WINTER QUARTER / DECEMBER 2000
MOUNT WILSON OBSERVATORY ASSOCIATION
REFLECTIONS

WINTER COMES TO MOUNT WILSON

The Monastery after the blizzard of 1907.

When George Ellery Hale arrived in Southern California in the winter of 1903–04, these chilly months were called by eastern visitors "The Season" — the time of the year when this subtropical corner of America was considered to be at its best, and when anyone who could afford it would abandon the bleak Northeast and Midwest and take up residence in sunny, fashionable Pasadena.

But while winter may have been banished from Los Angeles and its suburbs, it still lingers at Mount Wilson's 5,700-foot elevation. Not a four- or five-month deep freeze, as in Hale's home town of Chicago, but winter nonetheless. According to weatherman–postman Lu Rarogiewicz, whose mountaintop home gives him an eagle's-eye perspective on the weather scene, winter's total snowfall averages about 32 inches. Over the past 14 years (since Lu took his job at Mount Wilson), the driest season, 1996–97, had a total of 13 inches; the snowiest one, 1997–98, had 61 inches.

Winter temperatures at Mount Wilson are relatively mild compared with those at the same elevation further inland. The December/January/February daytime high temperature averages 53 degrees Fahrenheit, with the nighttime low averaging 37 degrees. The lowest temperature ever recorded is 10 degrees Fahrenheit.

Most winter storms begin as rain, then turn to snow as the later part of the storm brings in colder air, and they typically leave less than a foot of snow. But roughly once every 10 years, a major, multifoot snowfall can be expected. The drought-breaking storm of March 1991 is a case in point. "We went through that winter with almost no snow until the third week of March, and I was beginning to wonder if we would go the whole season without any 'real' snow," Lu recalls. "Then all of a sudden we got 34 inches of wet snow. We were marooned for four days on the mountain. The storm itself lasted 2-1/2 days, and then it took a day and a half for the snowplows to get here from Red Box Junction. The snow lay in drifts 20 to 30 feet deep along the upper Mount Wilson road."

As part of his four-times-per-day weather observing routine, Lu first measures any snow that has fallen since the last observation, then melts it down and measures its water content as though it were rain. "The snow at Mount Wilson usually has a high water content — typically it takes just 3 to 5 inches of snow to make an inch of water — compared to the more powdery snow that falls at ski resorts further inland, where the snow-to-water ratio may be 10 to 1 or more," he points out.

In addition to snow, winter at Mount Wilson can include high winds — in February 1993, for example, a windstorm blew steadily at more than 80 mph for 40 minutes, with gusts up to 95 mph. Another winter weather problem is rime ice, which accumulates on the solar towers, TV towers, and other structures when foggy air drops below freezing. This can be a considerable hazard to people below when it begins to melt after the sun comes out.

Whether it's rain, sleet, snow, ice, or wind, in his 14 years at Mount Wilson, Lu has had a chance to observe a good deal of winter weather at close range. At 4:00 P.M. on December 3, 2000, he recorded his 19,093rd observation. And in spite of having to take measurements out on his rooftop observing station at 10:00 P.M. and 4:00 A.M. — every night and in all types of weather — he notes that he still enjoys doing it.

— Bob Eklund

ABOUT MWOA

The Mount Wilson Observatory Association (MWOA) is a support group made up of friends of the Mount Wilson Observatory. MWOA is a nonprofit California corporation, independent of the Mount Wilson Observatory and the Mount Wilson Institute, which operates the Observatory. MWOA's goals include increased public awareness of the Observatory's unique history and continuing scientific contributions, as well as improvement of the quality of public access at Mount Wilson.

INFORMATION

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For the use of historical photographs of Mount Wilson, MWOA thanks the Observatories of the Carnegie Institution of Washington, the Huntington Library, and Don Nicholson.

PAGE ONE BANNER PHOTOGRAPH

The 100-inch dome after a heavy snowstorm.

MWOA Notes

Jed Laderman Joins MWOA Board

We welcome Jed Laderman, MWOA docent and Vice-President of the Santa Monica Amateur Astronomy Club, as a member of MWOA's nine-person Board of Trustees. Jed was elected for a 3-year term by the MWOA membership at our November 26 Annual Meeting; he fills the position vacated by retiring Board member Daryl Parker. The membership also reelected Board members Greg Smith and Tim Thompson for 3-year terms. MWOA's officers for the coming year are Don Nicholson, President; Mike Simmons, Vice-President; Gale Gant, Secretary; and Greg Smith, Treasurer.

2001 — A COLOR Calendar Odyssey

To help you navigate your way through the first year of the new millennium, the Mount Wilson Millennium Calendar for the year 2001 is now available by mail order. The calendar contains 12 color photos related to Mount Wilson, plus historical dates of interest and astronomical events for the coming year. To order, send a check payable to "Mount Wilson Institute" (not MWOA) for $14 per calendar (includes shipping) to: *Mount Wilson Institute Accounting Office, 133 West Chapman Ave, Unit E, Fullerton, CA 92832-1451.*

Web Expert Wanted

If you have experience in creating and updating Web sites, and would like to help spruce up the Mount Wilson Observatory site (www.mtwilson.edu), please contact Don Nicholson at (310) 476-4413. The Internet is a key medium for the Observatory's outreach to the public, and your help in improving this site's design and content would be a very important service to both the Observatory and the public.

New 16-inch Telescope at Mount Wilson

Meade Instruments is providing Mount Wilson Observatory with a 16-inch Schmidt-Cassegrain telescope to be mounted in the small dome just southwest of the 60-inch. This instrument replaces the 12-inch Schmidt camera formerly mounted in that dome, and is expected to be more useful to visiting amateurs and professionals than the Schmidt camera, which will find a new home with comet-hunter David Levy in Arizona.

A membership form may be found on page 8.

MWOA MEMBERSHIP BENEFITS

Associate, $20 — Includes newsletters (*Reflections* and *OverView*) plus participation in MWOA member events such as tours, star parties at Mount Wilson, and lectures.

Family, $30 — Permits family members in your household to participate in MWOA events.

Sustaining, $100 — Includes all of the above, plus invitations to participate in special events, such as observing nights on the 60-inch telescope.

Observatory Buys Bobcat; Funds Still Needed to Pay Off Loan

Please feed the Kitty — donations are welcome!

In order to be prepared for the oncoming snow season, the Observatory has taken delivery of its new Bobcat. Mountain Superintendent Sean Hoss and his crew are delighted with their new vehicle, especially because (1) it runs (its predecessor had sadly given in to old age); and (2) it has an enclosed, heated cab, which will make snowplowing a much more comfortable chore. As the funds available at the time of purchase were not enough to pay the full price of the vehicle, it was necessary to take out a loan for a portion of that price. Donations to the MWOA Bobcat Fund are still needed to pay off this loan. Please make your check payable to "MWOA (Bobcat Fund)" and mail to: *MWOA, P.O. Box 70076, Pasadena, CA 91117*. Questions? Call Don Nicholson at (310) 476-4413.

"One Thousand Years of the Art and Science of Astronomy" Featured at the Huntington Library

Humankind's changing conceptions of the heavens over the past millennium are explored in a new exhibition entitled "Star Struck." Many delightful rare books and manuscripts are on display, including works by Ptolemy, Galileo, Copernicus, Newton, Kepler, Hubble, and Einstein. As one might expect, Mount Wilson Observatory plays a prominent role in the exhibit. The teen-age George Ellery Hale's telescope, a lovely old 4-inch refractor, is there to admire, and nitrate film clips of activities on Mount Wilson during the 1920s and 1930s have been rescued, cleaned, and transferred to a 50-minute DVD for viewing. A suggestion: bring a small flashlight for reading the placards in the soft illumination. For information, call the Huntington at (626) 405-2100 or visit www.huntington.org. The exhibit runs through May 13, 2001. Other Pasadena cultural institutions are also presenting related exhibitions and programs as part of an endeavor called "The Universe" — visit www.pasadena-universe.org for more information.

THE VIEW FROM MOUNT WILSON

SALLIE BALIUNAS
DEPUTY DIRECTOR,
MOUNT WILSON INSTITUTE

Can struts of 19th-century riveted steel and French bottle glass foment a revolution in astronomy so profound it shakes humankind's perception of our relation to the cosmos? Yes, if those ingredients help build the largest telescope on the earth and are put to use by great scientists as instruments of discovery.

It happened at Mount Wilson Observatory — and not by accident. The founder of the Observatory, George Ellery Hale, had learned that the mountaintop possessed the uniquely calm and clear astronomical skies he had sought. His grand dream took form starting in 1904, as he built the Solar Tower telescopes and what we call our "nighttime" telescopes — the 60-inch and 100-inch reflectors — that were, in their turn, the largest in the world.

Hale also recognized that the magnificent telescopes required great minds to realize the instruments' potential. The two lights in our story are Edwin Hubble and Milton Humason. Hubble, a professionally trained astronomer who joined the Observatory staff in 1919, dressed stiffly in coat and tie while perched 30 feet in the air at the telescope's Newtonian platform. Likeable Humason never went to high school. He worked on and near Mount Wilson as a busboy, muledriver, gardener, and citrus grower. In 1917, he joined the Observatory staff as a janitor, where he rose to assistant astronomer, and finally full staff member. Humason showed unequaled talent as "one of the best observers we ever had," as staff astronomer Harlow Shapley said.

The team of Hubble and Humason swept through the cosmos with the 100-inch telescope starting in the mid-1920s and upended cosmology from the "dreamy world of speculation," as Hubble wrote of the old ideas, to modern cosmology.

Today we know that the current configuration of space–time arose around 15 billion years ago from an incredibly hot and dense state. Infinite in extent then and now, the universe continues to expand. The galaxies trace the expansion of space, with distant galaxies speeding away faster than nearer ones. Hubble and Humason discovered this cosmic law in their measurements of the velocity and distance of galaxies.

What is humankind's place in a cosmos where the light of a galaxy's one hundred billion stars pales in the blackness isolating hundreds of billions of galaxies? Consider that evidence for over 50 planets has been found so far around nearby stars. The myriad stars in the universe mean an incredible number — trillions — of planets. But science yields no evidence thus far for life

TO PAGE 6 ➤

Small-Scale Optics

Looking at Wildlife on Mount Wilson

MIKE BRADFORD

When you first arrive on Mount Wilson, you might think that all that is there are a few trees, birds, and squirrels. But closer examination reveals extensive and diverse flora and fauna, particularly birds. The reason for an abundance of different species is that there are diverse habitats — chaparral, California Live Oak, conifers, and one riparian corridor, which goes dry in some years. The hope is that the visitor to Mount Wilson will not only come for the astronomical aspect, but also for the chance of seeing a Western Tanager's nest or a Black Bear crossing a trail.

The mammals comprise a small number of species, but are an exciting group to observe. There are the usual small and abundant creatures such as Western Gray Squirrel, California Ground Squirrel, and Merriam's Chipmunk. Intermediate-size species are Striped Skunk, Raccoon, Ring-Tailed Cat, Gray Fox, and Bobcat. Large species include Mule Deer, Black Bear, and Mountain Lion.

Nothing can beat such experiences as finding a Black Bear looking in your kitchen window, a female Mule Deer nursing its spotted fawn, or a Bobcat capturing a California Ground Squirrel. All of these mammals can be seen any time of the year. Some are more common (squirrels) than others (Mountain Lion), but consider it a treat to see any of them.

The birds comprise the single largest group of wildlife on Mount Wilson. Many can be seen year round, some just in the winter or summer, and still others just pass through in the spring and fall.

Some of the more easily identifiable birds for a casual observer who visits Mount Wilson can be seen year round. One example is Steller's Jay, which is mostly blue with a black head and a pointed crest on top of its head. It is quite noisy and will often chase larger birds or squawk loudly at people as they walk by.

The Acorn Woodpecker is the most common woodpecker on the mountain. Its face is a mixture of red, yellow, white, and black colors, giving it a clownish appearance. Acorn Woodpeckers store thousands of acorns in individual holes in one tree alone. This is called an acorn granary, and there are a number of these trees on the mountain. The White-breasted Nuthatch has a gray back and white body. The top of its head is black. This small bird is often seen going down a tree head-first while it forages for insects hiding in the bark.

Another year-round bird, the Mountain Chickadee, is a small grayish bird with a black and white head. Chickadees move quickly from tree to tree and branch to branch, quite often foraging while upside-down. They are very trusting and if given enough time will eat food out of one's hand.

ALL WILDLIFE PHOTOS BY MIKE BRADFORD

The Steller's Jay (above) is a high-altitude bird of the West related to the Blue Jay of the east. The Western Scrub-Jay (below) is a familiar bird in suburban gardens as well as on Mt. Wilson.

In Mike's photo of a Mountain Chickadee, the bird's black cap is obscured by reflected sunlight, but its white "eyebrow" is clearly visible.

An Acorn Woodpecker at a granary tree, where the bird has inserted acorns into numerous holes drilled in the bark.

The Common Raven is a very large, all-black bird, usually seen year round with its lifetime mate. Ravens often go into a dive while flying. The interesting thing about the dive is that the bird is upside-down with its back facing the ground.

Other year-round birds include Band-tailed Pigeon, Mourning Dove, Oak Titmouse, Western and Great Horned Owls, Spotted Towhee, Western Scrub-Jay, House and Purple Finches, Dark-eyed (Oregon) Junco, Red-tailed and Cooper's Hawks, Turkey Vulture, Nuttall's and Hairy Woodpeckers, Northern Flicker (red-shafted form), Anna's Hummingbird, Bushtit, Wrentit, American Robin, Brown Creeper, Bewick's and Canyon Wrens, and Yellow-Rumped (Audubon's) Warbler. Most of these birds are commonly seen on the mountain.

Summer birds that breed on Mount Wilson include the year-round birds plus Violet-green Swallow, Blue-gray Gnatcatcher, Black-headed Grosbeak, five species of flycatchers, and four species of warbler. Uncommon birds are Solitary Vireo, Lawrence's Goldfinch, and Chipping Sparrow.

The Western Tanager is probably the prettiest bird on Mount Wilson. The male has a bright yellow body with black wings and back, and a bright red head. The female is a dull yellow throughout. The Western Tanager is seen in the spring and summer. The Western Bluebird, seen all year, is bright blue with a rusty-red breast, and is quite often seen in flocks of 10 to 20 birds. It can be seen flycatching from a tree or foraging on the ground. In spring, the Western Bluebird is often seen going in and out of nest holes in trees.

Some examples of winter birds are Williamson's, Red-breasted, and Red-naped Sapsuckers; Red-breasted and Pygmy Nuthatches; Ruby-crowned Kinglet; Hermit Thrush; Cedar Waxwing; Phainopepla; Merlin; and White-crowned, White-throated, and Golden-crowned Sparrows. Birds such as the Golden-crowned Kinglet, White-throated Sparrow, Hermit Warbler, and Pine Siskin may be present some winters.

Birds that migrate through the Mount Wilson area but do not stay are the Western Kingbird; Lazuli Bunting; Warbling Vireo; and Nashville, Orange-crowned, and Wilson's Warblers. The most exciting times for birdwatching on Mount Wilson are early May, late August, and early September when the migrants are passing through. In late June and early July, you'll see juveniles constantly begging for food from their parents. It's always entertaining to watch adult Western Bluebirds feed their young.

Some other interesting bird observations include watching a Western Wood-Pewee defending its nest from a Steller's Jay, a female Western Tanager building a nest, a Cooper's Hawk chasing a Western Gray Squirrel through a tree, and 20 Western Bluebirds all bathing in a pool of water at one time.

A Merriam's Chipmunk enjoys a snack. These handsome rodents forage for seeds and nuts of conifers and various chaparral species. They hibernate in winter.

The American Robin commonly nests in montane regions as well as in suburban parks.

The Band-tailed Pigeon's descending, two-note "hoo-hoo" song can be heard all year.

Mike Bradford graduated from the University of Massachusetts at Amherst with a B.S. in astronomy. For 8-1/2 years, he lived and worked on Mount Wilson, running the 60- and 100-inch telescopes. Recently he moved to Socorro, New Mexico, to work at the Very Large Array.

Birdwatching on Mt. Wilson

Mike Bradford, the author of the accompanying article, was part of a five-year volunteer effort to map the distribution of breeding birds throughout the county. (The project is the Los Angeles County Breeding Bird Atlas, sponsored by Los Angeles Audubon Society and the Natural History Museum.)

Mike and other volunteers found evidence that 67 species of birds breed on and around Mt. Wilson. Breeding species in comparably sized areas elsewhere in the county range from fewer than 20 in some desert areas to over 80 in a few particularly fecund blocks containing wetlands.

The underlying reason for the richness of breeding avifauna on Mt. Wilson can be traced to its rugged topography: the relatively extreme elevational differences support a variety of habitats, each of which is utilized by a handful of "specialists" adapted to it. (There are, of course, a few "generalists" that can utilize many habitats.)

As you walk about the area, you can observe dry chaparral at lower elevations, riparian in the creek bottoms, oak woodland and oak-conifer associations on the northern slope, and montane chaparral and coniferous forest near the mountain top, all with associated species. Birds typical of the urbanized lowlands might be encountered around the structures at the Observatory or transmitting stations, and open water from leaking faucets or runoff can attract birds of many species.

To my knowledge, there have been no surveys on Mt. Wilson comparable to the Breeding Bird Atlas effort for wintering or migratory species. It is safe to predict, however, that well over 100 species make use of the habitats to be found around Mt. Wilson at some point in the year. Although the Atlas field work is complete, researchers continue to study birds in the area; Lilac-crowned Parrot may become the next species documented as breeding on Mt. Wilson.

— Larry Allen

Larry is the Project Coordinator for the Los Angeles County Breeding Bird Atlas (www.lam.mus.ca.us/~lacbba) and co-author of the forthcoming Atlas publication, anticipated in late 2001. If you are interested in sponsoring a species in the Atlas, send e-mail to <larry.w.allen@paclink.net>. The area around Mt. Wilson is included in the annual Pasadena Christmas Bird Count: contact Jon Fisher <Jon_Fisher@wdi.disney.com> to participate.

Mt. Wilson Memoir

A COLD WINTER'S NIGHT AT MOUNT WILSON

DON NICHOLSON

One winter night in the mid-1930s, my father had reserved the 100-inch to photograph the ninth satellite of Jupiter, which he had discovered while a graduate student at the University of California. Since the satellite was very far from Jupiter, its orbit was subject to many perturbations and it had to be observed frequently in order to keep it from getting lost. Incidentally, it was also possible that another satellite might be found.

For several months prior to the scheduled observation, Dad had told me many times about the importance of getting a good plate. First, a guide star had to be carefully observed and tracked to overcome slight periodic errors in the telescope drive and to compensate for atmospheric refraction. Second, the plate holder had to be moved at precise intervals in order to correct for the differential motion of Jupiter. And all this had to take place over an exposure of a couple of hours.

An exquisite wintry view looking down on the 60-foot solar tower and the Snow telescope from the 150-foot solar tower.

Mount Wilson looking like a marshmallow cake after the 1907 blizzard.

It was obviously a task that could be accomplished only by a very careful and experienced observer. As the scheduled day approached, however, I became convinced that I was up to the task and asked permission to make the exposure. Dad expressed doubt that such an opportunity should be entrusted to a raw recruit, but said he would think about it. Finally he agreed, with apparent reluctance, to let me make the exposure.

On the afternoon before the event, we had a dress rehearsal at the Newtonian focus of the 100-inch and I felt that I was ready. When night came and Jupiter was well up in the eastern sky, we went to the dome, loaded the plate holder, and climbed the steps to the platform. After inserting the plate holder and moving the telescope into position, I sat down in the observing chair, located the guide star, and prepared to begin the exposure.

Dad then bid farewell and retired. All went well and I could see that this was going to be a piece of cake. As time went on, however, I began to realize why Dad had left the platform. IT WAS COLD! Of course I couldn't leave the chair to stomp around the platform in an effort to keep warm. I had to stay glued to the eyepiece in order to make the differential corrections. Remember, this was before the days of down jackets and warm, light clothing — no electrically heated flying suits, either. Somehow I survived the numbing experience and finally inserted the dark slide, at which time Dad reappeared on the platform, warm and comfortable. We developed the plate in a warm darkroom and I partially thawed. Close examination of the plate did reveal the ninth satellite, but no others. That had to wait for a later day.

In retrospect, I'm sure that Dad, who had been through this chilling experience many times before, knew all along that he would let me make the exposure. He didn't want to give me the opportunity to back out, but led me down the long garden path to the coldest experience I have ever had.

Don Nicholson is the President of MWOA. Don's father, Seth Nicholson, went on to discover the 10th, 11th, and 12th satellites of Jupiter with the Mount Wilson 100-inch telescope, tying Galileo's record of discovering four Jovian moons.

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This account is reprinted from the May 1995 *MWOA Newsletter*.

VIEW FROM MOUNT WILSON — FROM PAGE 3

other than on Earth. Scientifically, we must conclude that we may be alone in an infinite cosmos.

Science *per se* ends here for now, but we can dreamily speculate. If we are alone, then the stars, planets, and galaxies await our exploration. But we may not be alone. If other intelligent life exists in the cosmos, it is likely to be far more advanced than we, owing to the two scientific discoveries that our solar system is rather young (4.6 billion years old) in a much older universe (15 billion years). We might hope to be separated from those other intelligent beings by distances too large to allow significant interaction — otherwise our vaunted ego will be shaken in its confident belief that we humans stand alone at the pinnacle of intelligence.

– S.B.

ELSEWHERE

NON-MWOA EVENTS OF GENERAL INTEREST ACROSS THE SCIENCE SPECTRUM

★ Compiled by Laura Woodard Eklund

PLANETARIA

• Through Jan. 1, Griffith Observatory planetarium: "The Christmas Star." Admission: $2–4. Call for schedule (closed Mondays). Info: (323) 664-1191.

• Opening Jan. 3, Griffith Observatory planetarium: "Mirror of Venus." Admission: $2–4. Call for schedule (closed Mondays). Info: (323) 664-1191.

• Fri., Jan. 5, 12, 19, or Feb. 2, 8:00 P.M., Santa Monica College planetarium: "From Quarks to Quasars" (explore the forces that shape and bind our universe) in John Drescher Planetarium, Room 223, Technology Bldg. $4. (Preceded at 7:00 P.M. by "The Night Sky Show," $4 or $7 for both shows.) Speaker: Jon Hodge (SMC Planetarium Director). Info: (310) 434-4223.

STAR PARTY

• Sat., Jan. 6, dusk–10:00 P.M., Griffith Observatory, on the lawn. Info: (323) 664-1191.

CONFERENCE

• Jan. 7–11, joint meeting of the American Astronomical Society and the American Association of Physics Teachers, Town and Country Resort and Conference Center, San Diego. Monday night talk by NASA Administrator Dan Goldin; Wednesday night banquet with speaker K.C. Cole; Thursday luncheon honoring Margaret Burbidge. Fees: $130–305. Info: www.aas.org or (202) 328-2010. Mount Wilson–related papers (abstracts are posted on the Web):

✓ Sun. afternoon, Jan. 7 (at SDSU): T.R. Williams (Rice University) talks on "The Director's Choice: Mellish, Hubble and the Discovery of the Variable Nebula" (at Yerkes)

✓ Mon. morning, Jan. 8: Don Osterbrock (UC Santa Cruz) talks on "Walter Baade at Palomar 1937–1958"

✓ Tue., Jan. 9, posted all day: "The Mount Wilson Adaptive Optics Coronograph" (on the 100-inch)

✓ Wed., Jan. 10, posted all day: "The Little Thompson Observatory" (the 2nd Telescopes In Education site, in Colorado)

CLASSES

• Tue., Jan. 9–Mar. 27: UCLA Extension. Parking: $6/day. Info: uclaextension.org or (310) 825-9971. Ask if can attend first class for free. Choose one:

✓ 6:30–9:30 P.M., Astronomy XL 5: "Life in the Universe," Simon Balm. 5117 Math Sciences Bldg. Fee: $330 (4 units).

✓ 7:00–10:00 P.M., History XL 3B: "Physical Sciences Since the Enlightenment, 1700 to the Present: Introduction to History of Science," Minghui Hu. 3150 Life Sciences Bldg. Fee: $335 (4 units) or $195 (noncredit).

EXHIBITIONS

• Through May 13, 2001: "Star Struck: One Thousand Years of the Art and Science of Astronomy." Rare books and manuscripts from the Huntington Library collection (including works by Ptolemy, Galileo, Copernicus, Newton, Kepler, Hubble, and Einstein) and works on loan from the J. Paul Getty Museum, Caltech, NASA, and Carnegie Observatories. Huntington Library, San Marino. Admission: $0-$8.50 (free on first Thursday of each month). Call for hours. Info: (626) 405-2100 or www.huntington.org.

• Ongoing exhibit: "No One May Ever Have the Same Knowledge Again: Letters to Mount Wilson Observatory, 1915–1935, " Museum of Jurassic Technology, 9341 Venice Blvd, Culver City. Hours: Thu. 2:00–8:00 P.M. and Fri.–Sun. noon–6:00 P.M. Donation: $0–$4. Info: www.mjt.org or (310) 836-6131.

TELEVISION (specials)

• Scientific American Frontiers: "Life's Really Big Questions" - KVCR (Ch. 24): Tue., Dec. 19, 8:00–9:00 P.M. (repeats Fri., Dec. 22, 12:30-1:30 P.M.); KCET (Ch. 28): Wed., Dec. 20, 8:00–9:00 P.M.

• Eyewitness: "Planets" — KCET (Ch. 28): Tue./Wed., Dec. 19/20, 12:30–1:00 A.M.

• The First Measured Century (data analysis of 20th century) — KVCR (Ch. 24): Wed., Dec. 20, 8:30–11:30 P.M. (repeats Sat., Dec. 23, 10:00 A.M.–1:00 P.M.); KCET (Ch. 28): Wed., Dec. 20, 9:00 P.M.–midnight.

TELEVISION (ongoing)

• Jack Horkheimer: StarGazer (weekly dose of night sky) — KVCR (Ch. 24): Sat. 9:55–10:00 A.M. (repeats Sun.11:30–11:35 P.M.)

• Beakman's World (zany science for kids) — KCAL (Ch. 9): Mon.-Fri. 7:30–8:00 A.M.

• Real Science (science careers for grades 6–12) — KLCS (Ch. 58): Mon. 11:30 A.M.–noon

• FutureWatch — KVCR (Ch. 24): Tue. 11:00–11:30 P.M.

• 3-2-1 Classroom Contact (science for grades 3–6) — KLCS (Ch. 58): Wed. 10:45–11:00 A.M.

• Closer to Truth (panel on science/humanities) — KOCE (Ch. 50): Wed. 10:00–10:30 P.M.; (repeats Sat. 6:30–7:00 P.M.); KLCS (Ch. 58): Sat. 10:00–10:30 P.M.; KVCR (Ch. 24): Sat., Dec. 23, 11:00–11:30 P.M.

• Newton's Apple (grades 5–12) — KLCS (Ch. 58): Fri. 4:30–5:00 P.M.

TELECOURSES (ongoing)

• World of Chemistry — KOCE (Ch. 50): Sun. 9:00–10:00 A.M.

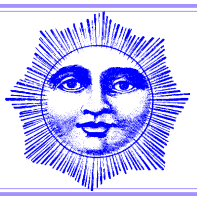
• Oceanus: Marine Environment (oceanography) — KOCE (Ch. 50): Sun. 10:00–11:00 A.M.

• Cycles of Life (biology) — KOCE (Ch. 50): Tue. 5:30–6:30 A.M.

• Universe: The Infinite Frontier (partly filmed at MWO) — KOCE (Ch. 50): Thu. 5:00–6:00 P.M.

• Earth Revealed (geology) — KOCE (Ch. 50): Fri. 6:30–7:30 A.M.

Christmas Morning Eclipse Before you open your Christmas stocking on the morning of the 25th, you might want to check out the partial eclipse visible from Los Angeles. At maximum, the Sun will be 15 percent diametrically obscured, and 14 degrees above the horizon. Following are the times (for West Los Angeles) — Sunrise: 6:58 A.M.; first contact: 7:37 A.M.; maximum: 8:22 A.M.; last contact; 9:12 A.M.



Mount Wilson Observatory Association
P. O. Box 70076
Pasadena, CA 91117

DIRECTIONS TO MOUNT WILSON

From the 210 freeway, follow the Angeles Crest Highway (State Highway 2 north) out of La Cañada/Flintridge for 14 miles to Red Box–Mount Wilson Road; turn right, and go another 5 miles to the Observatory gate, marked Skyline Park. Walk in on the Observatory access road (far left side of parking lot) about 1/4 mile to the Observatory area. The Museum is opposite the 150-foot solar tower. The Skyline Park–Observatory area is open to the public only on weekends from 10:00 A.M. to 4:00 P.M. The U.S. Forest Service requires those parking within the Angeles National Forest to carry a "Forest Adventure Pass." It can be purchased for $5 (one day) or $30 (season) at Clear Creek Ranger Station or Red Box Ranger Station, or at major sporting goods outlets such as Sports Chalet.

Membership Benefits – see page 2

JOIN THE MOUNT WILSON OBSERVATORY ASSOCIATION

Has Your Membership Expired?

MWOA membership renewals were due September 30, 2000, for all members — unless your mailing label shows "01/09."

To Renew or Begin a New Membership —

Detach and mail this form with your check (payable to MWOA) in the amount for an Associate, Family, or Sustaining membership.

Name Telephone

Address (Street/City/State/Zip)

Type of Membership (check one) ◯ Associate ($20) ◯ Family ($30) ◯ Sustaining ($100)

Make your check payable to MWOA, and mail to MWOA, P. O. Box 70076, Pasadena, CA 91117.