search for Extraterrestrial Intelligence (SETI), 9:34–39  
Sedna object, 6:25  
SEL2 (Sun-Earth Lagrange point number 2), 9:24  
SETI (Search for Extraterrestrial Intelligence), 9:34–39  
Shalbatana Vallis (Mars), 12:34  
6489 Golevka asteroid, 3:32  
slooh.com web site, 3:18  
SMART-1 (lunar probe), 2:26  
socializing, 7:17  
solar bursts. See Sun, bursts from solar flares. See Sun, flares on solar system, most distant object known, 6:25  
Sombrero Galaxy (M104), 1:24  
sounding rockets, 11:26  
South Africa, observing Venus transit of Sun from, 10:76–81  
space, and reference frames, 5:18  
spacecraft and interplanetary travel, history of desires/dreams about, 1:48–52  
space shuttle missions, force required to reach International Space Station, 6:71  
Spirit (Mars rover)  
landing in Gusev Crater, 4:32–37  
live updates of, 1:104–105  
Spitzer Space Telescope (SST), 8:48–53  
finding of youngest known planet, 9:26  
observing RCW 49, 9:24  
SST. See Spitzer Space Telescope  
star atlases, 4:80–83, 12:44–49  
Stardust (spacecraft), Comet Wild 2 flyby, 4:24  
stars  
See also names of specific stars and types of stars  
brightest known, 4:28  
differentiating from planets and moons, 3:72–73  
formation of  
declining rate of, 7:30  
in Gould's Belt, 9:40–45  
high-mass and low-mass stars, 8:30  
largest known, 4:28  
size of, why such variety in, 1:72  
transitory, near Sun, 7:28  
whether still there, 7:76–77  
StarBlast (amateur telescope), 1:84–87  
suborbital rockets, 11:26  
Summer Triangle, 8:16  
Sun  
burst from, mapping, 10:24  
evolution of  
compared to start 15x larger, 11:34–39  
when becomes red giant, 11:40–44  
flares on, largest recorded, 2:28  
stars near, transitory, 7:28  
storms in November 2003, 10:28  
Venus transit of, 6:12, 14, 74–77  
history of observation of, 6:32–37  
trips for observing, 10:76–81  
whether moves around in space enough to detect, 4:66–67  
Sun-Earth Lagrange point number 2 (SEL2), 9:24  
Supernova 1987A, 6:28  
supernovae

and gamma-ray bursts, 10:44–49  
of year 1006, 2:48–52

**T**  
TAL's 150K and 200K (amateur telescopes), 3:90–93  
teaching astronomy, 11:82–85  
telescopes, amateur

See also names of specific amateur telescopes  
add-ons, 12:92–98  
getting most out of, 1:18  
history of, 11:76–81  
size of

criteria for small, medium, large, 9:67  
needed to see deep-sky objects, 9:66

telescopes, professional  
eSTAR (“intelligent agent” computer program)  
for, 2:27.

See also names of specific professional  
telescopes  
robotic-controlled, 5:80–83

Tele Vue-60 (amateur telescope), 11:90–93

temperature, absolute zero, 2:18

Tenagra Observatories, 5:80–83

Tharsis (martian volcanic bulge), 11:30

time, and reference frames, 5:18

Titan (Saturn's moon), lakes on, 1:28

Tiu Vallis (on Mars), 8:32

tours, *Astronomy's*

Alaska, 1:76–78

Hawaii, 1:79–81

Toutatis (asteroid), 10:70–71

travel, interplanetary, history of desires/dreams  
about, 1:48–52

Turner, Michael, 4:44–49

200K amateur telescope, TAL's, 3:90–93

**U**

universe

age of, 6:70

map of, 2:27

Uranus

core of, whether solid, 10:67

difference in appearance from Neptune, 5:30

**V**

V838 Mon (star), 6:22

vacations, to observe astronomical events, 8:14

variable stars, RR Lyrae-type, 1:26

Veenbos, Kees, 4:38–43

Vega (star)

as part of Summer Triangle, 8:16

planet circling, 3:29

Veil Nebula, 9:26

Venus, transit of the Sun, 6:12, 14, 74–77

history of observation of, 6:32–37

trips for observing, 10:76–81

Very Large Space Telescope (VLST), plans for,  
10:32–37

Very Large Telescope Imager and Spectrometer in  
Infrared (VISIR), 8:28

Voyager 1 (spacecraft), entering interstellar space,  
2:27

**W**

web site, slooh.com, 3:18

Weiler, Ed, 7:20

white dwarf stars, time takes to turn to black dwarf,  
12:74–75

winds, galactic, 4:26

wind speed, on gas-giant planets, 11:71

Wolf-Rayet stars, 11:70

**X**

X Prize suborbital rockets, 11:26

X-ray flashers, and gamma-ray bursts, 2:30

X-ray flashes (XRFs), 1:27

X rays, detected from Saturn, 6:26

## Author index

**A**

Adler, Robert

Do jets carve nebulae?, 3:29

Finding small ones, 3:28

Making scopes smart, 2:27

Seeing sharply for less, 2:32

Vega's dusty disk hides a planet, 3:29

Where galactic winds blow, 4:26

**B**

Baird, Laura

Better views in space, 12:30

Bakich, Michael E.

25 great accessories, 12:92–98

The 25 greatest astrophotos in history, 2:34–41

Astrology: fact or fiction?, 12:50–56

The backyard telescope, 11:76–81

Barnard's Milky Way, 8:70–75

Biggest solar flare ever recorded, 2:28

The Caldwell Catalog, 10:72–75

Hubble sees starfire in the nearby Pinwheel

Galaxy, 3:26

Reclaim the night sky, 6:38–43

Venus transit trips, 10:76–81

Viewing Venus in transit, 6:74–77

A visit to the planetarium, 7:84–87

Bartusiak, Marcia

The amazing lives of two stars, 11:34–39

Bell, Trudy E.

Disappearing act, 3:80–83

Benton, Jr., Julius

Saturn in prime time, 1:88–92

Berman, Bob

Astronomy for free?, 8:14

Behind the galaxy, 10:14

Eye see, you see, 9:14

Frames of reference, 5:18

Glass half empty?, 11:14

The last big one, 6:12

Moon orbit oddities, 12:16

Nothing is absolute, 2:18

A SLOOH of fun, 3:18

Stupidity smarts, 1:16

Theory chaotic, 7:16

True colors, 4:14

Beucher, Jackie

A League of its own, 8:84–87

Burnham, Robert

Asteroid showers?, 11:24

Big galaxies are hungry, 1:27

Big galaxy's violent past, 11:28

Biggest solar flare ever recorded, 2:28

“Blueberries,” “popcorn” on Mars, 11:30

Born in a rough neighborhood, 2:24

Cassini closes in, 7:26

Catastrophic landslides at Olympus Mons, 6:25

Centaurus A eats galaxies for snack food, 9:22

Chandra finds jets in Cassiopeia A, 12:30

Digitizing Lunar Orbiter photos, 6:25

Discovery telescope, 1:27

Distant star has Sun-like X-ray cycle, 8:30

Double pulsar found: will test extreme physics,  
4:25

Down in the valley, 7:32

Dust disks common?, 6:28

Envisioning Mars, 4:38–43

Epsilon Indi B has a companion, 1:28

ESA's Don Quijote to impact an asteroid, 10:28

Europe scales back, 2:28

Exo-Neptunes found, 11:20

Fast track to Earth, 10:30

Gamma-ray glow's sources found, 6:26

Globular clusters point to a tangled history for  
LMC, 10:26

GRBs, X-ray flashers the same?, 2:30

Have astronomers found a local gamma-ray  
burst?, 9:26

Hermes recovered, 1:30

Hot stellar cocoon, 3:29

HST, Keck find a galaxy from the “Dark Ages”,  
5:30

Hubble goes very deep, 6:26

Is Mars emerging from an ice age?, 4:28

Is this the smallest black hole known?, 4:25

Kicking the Kuiper Belt, 3:29

Low-power gamma-ray bursts?, 11:28

Lunar Apennines, 1:82–83

Making stars quickly, 3:32

To Mars, via the Moon, 4:25

Mars has methane, 7:28

“Mars soil” on Earth, 2:30

Martian “blueberries” in Utah, 9:26

Microlensing finds a world, 7:30

Milky Way adds a “new” spiral arm, 8:30

Milky Way's age, 12:34

Moon prospecting, 1:27

Moon rock odyssey, 11:26

Moving worlds with sunlight, 3:32

New moons, 11:28

New “nearest galaxy” found, 2:32

Opportunity at Meridiani, 5:42–47

Opportunity rover hits the beach, 6:26

Pot of Gold: Mars mystery rock, 9:28

Pulsar makes waves; merger looms, 3:30

Rambling in the lunar Alps, 11:74–75

“Razorback” rock is Mars mystery, 10:30

Rim shot, 10:22

Ringed star-fire: the Sombrero Galaxy, 1:24

Rosebud nursery for growing stars, 5:28

Roving Mars with Opportunity, 8:32

Sedna poses solar system puzzle, 6:25

SN blows X-ray bubble, 4:26

Spitzer finds youngest planet, 9:26

Star carves hollow in gas cloud, 12:28

Sun blasts system, 11:28

Supermassive black hole imaged in radio, 7:30

Supernova 1987A's pearly ring, 6:28

Supernova starburst in dwarf galaxy, 5:32

Supernova survivor-star found, 4:25

Supersize that superstar!, 4:28

Surface ice near the martian equator?, 6:25

Tiny scopes find big planet, 12:32

Touchdown at Tranquility, 7:82–83

Twist and shout, 11:24

Two dust jets near the solar system, 6:24

Why do Mars's polar canyons spiral?, 7:32

Will Jupiter lose its spots?, 7:28

X rays detected from Saturn, 6:26

The young planets of AU Microscopium, 11:32

**C**

Chaple, Glenn

Astro-socializing, 7:17

A bright star passes, 9:16

Cassiopeia delights, 11:15

Gettin' shapes, 10:16

Holiday wish list, 12:18

In like a lion, 4:16

Observers get set, 3:20

The Orion Nebula, 2:19

A ring and a triangle, 8:16

“Scoping tips, 1:18

A tale of two galaxies, 5:20

Transit viewing, 6:14

Cooke, Bill

Killer impact, 12:38–43

Croswell, Ken

M67: the Ultimate Survivor, 3:70–71

Cuillandre, Jean-Charles

Mauna Kea's colorful universe, 8:34–41

**D**

Dorminey, Bruce

Into the abyss, 3:48–53

Warm and not so fuzzy, 8:48–53

Drohojowska-Philp, Hunter

Drawing the universe, 12:90–91

**E**

Edberg, Steve

The Maksutov revolution, 10:82–85

Star power, 7:88–91

Eicher, David J.

America loves Hubble, 11:6

Are we helpless from space rocks?, 12:6

Astronomy Day, 5:8

Astronomy's big, rare event, 6:6

*Astronomy* snags two Ozzies, 2:6

Cassini's long, strange trip, 10:6

Cassini's long cruise to Saturn, 1:6

Check out the new Astronomy.com, 9:6

Color imaging as good as it gets, 8:6

The forgotten black holes, 3:6

From heaven on Earth...into thin air, 1:79–81

Is there life under the ice?, 7:6

Return to the Red Planet, 4:6

Venus transit trips, 10:76–81

**F**

Falk, Dan

ETs — write to us, 12:36

Fazekas, Andrew



The big cosmic picture, 2:27  
 “Heavy” nitrogen found in comets, 1:30  
 LMC’s old-star halo, 1:26  
 Record-breaking quasar mirage, 4:26  
 Spinning like a top, 3:30  
 Stardust sees target, 3:30  
 Tracing early rocks, 1:28  
 Uranus, Neptune looking less alike, 5:30  
 Visions of space, 7:78–81  
 Young star ejects jet, 5:32

Fletcher, Bill  
 Shooting the sky, 9:74–79

Fletcher, Sally  
 Shooting the sky, 9:74–79

**G**

Gamble, Jim  
 All-sky fireball network, 5:76–79

Garfinkle, Robert A.  
 Polar Moon, 12:84–89

Greiner, R. A.  
 Canon 10D digital camera, 9:84–87

**H**

Hallas, Tony  
 CCD images at their best, 2:84–89

Hanson, Mark  
 Canon 10D digital camera, 9:84–87

Harrington, Phil  
 Celestron’s Advanced Series telescopes, 8:88–91  
 Choosing a star atlas, 4:80–83  
 JMI’s RB-66 binoscope, 2:90–93  
 Orion’s Atlas 8, 5:86–89  
 Orion’s StarBlast, 1:84–87  
 TAL’s 150K and 200K, 3:90–93

Healy, David  
 A visit to Mars Hill, 6:84–87  
 When astrophotos go bad, 4:74–78

Hughes, Annie  
 Galactic habitable zone: the Milky Way’s “ring of fire”, 4:22

**J**

Jayawardhana, Ray  
 Chasing the shadow of Venus, 6:32–37

Johnston, Lisa  
 Extreme imaging, 8:80–83

**K**

Kawa, Barry  
 Japan’s telescope show, 2:80–83

Kenyon, Scott  
 Cosmic snowstorm, 3:42–47

Kier, Ruben  
 Build an astro-shed, 11:72–73

**L**

Ling, Alister  
 Toutatis shoots past Earth, 10:70–71

Loewen, Cory  
 Capturing aurorae, 3:84–89

Lorenz, Ralph  
 Glints from Titan’s surface, 1:28

**M**

Marcotte, Mike  
 Konus’s new Mak-Cass, 4:84–86

McEwen, Alfred S.  
 Journey to Saturn, 1:34–41

McGovern, Jeremy  
 Classroom astronomy, 11:82–85  
 Ice smothers fire, 8:26  
 Making stars more slowly, 10:28  
 Mars Odyssey working overtime, 12:30  
 Into McNeil’s Nebula, 7:30  
 Voyager 1: in interstellar space?, 2:27

McKee, Maggie  
 Catching photons, 2:26  
 Killer gamma-ray bursts?, 1:28  
 X-ray flash theory dashed, 1:27

Moomaw, Bruce  
 Spirit lands at Gusev, 4:32–37  
 Stardust collects bits of Comet Wild 2, 4:24

Morris, Charles S.  
 A tale of two comets, 5:70–75

Motazedian, Tâhirih  
 Does Mars have flowing water?, 6:66–69

**N**

Nadis, Steve  
 Black holes in the middle, 3:36–41  
 In the line of fire, 1:42–47  
 The lost years of Michael Turner, 4:44–49

Netting, Jessa Forte  
 Black holes that hide, 2:32

Newton, Jack B.  
 Amateur CCD discoveries, 6:78–82

**O**

Oberg, James  
 Can the X Prize help space research?, 11:26  
 Fixing a space probe en route, 7:26  
 The Genesis snatch, 10:24  
 Going roughly into the lunar polar night, 8:26  
 Inflatable heat shields: rescue pods?, 1:26  
 “Maybe” to the Moon this year, 6:24  
 The place in space to hang out, 9:24  
 Probing relativity from Earth orbit, 3:28  
 Putting the touch on a comet, 12:32  
 Sending a MESSENGER to Mercury, 5:28  
 SMART-1: slow boat to the Moon, 2:26

**P**

Pappalardo, Robert  
 Jupiter’s water worlds, 7:34–41

Peach, Damian  
 Jupiter at its best, 4:70–73

Polakis, Tom  
 Cancer, Leo, and Leo Minor, 3:76–79  
 The Oregon Star Party, 9:80–83  
 Orion the Hunter, 2:74–79  
 Robotic observing, 5:80–83

**Q**

Quandt, Matthew  
 Wartime astronomy, 12:80–83

**R**

Reddy, Francis  
 Blushing asteroids, 8:32  
 Cassini discoveries at Saturn, 11:28  
 Star light, star bright, 2:48–52  
 The star-splitting jets of supernovae, 10:44–49  
 Swirling echoes of light, 6:22  
 Was the “Great Dying” caused by an impact?, 8:28  
 X-ray plumes in M87, 8:28

Ridpath, Ian  
 Trekking the autumn sky, 9:70–73  
 Wander the winter sky, 12:76–79

**S**

Schaller, Adolf  
 Genesis planet, 6:44–49

Schomaker, William  
 interview of Jay Pasachoff, 1:20  
 interview of Jerry Lodriguss, 2:20  
 interview with Anthony Aveni, 11:18  
 interview with David Levy, 4:18  
 interview with Ed Weiler, 7:20  
 interview with Jesús Maíz-Apellániz, 10:18  
 interview with Lori Marino, 9:18  
 interview with Michael Paolucci, 12:20  
 interview with Owen Gingerich, 5:22  
 interview with William Hartmann, 6:16  
 interview with Xiaohui Fan, 8:20

Sefick, John  
 Extreme imaging, 8:80–83

Shostak, Seth  
 Listening for a whisper, 9:34–39

Shubinski, Raymond  
 The Tele Vue-60, 11:90–93

Sietzen, Jr., Frank  
 To the cosmic edge, 7:70–73  
 A new vision for space, 5:48–51

Spudis, Paul D.  
 How Earth got its Moon, 7:42–47

Stern, S. Alan  
 Red Sun dying, 11:40–44  
 On the trail of Vulcanoids, 2:42–46

**T**

Talcott, Richard  
 Cassini reaches Saturn, 10:38–43  
 Cassini spies Phoebe, 9:46–49

Great comets, 5:36–41  
 From heaven on Earth...into thin air, 1:76–78  
 Where have all the spirals gone?, 4:26

Terry, Matthew  
 Our local star factory, 9:40–45

Thomas, Vanessa  
 Listening to solar activity, 2:28  
 Super stars in Lynx, 2:27

Tirion, Wil  
 The golden age of star maps, 12:44–49

**V**

Villard, Ray  
 Beyond Hubble, 10:32–37  
 Did NASA fake the Moon landing?, 7:48–53  
 Genesis planet, 6:44–49

**W**

Whitt, Kelly Kizer  
 Chandra sees quadruple quasar, 10:26  
 The last good-bye, 2:28  
 Solar bursts mapped, 10:24  
 Stellar runts *are* stars, 10:26

**Y**

Yeomans, Donald  
 “Space flight is utter bilge.”, 1:48–52

**Z**

Zerbinos, Pamela  
 Black hole filling, 11:24  
 Cassini: Saturn, Titan in sights, 8:24  
 First light for VISIR instrument, 8:28  
 FUSE pierces the Veil, 9:26  
 Galaxies that got old early, 10:28  
 Mini-galaxies discovered, 7:28  
 Rungs of gas and dust, 8:30  
 Seeing stars like sand, 7:24  
 Shadow sheds light on star-making, 8:30  
 Solar neighbors run wild, 7:28  
 Star-formation rate in decline, 7:30  
 Stripping a spiral, 9:28  
 Two faces of Iapetus, 8:28  
 Unexpected worlds, 9:24

Zimmerman, Robert  
 The looming death of Hubble, 11:46–52  
 Seeking other Earths, 8:42–47

## Title index

**A**

All-sky fireball network, 5:76–79  
 Amateur CCD discoveries, 6:78–82  
 amazing lives of two stars, The, 11:34–39  
 America loves Hubble, 11:6  
 Anthony Aveni, 11:18  
 Are we helpless from space rocks?, 12:6  
 Asteroid showers?, 11:24  
 Astrology: fact or fiction?, 12:50–56  
 Astronomy Day, 5:8  
 Astronomy for free?, 8:14  
 Astronomy’s big, rare event, 6:6  
 Astronomy snags two Ozzies, 2:6  
 Astro-socializing, 7:17

**B**

backyard telescope, The, 11:76–81  
 Barnard’s Milky Way, 8:70–75  
 Behind the galaxy, 10:14  
 Better views in space, 12:30  
 Beyond Hubble, 10:32–37  
 big cosmic picture, The, 2:27  
 Big galaxies are hungry, 1:27  
 Big galaxy’s violent past, 11:28  
 Biggest solar flare ever recorded, 2:28  
 Black hole filling, 11:24  
 Black holes in the middle, 3:36–41  
 Black holes that hide, 2:32  
 “Blueberries,” “popcorn” on Mars, 11:30  
 Blushing asteroids, 8:32  
 Born in a rough neighborhood, 2:24  
 bright star passes, A, 9:16  
 Build an astro-shed, 11:72–73

**C**

Caldwell Catalog, The, 10:72–75  
 Cancer, Leo, and Leo Minor, 3:76–79

Canon 10D digital camera, 9:84–87  
Can the X Prize help space research?, 11:26  
Capturing aurorae, 3:84–89  
Cassini closes in, 7:26  
Cassini discoveries at Saturn, 11:28  
Cassini reaches Saturn, 10:38–43  
Cassini: Saturn, Titan in sights, 8:24  
Cassini's long, strange trip, 10:6  
Cassini's long cruise to Saturn, 1:6  
Cassini spies Phoebe, 9:46–49  
Cassiopeia delights, 11:15  
Catastrophic landslides at Olympus Mons, 6:25  
Catching photons, 2:26  
CCD images at their best, 2:84–89  
Celestron's Advanced Series telescopes, 8:88–91  
Centaurus A eats galaxies for snack food, 9:22  
Chandra finds jets in Cassiopeia A, 12:30  
Chandra sees quadruple quasar, 10:26  
Chasing the shadow of Venus, 6:32–37  
Check out the new Astronomy.com, 9:6  
Choosing a star atlas, 4:80–83  
Classroom astronomy, 11:82–85  
Color imaging as good as it gets, 8:6  
Cosmic snowstorm, 3:42–47

**D**  
Did NASA fake the Moon landing?, 7:48–53  
Digitizing Lunar Orbiter photos, 6:25  
Disappearing act, 3:80–83  
Discovery telescope, 1:27  
Distant star has Sun-like X-ray cycle, 8:30  
Does Mars have flowing water?, 6:66–69  
Do jets carve nebulae?, 3:29  
Double pulsar found: will test extreme physics, 4:25  
Down in the valley, 7:32  
Drawing the universe, 12:90–91  
Dust disks common?, 6:28

**E**  
Ed Weiler, 7:20  
Envisioning Mars, 4:38–43  
Epsilon Indi B has a companion, 1:28  
ESA's Don Quijote to impact an asteroid, 10:28  
ETs — write to us, 12:36  
Europe scales back, 2:28  
Exo-Neptunes found, 11:20  
Extreme imaging, 8:80–83  
Eye see, you see, 9:14

**F**  
Xiaohui Fan, 8:20  
Fast track to Earth, 10:30  
Finding small ones, 3:28  
First light for VISIR instrument, 8:28  
Fixing a space probe en route, 7:26  
forgotten black holes, The, 3:6  
Frames of reference, 5:18  
From heaven on Earth...into thin air, 1:76–81  
FUSE pierces the Veil, 9:26

**G**  
Galactic habitable zone: the Milky Way's "ring of fire", 4:22  
Galaxies that got old early, 10:28  
Gamma-ray glow's sources found, 6:26  
Genesis planet, 6:44–49  
genesis snatch, The, 10:24  
Gettin' shapes, 10:16  
Owen Gingerich, 5:22  
Glass half empty?, 11:14  
Glints from Titan's surface, 1:28  
Globular clusters point to a tangled history for LMC, 10:26  
Going roughly into the lunar polar night, 8:26  
golden age of star maps, The, 12:44–49  
GRBs, X-ray flashers the same?, 2:30  
Great comets, 5:36–41

**H**  
William Hartmann, 6:16  
Have astronomers found a local gamma-ray burst?, 9:26  
"Heavy" nitrogen found in comets, 1:30  
Hermes recovered, 1:30  
Holiday wish list, 12:18  
Hot stellar cocoon, 3:29  
How Earth got its Moon, 7:42–47  
HST, Keck find a galaxy from the "Dark Ages", 5:30

Hubble goes *very* deep, 6:26  
Hubble sees starfire in the nearby Pinwheel Galaxy, 3:26

**I**  
Ice smothers fire, 8:26  
Inflatable heat shields: rescue pods?, 1:26  
In like a lion, 4:16  
In the line of fire, 1:42–47  
Into McNeil's Nebula, 7:30  
Into the abyss, 3:48–53  
Is Mars emerging from an ice age?, 4:28  
Is there life under the ice?, 7:6  
Is this the smallest black hole known?, 4:25

**J**  
Japan's telescope show, 2:80–83  
Jay Pasachoff, 1:20  
Jesús Maíz-Apellániz, 10:18  
JMI's RB-66 binoscope, 2:90–93  
Journey to Saturn, 1:34–41  
Jupiter at its best, 4:70–73  
Jupiter's water worlds, 7:34–41

**K**  
Kicking the Kuiper Belt, 3:29  
Killer gamma-ray bursts?, 1:28  
Killer impact, 12:38–43  
Konus's new Mak-Cass, 4:84–86

**L**  
last big one, The, 6:12  
last good-bye, The, 2:28  
League of its own, A, 8:84–87  
Levy, David, 4:18  
Listening for a whisper, 9:34–39  
Listening to solar activity, 2:28  
LMC's old-star halo, 1:26  
Jerry Lodriguss, 2:20  
looming death of Hubble, The, 11:46–52  
Lori Marino, 9:18  
lost years of Michael Turner, The, 4:44–49  
Low-power gamma-ray bursts?, 11:28  
Lunar Apennines, 1:82–83

**M**  
M67: the Ultimate Survivor, 3:70–71  
Making scopes smart, 2:27  
Making stars more slowly, 10:28  
Making stars quickly, 3:32  
Maksutov revolution, The, 10:82–85  
Mars has methane, 7:28  
Mars Odyssey working overtime, 12:30  
"Mars soil" on Earth, 2:30  
Martian "blueberries" in Utah, 9:26  
Mauna Kea's colorful universe, 8:34–41  
"Maybe" to the Moon this year, 6:24  
Michael Paolucci, 12:20  
Microlensing finds a world, 7:30  
Milky Way adds a "new" spiral arm, 8:30  
Milky Way's age, 12:34  
Mini-galaxies discovered, 7:28  
Moon orbit oddities, 12:16  
Moon prospecting, 1:27  
Moon rock odyssey, 11:26  
Moving worlds with sunlight, 3:32

**N**  
New moons, 11:28  
New "nearest galaxy" found, 2:32  
new vision for space, A, 5:48–51  
Nothing is absolute, 2:18

**O**  
Observers get set, 3:20  
On the trail of Vulcanoids, 2:42–46  
Opportunity at Meridiani, 5:42–47  
Opportunity rover hits the beach, 6:26  
Oregon Star Party, The, 9:80–83  
Orion Nebula, The, 2:19  
Orion's Atlas 8, 5:86–89  
Orion's StarBlast, 1:84–87  
Orion the Hunter, 2:74–79  
Our local star factory, 9:40–45

**P**  
place in space to hang out, The, 9:24  
Polar Moon, 12:84–89

Pot of Gold: Mars mystery rock, 9:28  
Probing relativity from Earth orbit, 3:28  
Pulsar makes waves; merger looms, 3:30  
Putting the touch on a comet, 12:32

**R**  
Rambling in the lunar Alps, 11:74–75  
"Razorback" rock is Mars mystery, 10:30  
Reclaim the night sky, 6:38–43  
Record-breaking quasar mirage, 4:26  
Red Sun dying, 11:40–44  
Return to the Red Planet, 4:6  
Rim shot, 10:22  
ring and a triangle, A, 8:16  
Ringed star-fire: the Sombrero Galaxy, 1:24  
Robotic observing, 5:80–83  
Rosebud nursery for growing stars, 5:28  
Roving Mars with Opportunity, 8:32  
Rungs of gas and dust, 8:30

**S**  
Saturn in prime time, 1:88–92  
"Scoping tips, 1:18  
Sedna poses solar system puzzle, 6:25  
Seeing sharply for less, 2:32  
Seeing stars like sand, 7:24  
Seeking other Earths, 8:42–47  
Sending a MESSENGER to Mercury, 5:28  
Shadow sheds light on star-making, 8:30  
Shooting the sky, 9:74–79  
SLOOH of fun, A, 3:18  
SMART-1: slow boat to the Moon, 2:26  
SN blows X-ray bubble, 4:26  
Solar bursts mapped, 10:24  
Solar neighbors run wild, 7:28  
"Space flight is utter bilge.", 1:48–52  
Spinning like a top, 3:30  
Spirit lands at Gusev, 4:32–37  
Spitzer finds youngest planet, 9:26  
Star carves hollow in gas cloud, 12:28  
Stardust collects bits of Comet Wild 2, 4:24  
Stardust sees target, 3:30  
Star-formation rate in decline, 7:30  
Star light, star bright, 2:48–52  
Star power, 7:88–91  
star-splitting jets of supernovae, The, 10:44–49  
Stellar runts *are* stars, 10:26  
Stripping a spiral, 9:28  
Stupidity smarts, 1:16  
Sun blasts system, 10:28  
Supermassive black hole imaged in radio, 7:30  
Supernova 1987A's pearly ring, 6:28  
Supernova starburst in dwarf galaxy, 5:32  
Supernova survivor-star found, 4:25  
Supersize that superstar!, 4:28  
Super stars in Lynx, 2:27  
Surface ice near the martian equator?, 6:25  
Swirling echoes of light, 6:22

**T**  
tale of two comets, A, 5:70–75  
tale of two galaxies, A, 5:20  
TAL's 150K and 200K, 3:90–93  
Tele Vue-60, The, 11:90–93  
Theory chaotic, 7:16  
Tiny scopes find big planet, 12:32  
To Mars, via the Moon, 4:25  
To the cosmic edge, 7: 70-73  
Visions of space, 7:70–73  
Touchdown at Tranquillity, 7:82–83  
Toutatis shoots past Earth, 10:70–71  
Tracing early rocks, 1:28  
Transit viewing, 6:14  
Trekking the autumn sky, 9:70–73  
True colors, 4:14  
25 greatest astrophotos in history, The, 2:34–41  
Twist and shout, 11:24  
Two dust jets near the solar system, 6:24  
Two faces of Iapetus, 8:28

**U**  
Unexpected worlds, 9:24  
Uranus, Neptune looking less alike, 5:30

**V**  
Vega's dusty disk hides a planet, 3:29  
Venus transit trips, 10:76–81  
Viewing Venus in transit, 6:74–77

Visions of space, 7:78–81  
visit to Mars Hill, A, 6:84–87  
visit to the planetarium, A, 7:84–87  
Voyager 1: in interstellar space?, 2:27

## **W**

Wander the winter sky, 12:76–79  
Warm and not so fuzzy, 8:48–53  
Wartime astronomy, 12:80–83  
Was the “Great Dying” caused by an impact?, 8:28  
When astrophotos go bad, 4:74–78  
Where galactic winds blow, 4:26  
Where have all the spirals gone?, 4:26  
Why do Mars’s polar canyons spiral?, 7:32  
Will Jupiter lose its spots?, 7:28

## **X**

X-ray flash theory dashed, 1:27  
X-ray plumes in M87, 8:28  
X rays detected from Saturn, 6:26

## **Y**

young planets of AU Microscopium, The, 11:32  
Young star ejects jet, 5:32