February 2003
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Stars and Scopes

Newsletter of the Rocky Mountain Astronomy Club
www.rmastronomy.com

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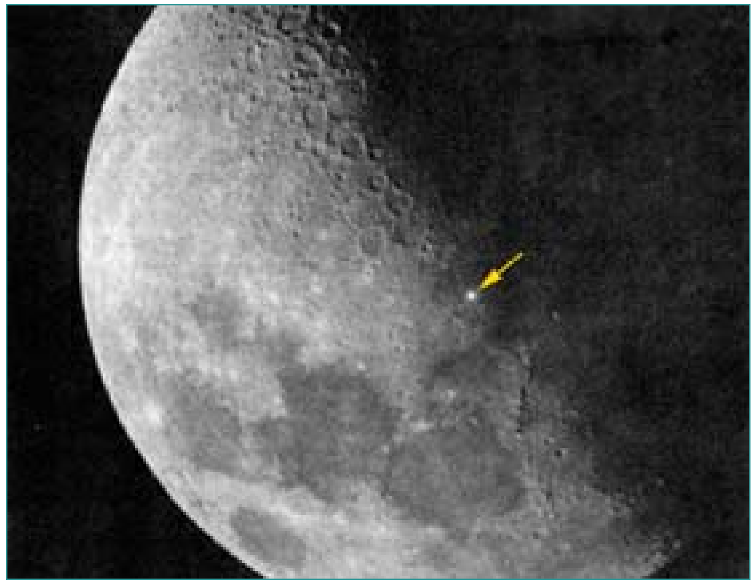
Upcoming Events

- Feb 1–Club Star Watch, 7 pm at Graneros Gorge, south of Pueblo
- Feb 10–Board Meeting, 6 pm, Club Meeting and Program, 7 pm at University of Southern Colo., rm. 217b
- Feb 22 – Star Watch, 6 pm at the Raptor Center, Pueblo
- March 2003 – Southern Colo. Observatory operator training, contact Bill Brown for details
- Mar 1 – Club Star Watch, location to be announced
- Mar 10 – Board Meeting, 6 pm, Club Meeting and Program, 7 pm at University of Southern Colo., rm. 217b
- Mar 29 – Star Watch, 6 pm at the so. Fishing area, Pueblo Reservior
- Apr 8 – Board Meeting, 6 pm, Club Meeting and Program, 7 pm at University of Southern Colo., rm. 217b



Leon H. Stuart's controversial photograph, a 1/2-second exposure taken on November 15, 1953, records a bright flash seen against the lunar disk. With an estimated magnitude of –1, the flash persisted for at least 8 seconds. Courtesy The Strolling Astronomer.

The Moon's Youngest Crater?

By J. Kelly Beatty and Monica Bobra, Sky & Telescope

January 23, 2003 — On the evening of November 15, 1953, amateur astronomer Leon Stuart simply wanted to test a new camera. But the evening turned unexpectedly eventful when, after taking his fourth and final image, Stuart glanced down at the camera's focusing screen and spotted a starlike pinpoint of light near the Moon's terminator. Stunned, he rushed to the darkroom and quickly found the bright flare on his hastily developed film. To him, it was obvious that the brightening represented the impact of a large meteorite on the lunar surface.

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Learning the Night Sky

"The Motions in the Sky and Finding your Way Around;" Part 2

By Bill Brown

The February 2003 presentation for the club meeting will address **chapters 14-29** of ***40 Nights to Knowing the Sky*** by Fred Schaaf. This will be **part 2** of a series of presentations on the basics in astronomy. For beginners this is a great time to learn the ropes, for long-time observers, a chance to brush up on your skills . . .

In our second discussion, we will discuss brightness magnitude, seasonal and other constellations, naked-eye planets, the Milky Way, special stars, bright deep-sky objects, meteors, meteor showers, conjunctions, occultations and eclipses of the Sun and Moon. This is your chance to "come up to speed" on beginning astronomy!

Celestial Events

February 2003
Look for **Mercury, Venus, Mars** and **Jupiter,** in the pre-dawn sky.

May 15, 2003
Lunar eclipse; totality lasts 55 minutes.

August 27, 2003
Mars closest to Earth in many centuries. Don't miss it!

October 2003
Comet Encke; 3.3 year orbit will bring it close enough to almost see naked eye - nice with binoculars or scopes.

November 23, 2003
Lunar eclipse; totality lasts 24 minutes

December 2003
At Midnight, **Saturn** will be at its highest point in the sky in 30 years. Spectacular viewing!

"SCO" Operator Training

Beginning in March 2003, RMAC will begin training members as **observatory operators** for the new Southern Colo. Observatory. All current paid, members of Rocky Mountain Astronomy Club are eligible for these series of training classes. The first classes will take place during the day on Saturdays so that trainees can learn their way around the observatory during daylight hours. Nighttime sessions will involve actual operation of the scope with one public session trial run. The goal is to train operators to run public observing sessions at SCO. Operators will be taught all responsibilities involved in opening, operating and closing the observatory for observing sessions. If you are interested in taking these training classes, please contact Bill Brown at (719) 549-2683 or via email: brownwc@uscolo.edu.

January Club Program

"The Motions in the Sky and Finding Your Way Around, part 1"

Bill Brown began a wonderful series of presentations to the membership during the January RMAC meeting. Based on the book, ***40 Nights to Knowing the Sky*** by Fred Schaff, Bill explained many different methods for observing. First, he gave a definition of the sky. He explained that **the sky** is basically a sphere extending from horizon to horizon and away from the Earth's surface. When thinking in terms of the sky, we should consider it as a huge inverted bowl. Bill continued his discussion with an explanation of how distances are measured to objects in the sky. **Light and time** are used to measure distance rather than miles. This is due to light traveling at 186,000 miles per second. In terms of Earth travel, envision circling the globe seven times in one second—that would be the speed of light or one **light-sec.** A **light year** is the distance traveled in one year— 6 trillion miles to be exact and an **astronomical unit** (AU) is equal to 8 light minutes.

To put light years in perspective with Earth, consider that the Moon, our own natural satellite, is 1.25 light seconds away. Our Sun is 8 light-minutes, or 1 AU, from Earth and Pluto is 5.5 light hours from our planet. The nearest star to Earth outside of the solar system is Alpha Centuri at 4.3 light years. Our nearest galaxy, the Andromeda system, is approximately 3,000,000 light-years from Earth and the edge of the universe has been determined to be 15,000,000,000 light years out from our planet.

Bill continued his discussion with an explanation of how to determine degrees for finding our way around the sky. Keeping in mind the "inverted bowl" analogy, one should remember that **zenith** is directly overhead (90 degrees) from our perspective. The **meridian** bisects the sky from true north to south. **Azimuth** is the direction away from true north to south and **Altitude** is the direction from the horizon up to zenith. This is the basis for the **Alt-azimuth coordinate system.**

We learned a practical way to determine the apparent **distance of objects** in degrees using the rule of thumb—literally. Extend your arm out directly in front of you. Your fingertip, at this distance, is approximately 1-2 degrees in width, your fist 10 degrees wide and your spread hand from thumb to pinkie is approximately 20 degrees apart. This "rule of thumb" applies to anyone since the length of the hand and arm when extended away from your body is proportionate to each person whether child or adult.

Bill addressed the mechanics involved in the **Earth's motion** and why objects appear to rise in the East and set in the West. He explained that the Earth rotates at the rate of 15 degrees per hour or 4 minutes per degree. This is a good thing to remember when trying to observe "low" sky objects. Based on the Earth's rate of rotation, we learned that a **solar day** is comprised of 24 hours—the time it takes for the Sun to return to the same altitude and azimuth in the sky. A **sideral day** is approximately 23 hours, 56 minutes, 4.091 seconds—the time it takes for a star to return to the same altitude and azimuth in the sky. We learned that the Earth moves at a rate of **1 degree per day** in its orbit of the Sun and that a **sidereal year** is 365.25636 solar days.

Bill continued his discussion by explaining the movement of the Moon and how that and the Earth's rotation affects the **Lunar phases.** The Moon, due to its own rotation and its orbit of Earth, appears to move East in the sky by 12 degrees per day or .5 degrees per hour. We learned that the sidereal period of the Moon is 27.3 days and its synodic period is 29.5 days. This helped to explain why we are only able to observe the "near" side of the Moon and that what we refer to as the "dark-side" is a misnomer. Bill further explained the various names and times of the Moon's phases. The Moon rises and sets within a 12 hour

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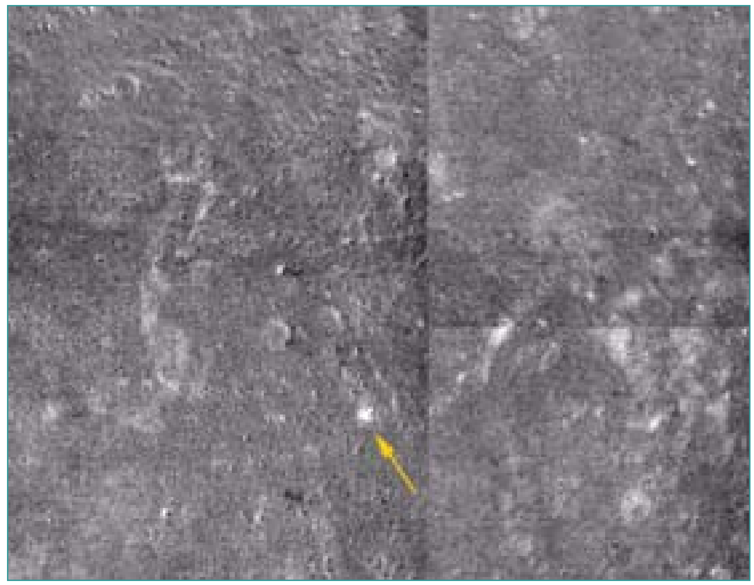
The Moon's Youngest Crater? (continued from page 1)

Stuart later published his picture in **The Strolling Astronomer** - www.justfurfun.org/djalpo. Although dismissed by skeptics as an artifact, his controversial claim recently caught the attention of astronomer Bonnie J. Buratti (Jet Propulsion Laboratory), who decided to investigate. She and Lane L. Johnson, a student at Pomona College, began scrutinizing high-resolution images of the Moon taken in 1994 by the Clementine spacecraft for evidence of a freshly formed crater near the center of the Moon's face.



This fresh-looking lunar crater (arrowed) appears significantly brighter, and thus inherently bluer, in a mosaic of blue-light and near-infrared images from the Clementine spacecraft. The colliding object that formed the crater was roughly 40 meters across, and it struck the Moon with the kinetic-energy equivalent of 500,000 tons of TNT. Courtesy Bonnie J. Buratti (Jet Propulsion Laboratory).

And they found one: a fresh-looking pit about 11/2 kilometers across between the large craters Schröter and Pallas at 3.88 degrees north, 2.29 degrees west. Moreover, the little crater and the splash of bright rays radiating from its rim are distinctly bluer than their surroundings, which lunar scientists consider the hallmark of a feature too fresh to have been "weathered" by the solar wind.

A crater of that size would result from an impactor some 40 meters in diameter — a reasonable match, say Buratti and Lane, both to the flash's estimated energy and to the few-times-per-century likelihood that something of such a size strikes the Moon. They feel confident that, after 50 long years of uncertainty, Stuart has finally been vindicated. Their results will be published in the upcoming issue of Icarus.

However, one unresolved issue concerns the flash's duration: it lasted too long. Stuart did not see the event's beginning or end, but his write-up suggests that the bright spot remained in view for at least 8 seconds. "That's a problem," comments cratering specialist H. Jay Melosh (University of Arizona). The impact's explosive power would have created a white-hot fireball expanding at 10 km or more per second. So an 8-second flash corresponds to an incandescent cloud of vaporized rock — and a corresponding crater — at least 80 km across.

Buratti counters that the fragments of Comet Shoemaker-Levy 9 blazed for several seconds when they slammed into Jupiter in 1994. Stuart's negative purportedly shows a faint halo around the flare, which Buratti speculates might signify an expanding shock wave or a radiating blob of molten material. In 1999, video cameras recorded several flashes on the Moon during the Leonid meteor shower, but each of those, Melosh says, lasted just a few milliseconds.

Was Stuart fooled by a bright "point" meteor, one heading directly toward his Tulsa, Oklahoma, backyard and thus leaving no streak in the sky? Buratti dismisses that idea as highly unlikely, because the photographed spot appears small and perfectly round. Besides, she adds, "The probability of a point meteor appearing on the leading side of the Moon is about one in 650,000." And meteors are generally rare in early evening, when Stuart snapped his famous frame. Nor could it have been due to a passing satellite, as the Space Age had not yet begun.

"This is the only record of a large impact on a solid surface," Buratti insists. But if she's right, and Stuart's account stands, then our understanding of impact physics will require significant reworking. "Whatever it was," comments Peter G. Brown, who researches meteor phenomena at the University of Western Ontario), "it was a neat event."

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January Club Program (continued from page 2)

period. When the Moon is at **new phase** it crosses the meridian at noon. Due to its position between the Earth and Sun, its unlit side faces Earth. When the Moon is at **full phase,** the Earth is positioned between it and the Sun and it crosses the meridian at midnight. At first quarter, the Moon is positioned to the left of Earth as it faces the Sun and crosses the meridian at 6 p.m.; the opposite occurs at third quarter when it crosses the meridian at 6 a.m. This helped explain why certain phases were better for observing than others. The discussion continued with an explanation for the **seasonal changes** on Earth and why certain constellations are visible during these seasons. We learned that the Earth travels in an elliptical path around the Sun and that due to the tilt of the Earth's axis (approx. 23 degrees), this accounts for portions of the planet (hemispheres) receiving more or less sunlight at certain times of the year. The **constellations** also appear to change with the seasons simply due to the Earth's position in its orbit around the Sun. We also learned that due to the position of the Earth's axis', circumpolar constellations appear to circle the poles—and that the tilt of the axis "wobbles" or shifts like a top every 26,000 years thus explaining why constellations appeared differently over the ages.

Bill finished his lecture by explaining **planet movements** and the **celestial sphere.** We learned that planets are referred to being **stationary** when they appear not to move in their orbits. **Prograde** motion occurs when they appear to move in the same direction as Earth and **retrograde** motion when they appear to move opposite. Bill explained that **superior planets** are the ones outside of Earth's orbit while **inferior planets** are the ones between Earth and the Sun. We learned that the celestial sphere uses a coordinate system similar to Earth. True north is considered celestial north and the celestial equator mimics the Earth's equator. **Right Ascension** (RA) is the equivalent of longitude and increases to the East and is measured in hours. **Declination** (Dec) is the equivalent of longitude and is measured in degrees. Degrees moving from the celestial equator to north pole are listed as positive numbers and moving from the equator to south pole are listed as negative. Bill explained how Equatorial telescope mounts (EQs) using this system need to be angled according to the user's latitude to be properly polar aligned.

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