

## Contact List

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### Kitt Peak Docent Program

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**Docent Forum:** <http://groups.yahoo.com/group/docentforum/>

**Docent Calendar:** <http://groups.yahoo.com/group/docentforum/>

**Volunteering at Kitt Peak:** <http://www.noao.edu/outreach/kpoutreach.html>

[www.noao.edu](http://www.noao.edu)



## Next Docent Meeting Tuesday, January 22

The next docent meeting will be held on Tuesday, January 22. The meeting will convene at 6:00 in the main conference room and will feature dinner and a speaker. Docents should visit the docent forum calendar to schedule their hours. Docents who do not have web access may contact Nick Petrosino. See the URL for the docent calendar at lower left.

«First Name» «Last Name»  
«Mailing Address»  
«City» «State» «Zip Code»

# DOCENT NEWS



## Happy New Year

### Points of Interest:

- The docent meeting is scheduled for Tuesday, January 22 and will feature dinner and two presentations by Dr. Alexandra Pope and Rich Fedele
- January 3: Quarantids Meteor Shower peak
- January 3: Earth at perihelion (0.983 AU)
- January 4: Isac Newton's 365th birthday (1643)
- Asteroid 2005 WJ56 near-Earth flyby (0.028 AU)
- January 14: MESSENER, 1st Mercury flyby
- January 22: Mercury at its greatest eastern elongation (19 degrees)
- January 29: Asteroid 2007 TU24 near-Earth flyby at 0.004 AU
- January 30: Asteroid 2007 WD5 near-Mars flyby, distance uncertain with a possibility of impact

For additional information about these points of interest, visit [www2.jpl.nasa.gov/calendar/](http://www2.jpl.nasa.gov/calendar/).

## ASTEROIDS IN JANUARY

If docents need arguments in support of NEO tracking programs, January presents two of them; although one of them has more to do with Mars than Earth. But the argument is cogent nonetheless.

Two interesting asteroids among many have been discovered recently by the NASA-funded Catalina Sky Survey. The first was Asteroid 2007 TU24, discovered October 10 by the Schmidt telescope on Mt. Bigelow. It belongs to a class of asteroids called Apollo, asteroids with Earth-crossing orbits.

On January 29 2007 TU24 will pass the Earth at a distance only 1.4 times that of the Moon, or about 556,000 kilometers (333,600 miles). If that seems like a long way, consider a person standing in the middle of the vast Sonoran Desert. Now imagine a randomly-fired bullet passing 21 feet from that person's head. If the Earth were 6 inches in diameter, about the diameter of a human head, 1.4 times the distance to the Moon at that scale would be 21 feet.

According to Jim Scotti of Spacewatch, another NASA-funded NEO tracking operation on Kitt Peak, 2007 TU24 is between 300 and 600 meters in diameter with a Minimum Orbit Intersection Distance of 147,000 kilo-

meters (88,200 miles), well inside the Moon's orbit. The bullet could get much closer next time.

The second discovery was Asteroid 2007 WD5, spotted on November 20. This asteroid does not pose a danger to Earth on this pass but could possibly impact Mars. 2007 WD5 is much smaller than 2007 TU24 at about 50 meters and is traveling about 29,000 miles per hour.

Because of its recent discovery, the asteroid's exact orbit is uncertain, and scientists estimate the chance of an impact at only 1 in 75. More likely is that it will pass Mars at about 50,000 kilometers (30,000 miles). But if an impact occurred, the magnitude would be similar to that of the Tunguska event of 1908 and would create a crater roughly half a mile wide. The impact would happen on January 30.

If these examples are not convincing enough, there is always asteroid Apophis in 2029, a 320-meter rock that will pass close enough to Earth to achieve naked-eye visibility. It may also pass through a gravitational "keyhole" that would alter its orbit and place it on an impact trajectory 7 years later. It is a good thing somebody is watching.

## PROGRAMS TO BEGIN THE NEW YEAR

We are starting off the year with programs both on the mountain and downtown and the hope of drawing crowds to these and all the other programs we offer throughout the year.

First up is Family ASTRO Night Sky Adventure on January 11. Any docents who were trained as event leaders for this program should plan to attend.

Next is New Scope Night the following evening on Kitt Peak. This program offers participants insight into the hobby of astronomy. They may bring their telescopes for

help with proper set up and operation followed by some observing after dark.

Lunar Adventure is a week later downtown on the 18th. The program explores all things lunar and includes some observing from the parking lot behind the building.

Finally comes Junior Astronomer on the 19th. New lower pricing should make this program more attractive to parents.

Docents may feel free to mention these programs to our guests at the visitor center. Up coming events are listed on the web site.

## MIT, HARVARD OFFER SOLUTION TO MARS ENIGMA

### HOW MARS COULD HAVE BEEN WARM AND WET BUT LIMESTONE-FREE

Planetary scientists have puzzled for years over an apparent contradiction on Mars. Abundant evidence points to an early warm, wet climate on the red planet, but there's no sign of the widespread carbonate rocks, such as limestone, that should have formed in such a climate.

Now, a detailed analysis in the Dec. 21 issue of Science by MIT's Maria T. Zuber and Itay Halevy and Daniel P. Schrag of Harvard University provides a possible answer to the mystery.

In addition to being warmed by a greenhouse effect caused by carbon dioxide in the atmosphere, as on Earth, the early Mars may have had the greenhouse gas sulfur dioxide in its atmosphere. That would have interfered with the formation of carbonates, explaining their absence today.

It would also explain the discovery by the twin Mars rovers, Spirit and Opportunity, of sulfur-rich minerals that apparently formed in bodies of water in that early Martian environment. And it may provide clues about the Earth's history as well.

The challenge was to interpret the planet's history, based on the data gathered by the Mars rovers - and especially Opportunity's discovery of sulfate minerals - from just tiny fractions of the surface, says Zuber, who is head of MIT's Department of Earth, Atmospheric and Planetary Sciences and the E.A. Griswold Professor of Geophysics. "How do you take very detailed measurements of chemical composition at one tiny place on Mars," she says, "and put it into the context of the broad evolution of the planet?" The breakthrough, she said, was when she and her colleagues realized "we'd been after the wrong molecule."

After several years of exploring the role of carbon dioxide and the carbon cycle, she said, they realized "maybe the key is sulfur dioxide, not carbon dioxide."

It was Opportunity's discovery of the mineral jarosite, which only forms in highly acidic water, that set them thinking about how that acidic environment could have come about. Sulfur provided the answer.

The new analysis suggests that on Mars, sulfur went through a whole cycle through the atmosphere, bodies of water on the surface, and burial in the soil and crust, comparable to the well-known carbon cycle on Earth. Through most of Earth's history, carbon dioxide has been released in volcanic eruptions, then absorbed into seawater, where it fosters the formation of calcium carbonate (limestone), which gets buried in ocean sediments.

Instead, the researchers propose, on Mars there may have been an analogous sulfur cycle. Much evidence suggests Mars may once have had an ocean that covered about a third of the planet, in its Northern hemisphere. Sulfur dioxide (SO<sub>2</sub>) dissolves easily in water, so after being spewed into the atmosphere by the giant volcanoes of Mars' Tharsis bulge, much of it would have ended up in the water, where it inhibited the formation of carbonate minerals but led to the formation of silicates and sulfites, such as calcium sulfite.

These minerals degrade relatively rapidly, so they would not be expected on the surface of Mars today. But they also allow formation of clays, which have been found on Mars, and which added to the puzzle since clays are usually associated with the same conditions that produce carbonates.

The new picture of a sulfur cycle helps to solve another mystery, which is how the early Mars could have been warm enough to sustain liquid water on its surface. A carbon dioxide atmosphere produces some greenhouse warming, but sulfur dioxide is a much more powerful greenhouse gas. Just 10 parts per million of sulfur dioxide in the mostly carbon dioxide air would double the amount of warming and make it easier for liquid water to be stable.

The analysis may also tell us something about our own planet's past. The early Earth's environment could well have been similar to that on Mars, but most traces of that era have been erased by Earth's very dynamic climate and tectonics. "This might have been a phase that Earth went through" in its early years, Zuber says. "It's fascinating to think about whether this process may have played a role" in the evolution of the early Earth.

The work was funded by NASA, a Radcliffe fellowship, the George Merck Fund, and a Harvard graduate fellowship.

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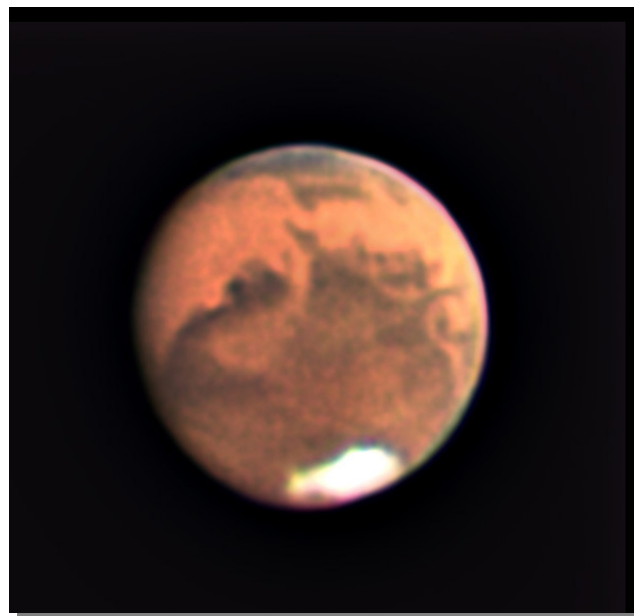


Image taken by Adam Block on August 3, 2003 with the visitor center 20-inch telescope.

# January 2008

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1 New Year's Day <i>Closed</i>	2 Sheila, Everett	3 Jerry, Joe, Joyce	4 John, Gerald	5 Jim, Eugene, Mike
6 Larry L., Ken	7 Everett, Jack	8 Joyce, Frank	9 Sheila, Robert	10 Jerry, Joe	11 Don, Vance (C)	12 Jim, Jerry
13 Jerry, Ken	14 Aubrey Joe W. (T)	15 Gerald, Barbara	16 Sheila, Robert	17 Jerry, Joe	18 Gerald, Don	19 Eugene, Paul
20 Gerald, Jerry	21 Ken, Aubrey, Joe W. (T)	22 Joyce, Frank <i>Docent Meeting</i>	23 Sheila, Barbara <i>Docent Training Begins</i>	24 Jerry, Joe	25 Don, Vance (C)	26 Larry L., Jim
27 Jerry, Gerald	28 Robert, Jack	29 Joyce, Paul	30 Sheila, Jack	31 Jerry, Joe		

## MEMBERS-ONLY EVENT A MEMORABLE SUCCESS

As they entered the 2.1-meter observatory, the guests exclaimed in amazement at the size of the telescope. They were the first of two groups who would stand at the eyepiece of what was once the largest telescope generally available to American astronomers.

31 people attended the Kitt Peak Members-only Program on Friday, December 21. After an introduction in the visitor center, the group was divided, and the group not at the large telescope remained at the visitor center to enjoy views through the 20-inch.

The night was cold so before swapping the groups, everyone thawed for 30 minutes in the visitor center where staff demonstrated astronomy freeware programs. Then it was back to the eyepiece.

Viewing was hampered by an almost full moon, and the choice of targets was restricted to those near the zenith to pre-

vent the eyepiece from achieving an awkward angle or elevation. Yet the guests were treated to a number of deep sky objects including star clusters and planetary nebulae.

Of course Mars and the Moon were prominent and the views of both were something to behold. The Moon actually looked better the previous night when the telescope was tested. The terminator was farther to the (lunar) east so the lighting angle was more favorable. But Friday night's view was still impressive.

A number of docents attended and assisted whenever necessary, in typical docent fashion. Thanks to Marlene Hilligoss, Vance Tanner, Aubrey Mendelow, and Joe Spitzer for their willing assistance throughout the evening. The department would be interested in their impressions of the event to better gauge its success. Suggestions for the next members' event are also welcome.