Mooncusser's 21st Century Almanac By Jim Carlson			
Full Moon – Fri. February, 02 at 00:47 EST **Last Quarter** – Sat. February, 10 at 04:52 EST **New Moon** – Sat. February, 17 at 11:15 EST **First Quarter** – Sat. February, 24 at 02:57 EST			
Object	Feb. 01 (EST)	Feb.14 (EST)	Feb. 28 (EST)
Sun	R: 06:53 S: 16:56	06:38 17:13	06:18 17:30
Mercury	R: 07:43 S: 18:19	07:04 18:29	05:37 16:36
Venus	R: 08:03 S: 18:52	07:48 19:23	07:30 19:57
Moon	R: 16:21 S: 06:49	04:52 13:33	14:10 04:51
Mars	R: 05:14 S: 14:18	05:00 14:14	04:42 14:11
Jupiter	R: 03:07 S: 12:26	02:26 11:42	01:39 10:54
Saturn	R: 17:35 S: 07:36	16:38 06:42	15:38 05:44
Uranus	R: 08:17 S: 19:28	07:27 18:41	06:34 17:50
Neptune	R: 07:15 S: 17:28	06:26 16:39	05:32 15:47
Pluto	R: 03:46 S: 13:48	02:56 12:58	02:02 12:04

February 2007 Events (UT)

01 – CCAS meeting at D-Y. The speaker for the evening will be **Larry Marschall**, professor of physics and astronomy at Gettysburg College. The title of his talk is "**Deconstructing Pluto**." The program will begin promptly **at 7:30 in the auditorium**. Bring a friend.

01 – (2) Pallas in conjunction with the Sun. Moon 1.8˚ north of M44.

02 – Saturn 0.5˚ south of the Moon at 2155 UT (1655 EST). Sunset at 1657 EST.

03 – Regulus occulted by the Moon from the Cape at about 0935 EST, re-appearing half an hour later. This is a morning event, so not visible.

04 – Zodiacal light visible for the next two weeks in the west after astronomical twilight.

05 – Mercury at ascending node.

07 – Moon at apogee (251,650 miles). Venus 0.7˚south of Uranus at 1300 UT (0800 EST). Mercury at greatest eastern elongation.

08 – Spica 1.3˚ north of the Moon at 0400 UT (2300 EST on the 7th). Neptune in conjunction with the Sun.

10 – Mercury at aphelion. Saturn at opposition, visible all night.

11 – Antares 0.7˚ north of the Moon at 2200 UT (1700 EST).

12 – Jupiter 6˚ north of the Moon at 1000 UT (0500 EST).

13 – Mercury stationary.

15 – Mars 4˚ north of the Moon at 0100 UT (2000 EST on the 14th). Mars is below the horizon at 2000 EST.

19 – (3) Juno stationary. Moon at perigee (224,586 miles). Venus 2˚ south of the Moon.

20 – Mercury at greatest northern heliocentric latitude.

23 – Mercury at inferior conjunction. Moon 1.5˚ north of M45 at 2300 UT (1800 EST).

Sources: TheSky6, Software Bisque
Observer's Handbook 2007, Royal Astronomical Society of Canada

The times of rise, transit, and set are for the days listed. On February 1st, for example, Saturn will set at 07:36, and rise at 17:35 EST.

February 1st Meeting

The program for the February meeting of the Cape Cod Astronomical Society will be on the status of former planet Pluto and how became to be a former planet. The speaker for the evening will be Larry Marschall, professor of physics and astronomy at Gettysburg College. The title of his talk is "Deconstructing Pluto." The program will begin at 7:30 in the Dennis-Yarmouth Regional High School auditorium.

Astro Trivia

What are the Quadrantids named after?

One Arcsecond: The Size of a Quarter at … Miles

Have you ever wondered how astronomers measure the angular size of a quarter at, say, three miles? There's an easy way to do it. Barney

Berger, a former president of the CCAS and a retired physicist with a Ph.D. from the University of Illinois, showed me how several years ago.

Imagine being at the center of a circle with a radius of 180 ÷ pi. That number is 57.296; mathematicians call it a radian, a dimensionless number. It turns out to be very handy for many calculations. At a distance of 57.296 inches, for example, one inch, the diameter of a quarter, subtends one degree. The same holds true for a mile or a stepladder, or any other kind of measure. At 57.296 miles, one mile subtends one degree, and at a distance of 57.296 stepladders, one stepladder subtends a degree. That's the whole trick

Enlarging the circle 60 times increases the radius to 3,437.76 units and the quarter, or mile, or stepladder then subtends an angle of one arcminute. Another 60 times and the object subtends one arcsecond. Doing a quick calculation with the quarter, 57.296 * 60 * 60 ÷ 5280 ÷ 12 = 3.255 miles. At 3.255 miles a quarter has an angular size of exactly one arcsecond. Wow! That's how small an arc second is.

But there's more. Every time I come across one of these calculations in print I like to check it out, and believe it or not, my estimate and theirs *never* agree!!

This happened recently with the February 2007 issue of Sky & Telescope. In an article about interferometry titled "Resolving the Faces of Stars" the authors say (pg.40), "The result allows measurements of details as small as a thousandth of an arcsecond wide – the apparent size of a penny in Los Angeles seen from Atlanta."

A site on the Web says that the distance between LA and Atlanta is 1938 miles. So, I took out my calculator and went through the whole exercise, making sure to multiply 57.296 by, 1) 0.75, the size of a penny measured in inches, and, 2) 1000, one thousandth of an arcsecond. The result I get, and the actual answer is, 2442 miles. That is, a penny at 2442 miles subtends an angle of one thousandth of an arcsecond. The difference between the two estimates, 2442 and 1938, is 504 miles, more than an 8 hour drive at 60 miles an

hour. They oughta do something about that.

Another way to look at it is: one thousandth of an arc second is equal to 0.000000277778 degrees, and the angular size of a penny at 1938 miles is 0.0000003499572 degrees. The difference appears to be small but the size of their penny is only 0.6 inches. That's in the same ball park, though, isn't it? Well maybe, but if we substituted Martian craters for ball parks we'd lose another Mars probe.

As an aside, I was at a conference at UMass-Amherst many years ago when the then editor of Astronomy magazine, Richard Berry, was roundly criticized for not noting that some of the photographs he published were color enhanced. They oughta do something about that.

One other thing. That number, 3.255 miles, rings a bell. At 3.26 light years the angular separation between the Sun and Earth, one astronomical unit, or 93,000,000 miles, is one arcsecond, or one parsec. Try calculating it yourself and see if that's what you get.

They oughta do something about that.

Jim Carlson

NASA News Release

The Moon is a Harsh Witness

January 26, 2007: With binoculars, examine the rugged face of the Moon. It is pocked with thousands of impact craters from interplanetary asteroids and comets. Ever wonder why Earth, a much bigger target, apparently has so few craters? They're so rare that a pristine example, the Barringer Meteor Crater in Arizona, is actually a tourist attraction. Did Earth just get lucky and

dodge the heavy artillery?

No, throughout the history of the solar system, Earth was bombarded even more than the Moon. But Earth is so geologically active that earthquakes, volcanoes, and plain old weather are continually crushing, melting, and reshaping its crust. In short, Earth is continually destroying evidence of its past, including evidence of ancient impact craters. Almost all the terrestrial craters that have been identified—only some 170 at last count—have been so eroded that essential clues have been erased.

Not so the Moon. In fact, according to Paul Spudis, a senior planetary scientist at Johns Hopkins University's Applied Physics Laboratory, one of NASA's best reasons for returning to the Moon is to learn more about Earth.

"The Moon is a witness plate for Earth," declares Spudis, borrowing an apt term from weapons research. When scientists want to measure the type, amount, and pattern of damage done by an explosion, they set up diagnostic "witness plates" of various materials nearby to register the impact of shrapnel and radiation.

"Earth and the Moon occupy the same position in the solar system," Spudis explains. "While Earth is a very dynamic planet, the Moon is a fossil world with no atmosphere. So the Moon preserves a record of the early history of the solar system that is no longer readable on Earth.

"That's not just speculation. In the early 1970s, the astronauts on the last three Apollo missions (15, 16, and 17) returned deep-drill core samples from three different sites on the Moon. The cores drilled more than 2 meters into the lunar regolith (the layer of broken rock and dust covering the Moon)."

The deepest samples brought up by those drill cores were 2 billion years old, and largely unchanged since they were laid down," Spudis says. And what a surprise recent re-analysis has revealed. "The lunar regolith traps particles from the solar wind. And drill cores show that the solar wind had a different chemical composition 2 billion years ago than it does today. There's no known explanation for that in solar theory. But that discovery is crucial for understanding the formation of Earth—and also the evolution of stars."

Below: Apollo 16 astronaut Charlie Duke (feet shown) drives a core sample tube into the lunar regolith
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Another big question a return to the witness-plate Moon might help answer is, What caused the sudden mass extinctions of life forms on Earth that mark the ends of different geological eras?

The most famous is the so-called K-T extinction that wiped out the dinosaurs 65 million years ago,

marking the end of the Mesozoic Era (the age of reptiles) and the beginning of the Cenozoic Era (the age of mammals). Much evidence suggests that an asteroid some 10 km wide slammed into Earth, creating such catastrophic climate change that photosynthesizing green plants died, starving more than half of all living beings worldwide; indeed, ground zero has been identified on Mexico's Yucatán Peninsula as the Chicxulub Crater, 160 km across.

There's evidence in the fossil record that such impacts occur periodically, "once every 26 million years," says Spudis. "Not everyone agrees, but I think it is pretty convincing."

Why would this happen? "Some theories are wild!" There might be a dark, distant companion of the sun that periodically perturbs comets in the Oort Cloud, and the comets rain down on Earth. Or perhaps the solar system as a whole is moving in and out of the plane of the Milky Way galaxy, and this somehow triggers periodic episodes of bombardment.

Before we get carried away with theory, however, "we need to establish whether this really happens," Spudis cautions. Is Earth truly subjected to periodic bombardment? Again, the Moon holds the key: Close-up study of the floors of several hundred lunar craters could confirm or falsify a 26-million year period. "We have to sample the stuff that got melted by the shock of impact, and determine the craters' ages."

The Moon is a harsh—and reliable—witness for Earth.

More APOD'S

Orion's Cradle   Tony Hallas

Comet McNaught   Robert H. McNaught

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The **Cape Cod Astronomical Society** meets at 7:30 pm on the first Thursday of every month at the Dennis-Yarmouth Regional High School in Yarmouth, Massachusetts. Meetings are open to the public. Membership dues are $30 for adults, $15 for students in two year colleges, no charge for students in K-12 schools.