Star Stuff

FERA
Ford Employees Recreation Association

THE FORD AMATEUR ASTRONOMY CLUB NEWSLETTER

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ASTEROID MATHILDE REVEALS HER DARK PAST

From NASANews@hq.nasa.gov (RELEASE: 97-147)

More than 100 years after her discovery, asteroid 253 Mathilde has been sharing her secrets with scientists in the Science Data Center at the Johns Hopkins University Applied Physics Laboratory in Laurel, MD. A 25-minute flyby of the asteroid by NASA's Near Earth Asteroid Rendezvous (NEAR) spacecraft on June 27 has resulted in spectacular images of a dark, crater-battered little world assumed to date from the beginning of the solar system.

The Mathilde flyby is the closest encounter with an asteroid to date and the first with a C-type asteroid. The asteroid's mean diameter was found to be 33 miles (52 kilometers), which is somewhat smaller than researchers originally estimated. A study of the asteroid's albedo (brightness or reflective power) shows that it reflects three percent of the Sun's light, making it twice as dark as a chunk of charcoal. Such a dark surface is believed to consist of carbon-rich material that has not been altered by planet-building processes, which melt and mix up the solar system's original building block materials.

The Mathilde flyby met all its initial goals: getting a clear image of the sunlit side of the asteroid, getting color images that will give clues to the types of rock that make up the asteroid, and getting images that will help researchers determine if Mathilde has any moons. In the next month, scientists expect to complete initial analysis of their data and have improved measurements of Mathilde's volume, mass, and density. "The Mathilde encounter was one of the most successful flybys of all time," said Dr. Robert W. Farquhar, of the Applied Physics Laboratory, NEAR Mission Director. "We got images that were far better than we thought possible, especially since the spacecraft was not designed for a fast flyby."

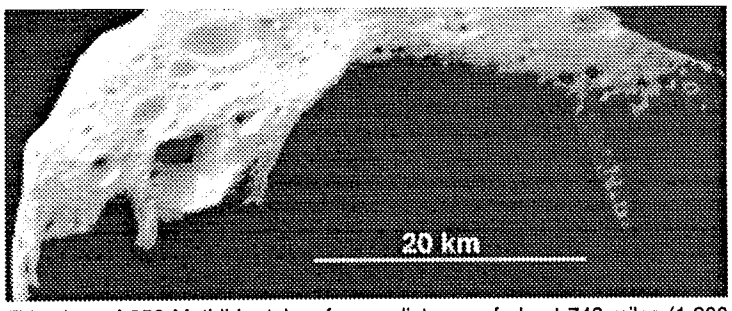
Only the multispectral imager, one of six instruments on the spacecraft, was used during the flyby in order to conserve power provided by solar-powered panels. The spacecraft was approximately 186 million miles from the Sun, too far to provide power for NEAR's other instruments. "Even though this was a very difficult undertaking," said Dr. Stamatios M. Krimigis, head of the APL Space Department that managed the program for NASA, "the NEAR Operations Team was so well prepared there was little doubt that it would succeed; not only that, but this was the smallest operations team of any planetary encounter, proving that the Discovery Program paradigm of 'smaller, faster, cheaper' is alive and well." Although Mathilde proved to be rounder than asteroids such as Gaspra and Ida, Dr. Joseph Veverka of Cornell University, Ithaca, NY, who leads the mission's imaging science team, said, "Mathilde turned out to be more irregularly shaped than most of us expected. The degree to which the asteroid has been battered by collisions is astounding. At first glance there are more huge craters than there is asteroid."

The imager found at least five craters larger than 12 miles (20 kilometers) in diameter just on the lighted side of the asteroid. Scientists wonder how the asteroid can remain intact after having been hit by this many projectiles, each probably at least a mile wide. The craters reveal evidence of the asteroid's makeup. "We knew that C-asteroids are black, but we did not expect their surfaces to be as uniformly black and colorless as Mathilde's surface turned out to be," Veverka said. "This global blandness is an important clue telling us that asteroids such as Mathilde are made of the same dark, black rock throughout because none of the craters, which are punched deep into the asteroid, show evidence of any other kind of rock." Such uniformity seems to confirm that C-type asteroids are in fact pristine samples of the primitive building blocks of the larger planets.

Dr. Donald K. Yeomans of the Jet Propulsion Laboratory, Pasadena, CA, who heads the radio science team formed to determine Mathilde's mass said, "Mathilde is an asteroid with a very tortured past." By determining the bulk density of the asteroid, researchers will have a clue to how it was formed. A composite of objects would have a lower density than a solid chunk from a larger asteroid. Data analysis to determine density will not be complete until later this year, but Dr. Yeomans said, "Preliminary results suggest that Mathilde is much less dense than we had thought."

One mystery that remains is Mathilde's extraordinarily slow (17.4 days) rotation rate. Its collision history could be a factor, but more research needs to be done to determine what role such collisions have played. The search for Mathilde moons continues; none has yet been discovered. The next major event of the NEAR mission will occur on July 3, when the spacecraft's bi-propellant engine is fired to head NEAR back toward Earth. This deep-space maneuver will be the first time the engine has been fired and will keep both engineers and scientists in suspense for 11 minutes before they know if the maneuver was successful. An Earth gravity-assist maneuver on Jan. 23, 1998, will send the spacecraft toward its primary target, asteroid 433 Eros. NEAR will reach Eros nearly a year later and will remain locked in orbit around the asteroid until Feb. 6, 2000, when the mission ends.

Commenting on the success of the Mathilde flyby soon after the first images were received, Dr. Wesley T. Huntress Jr., NASA Associate Administrator, Office of Space Science, said, "It's today that the Discovery Program really begins. NEAR was the first of our Discovery missions to be launched and it's the first to return scientific results." He said the APL-led team that managed the NEAR program proved the concept behind the Discovery Program: that exciting planetary missions can be done at low cost, in a short time.



This view of 253 Mathilde, taken from a distance of about 748 miles (1,200 kilometers), was acquired shortly after the NEAR spacecraft's closest approach to the asteroid on June 27, 1997. In this image, the asteroid has been rotated so that the illumination appears to come from the upper left. This portion of Mathilde shows numerous impact craters, ranging from over 18 miles (30 kilometers) to less than 0.3 miles (0.5 kilometers) in diameter. Raised crater rims suggest that some of the material ejected from these craters traveled only short distances before falling back to the surface; straight sections of some crater rims indicate the influence of large faults or fractures on crater formation. The number of craters as a function of size, and the number of each size within the visible area, are similar to values seen on asteroid 243 Ida, viewed by the Galileo spacecraft in 1993. A major difference between Ida and Mathilde appears to be the abundance of very large craters: Mathilde has at least 5 craters larger than 20 kilometers in diameter on the roughly 60% of the body viewed during the encounter. ☆

LETTERS

From: Douglas Lee Smith (dsmith71@ix.netcom.com)

My name is Douglas Smith. I was a member of the Ford club until Mar 97. I moved to Tucson Arizona at that time. Here are my first impressions.

The astronomy here is great. 300 clear nights a year. I have been here for 10 weeks now, and we have had only one day of rain, and maybe a half dozen cloudy nights in all. And clear air. Little pollution, and because of the professional observatories in the area, they have 'dark sky' ordinances governing the city lighting, meaning little light pollution. Even from my apartment complex in NW Tucson, I can set up on my balcony and have better skies then at Island Lake on the best of nights. This is what I do for my variable star observing. Once a week I travel about 17 miles North, putting a mountain range between me and Tucson, to a really secluded location in the desert. Talk about dark. On a new moon night, you literally can not see the horizon between the ground and the sky. The only way you know where it is where the stars stop. Milky way visible horizon to horizon. No trace of haze or anything on the horizon. I have routinely seen 13th magnitude stars, glob clusters, looking literally between cactus. I have already taken some wonderful astro photos (including some great Hale-Bopp pictures). This is the place for amateur astronomy.

One down observation. I joined the local amateur club (Tucson Amateur Astronomy Association). Attended my first club meeting 3 weeks ago. Very disappointed. Large club, about 300 members, but very unsophisticated. No interest in my equipment, interest, or other astronomy related organizations (like being a member of the AAVSO). Not what I expected. The Ford club was much better organized and a much more sophisticated group of people.

If and when I take a vacation back there (family in Detroit) I will try to appear at a meeting if possible.

Thanks. Special hello to Doug Bock and Bob MacFarland. ☆

FAAC WEB SITE STATISTICS

The following statistics are for the FAAC web site on the Ford intranet. For the time period from January 2, 1997 through June 30, 1997, the home page was accessed a total of 9468 times. This total is more than double the value for the last half of 1996.

Month	Total Hits	Month	Total Hits
Jan	1274	April	2143
February	1394	May	1426
March	1974	June	1257

Every time a user loads the home page, the server writes their computer's network address in the log file. In theory, the number of different host names indicates the number of different computer users that have viewed a particular file. For the first half of 1997, the home page was accessed by a total of 1026 different computers (all inside the Ford network).

Number of Hits	No. of Different Computers
only 1 time	367
only 2 times	142
3 to 5 times	203
6 to 10 times	127
11 to 25 times	108
26 to 50 times	45
51 to 100 times	17
101 to 200 times	14
more than 201 times	3

The number of hits for the various subject directories that have links on the home page are as follows:

Category	Total Number of Hits
Pictures	3833
What's New	2814
Misc. Info	1399
Q&A Page	1336
Newsletter	1240
For Sale	1234
Club Info	928

Another popular site was the special Comet hale-Bopp page, which had 1371 hits in the 2 months is was up. ☆

STAR STUFF

Monthly Publication of the Ford Amateur Astronomy Club

Star Stuff Newsletter
P.O. Box 7527
Dearborn, Michigan 48121-7527

1997 CLUB OFFICERS

President:	Bob MacFarland	313-33-79754
Vice President:	George Korody	248-349-1930
Secretary:	Harry Kindt	313-835-1831
Treasurer:	Ray Fowler	313-8292182 (pager)

GENERAL MEETINGS

The Ford Amateur Astronomy Club holds regular general meetings open to the public on the fourth Thursday of the month at 5:00 PM. Meetings are held in conference room 100 in the Ford Worldwide Web & Internet Applications (WWW&IA) building, at 555 Republic Drive in the Fairlane Business Park in Dearborn.

OBSERVING SITE

The Ford Amateur Astronomy Club has an established observing site, by permit, at the Spring Mill Pond area of the Island Lake Recreational Area in Brighton, Michigan located near the intersections of I-96 and US-23. Members are responsible for opening and closing the gate after the parks 10:00pm closing time. The combination for the lock should be available on our hotline number. Always close the gate behind you after 10:00pm whether entering or leaving the park.

OBSERVING HOTLINE NUMBER - (313) 39-05456

On Friday and Saturday nights, or nights before holidays, you can call the hotline number up to 2 hours before sunset to find out if we will be observing that night. Assume that any clear Friday or Saturday night is a candidate observing night unless something else is going on or none of the club officers are able to make it.

WWW PAGE

Computers inside the Ford network or on the Internet can access the F.A.A.C. web page at one of the following addresses:

Ford Intranet:	http://pt0106.pto.ford.com/faac/
Internet:	http://kode.net/~dougbock/faac/

MEMBERSHIP AND DUES

Membership to the Ford Amateur Astronomy Club is open to both Ford and Non-Ford Motor Company employees. The general public is also welcome to join. The dues structure is as follows:

Annual Individual/Family	$20.00
Lifetime Membership	$100.00

Membership benefits include a subscription to the Star Stuff newsletter, discounts on subscriptions to Astronomy and/or Sky & Telescope magazine(s), after hour use of the observing site at Island Lake, and discounts at selected area astronomical equipment retailers.

NEWSLETTER STAFF

Editor:	Paul Mrozek (313-33-73619)
Inter-company Mail:	MD 57, POEE.
E-mail:	pmrozek; pmrozek@pt0106.pto.ford.com pmrozek@ford.com (outside of Ford)

NEWSLETTER SUBSCRIPTION

A yearly subscription at a rate of $12.00 is available to those who are not members of the Ford Amateur Astronomy Club. Subscriptions are free to other astronomy clubs wishing to participate in a newsletter exchange.

JULY 1997

SUN	MON	TUE	WED	THU	FRI	SAT
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24 FAAC Meeting	25	26
27	28	29	30	31		

July 01 Asteroid 14 Irene at Opposition (9.5 Magnitude)
July 01 Asteroid 409 Aspasia at Opposition (10.7 Magnitude)
July 02 Asteroid 20 Massalia at Opposition (10.9 Magnitude)
July 02 Asteroid 44 Nysa at Opposition (10.6 Magnitude)
July 04 New Moon (2:42 pm)
July 04 Comet Encke, Near-Earth Flyby (0.1901 AU)
July 04 Earth at Aphelion (1.017 AU From Sun)
July 05 Asteroid 51 Nemausa at Opposition (10.5 Magnitude)
July 06 Asteroid 3671 Dionysus Near-Earth Flyby (0.1144 AU)
July 08 Asteroid 1988 XB Near-Earth Flyby (0.1080 AU)
July 10 Asteroid 532 Herculina at Opposition (9.4 Magnitude)
July 12 First Quarter Moon (5:45 pm)
July 12 Asteroid 2 Pallas at Opposition (9.6 Magnitude)
July 12 Asteroid 287 Nephtys at Opposition (11.0 Magnitude)
July 18 Comet Helfenzrieder Perihelion
July 19 Full Moon (11:23 pm)
July 21 Asteroid 9 Metis Occults PPM 118511 (9.1 Magnitude Star)
July 21 Neptune at Opposition
July 25 Moon Occults Saturn
July 26 Last Quarter Moon (2:31 pm)
July 27 Asteroid 444 Gyptis at Opposition (10.8 Magnitude)
July 29 Moon Occults Aldebaran, Visible from Southern USA
July 29 South Delta-Aquarids Meteor Shower Peak
July 29 Uranus at Opposition ☆

MEETING ANNOUNCEMENT

The Ford Amateur Astronomy Club (FAAC) holds regular general meetings on the fourth Thursday of each month, except November and December. Our next meeting will be **Thursday, July 24, at 5:00 pm.**

The FAAC meets in conference room 100 in the Ford WorldWide Web & Internet Applications (WWW&IA) building, at 555 Republic Drive in the Fairlane Business Park in Dearborn. The find the building take the Southfield Freeway to Rotunda Drive. Go east on Rotunda and take the first right into the Fairlane Business Park (there is a sign). The WWW&IA building is the first building on the left. Park on the south or east side of the building and come to the south door (there is a big "425" over the door). The WWW&IA building is secured with a card entry system. If no one is at the door to let you in, then dial 18388 on the lobby phone and we will send someone. When you enter the building, turn left and follow along the windows to the conference room. ☆

6/27/97 FAAC MEETING MINUTES

by Harry Kindt , Sec'y F.A.A.C.

The meeting was called to order by our president Bob MacFarland at 5:05 PM. There were 27 members and guests present. Bob mentioned that the club would be getting together on the night of July 3rd, 1997 for an informal star party at our viewing site at Island Lake, all are welcome, bring your 'scopes' and 'binoc's'. New members were introduced and welcomed to the club. Bob also mentioned that Doug Bock was seeking help in the completion of the re-furbishing of his domed observatory at his NCO site. At a recent star party at the NCO, members of several Astronomy clubs helped Doug re-build the flooring for the observatory, all that remains is placing the side and dome back on top of the new flooring.

George Korody reported on the completion of plans for a star party to be held on July 26, 1997. The party is being sponsored by the Astronomical Societies of Lenawee and Hillsdale Counties. The location is the Lake Hudson State Recreation Area in Clayton, MI. This site is the first Dark Sky Preserve in Michigan. If you are looking for dark skies, this is the place to be on July 26th. For more information and directions to the site, please contact any of the members of the executive committee.

Don Klaser reported on the progress of our own club's 5th Annual Star Party scheduled for September 6th, 1997 at Island Lake. We are in negotiations with several vendors in the area to help with the publicity and to provide door prizes for the event. We will also be talking to the park authorities in order to make some arrangements to have a concession stand available for refreshments during the event. We will once again, institute our "viewing certificate" program, wherein, guests will be able to look through specially marked telescopes and binoculars which will be pointed to various celestial objects. Once their list is completed, they will be issued a special certificate indicating that they have completed the list and viewed all of the specified objects. We are also encouraging other clubs in the area to participate and to present programs of interest to the general public. We would like to see more students come out to these star parties. With this in mind we are encouraging our membership to contact the schools in their area and to provide them with information about the event.

The treasurers report was read and accepted. Ray Fowler reported that the club was now accepting orders for the new polo-style T-shirts which are available to club members for $15.00. The new shirts are blue in color and have our club logo embroidered on them. In the future, and depending on the interest, other items of apparel with our club logo may be available. These include a hooded sweatshirt and/or a light weight zippered jacket.

Over our usual pizza and pop, club members had the opportunity to introduce themselves and give a brief description on their viewing experiences since our last general membership meeting.

Our featured speaker for the evening was Greg Burnett. Greg treated us to a entertaining slide show on his recent trip to New Mexico to pick up his son from school. Greg presented slides on his side trips to the Socorro VLA (Very Large Array) radio telescope observatory in New Mexico and to Roswell NM, site of the still controversial UFO "siting's" in 1947. Thanks again Greg for your usual lively and informative presentation.

Bob MacFarland mentioned that the club is always on the lookout for speakers at our general membership meetings. If you would like to be a speaker at one of our future meetings, please contact Bob MacFarland for scheduling. The meeting was adjourned at 6:30 PM. ☆

JULY SPACE HISTORY

The following July events come from the 05/31/97 edition of "Space Calendar." This calendar is compiled and maintained by Ron Baalke (baalke@kelvin.jpl.nasa.gov).

July 01 150th Anniversary (1847), Hind's Discovery of the Asteroid 6 Hebe
July 06 310th Anniversary (1687), Isaac Newton's Principia Published
July 10 5th Anniversary (1992), Giotto Flyby of Comet Grigg-Skjellerup.
July 19 30th Anniversary (1967), Explorer 35 Launch (Moon Orbiter)
July 22 25th Anniversary (1972), Venera 8 Venus Landing
July 23 25th Anniversary (1972), ERTS-1 Launch
July 24 5th Anniversary (1992), Geotail Launch
July 29 15th Anniversary (1982), Burnup of Salyut 6 Space Station (USRR)
July 31 5th Ann. (1992), STS-46 Launch (Atlantis), Tethered Satellite ☆

JULY 1997 SPACE EVENTS

The following July 1997 events come from the 05/31/97 edition of "Space Calendar." This calendar is compiled and maintained by Ron Baalke (baalke@kelvin.jpl.nasa.gov). Note that launch dates are subject to change.

July 01 STS-94 Launch, Columbia, MSL-1R
July 02 Seastar Pegasus XL Launch
July 03 NEAR, Deep Space Maneuver (TCM-8)
July 04 Mars Pathfinder, Trajectory Correction Maneuver #5 (TCM-5)
July 04 Mars Pathfinder Lands on Mars
July 08 Superbird-C Atlas 2 Launch
July 10 Galileo, Orbital Trim Maneuver #30 (OTM-30)
July 12 GSP-2R Navstar Delta 2 Launch
July 12 Panamsat-5 Proton Launch
July 20 Progress M-36 Launch (Russia)
July 23 NEAR, Trajectory Correction Maneuver #9 (TCM-9) ☆

ASTRONOMY WORKSHOP

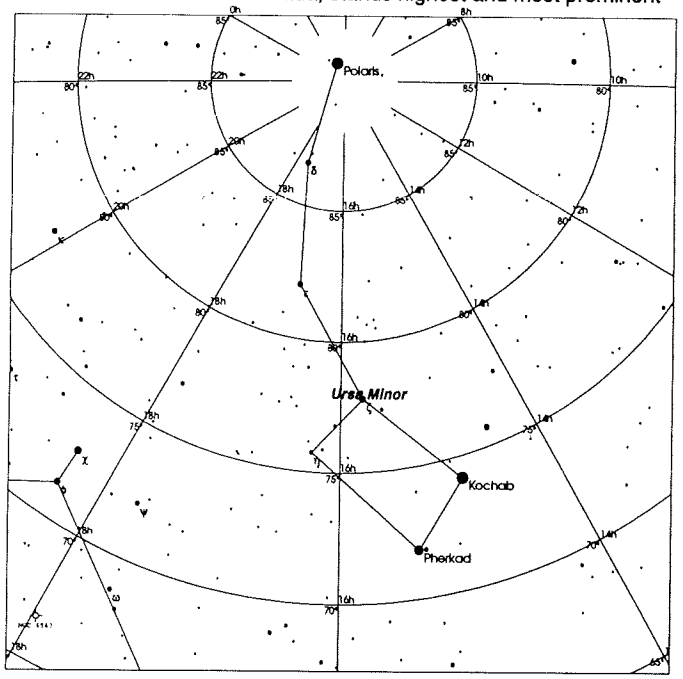
From Discover, June 1997, pg.96

Star Bright, by Bob Berman

Want to tell a magnitude 1 star from a 3 or 4? For help, look to the north.

Nothing in astronomy is more basic than the classification of star brightness. The ancient Greeks gave us our modem method, which unfortunately is an illogical reverse-order system. For reasons unknown, the Greeks allocated lower numbers to brighter stars and reserved higher numbers for dimmer stars. Sixth magnitude, at the top of the ancient Greek scale, represents the faintest objects seen on a perfect moonless night far from city lights. At the other extreme lies the brilliance of first- or even zero-magnitude stars like familiar Arcturus. Over the years, we've tailored the ancient system to suit our modern tastes: we now quantify star brightness precisely, so that five magnitudes represent a 100-fold change Put another way, one magnitude is the fifth root a 100, or 2.512. (Thus a star of magnitude 3 is 2.512 times brighter a a star of magnitude 4.)

June is ideal for viewing this system splayed across the sky. Start by following the Big Dipper's two leftmost stars down to the North Star, at the end of the Little Dipper's handle. This month the handle curves upward into the Little Dipper's bowl, a quadrangle containing only one medium-bright star named Kochab. Kochab, like the North Star, is a second-magnitude star. The bowl's next brightest star, Gamma, is third magnitude. The next star, Zeta, is fourth magnitude, and the dimmest, Eta, is fifth. All but one hit their respective magnitudes to within eight-hundredths of a point; together, they represent the core of the so-called polar sequence and serve as standards for the comparison of star brightness. This month the polar sequence, which never sets as seen from the United States and Canada, stands highest and most prominent



Glance from Kochab to Gamma, or Zeta to Eta and so on, and you'll see what a 2.5-fold brightness change looks like. The rest of the June sky displays only two zero-magnitude stars (Arcturus and Vega, both high up), five first-magnitude stars, and more than a hundred seconds and thirds. Away from city lights the heavens are awash with 2,000 fifth- and sixth-class stars. The pattern leaps out: the fainter you go, the more stars you see. That's why using a simple pair of binoculars suddenly increases the number of stars seen from 2,500 to 20,000. The profusion of newcomers — including even ninth-magnitude stars — is especially dramatic when sweeping binoculars along the eastern or southeastern midnight sky this month, as the Milky Way is rising.

Typical amateur telescopes carry the observer to the thirteenth magnitude; look through telescopes such as the Palomar and you'll see stars of magnitude 20. Until recently, the dimmest thing ever perceived, with the use of lengthy electronic image-intensifying exposures on giant telescopes, was magnitude 29. But in early 1996 the Hubble Space Telescope hit the jackpot. For ten days Hubble focused on a single spot in the handle of the Big Dipper and snapped more than 300 pictures. When combined, the images revealed never-before-seen stars and galaxies — some of them thirtieth magnitude. Astounding: A magnitude 30 star is 10 billion times dimmer than the faintest star of the Little Dipper. Imagine that you could spot the glow of a single cigarette on the moon.

This feat proves that a moderate-size telecope above Earth's atmosphere can outperform much larger instruments when it comes to plumbing the magnitude system's murky basement. That unfathomably dim region is home to a universe of unexplored treasures. Yet the journey really begins in a most accessible way — with a glance at the Little Dipper. ☆

OBSERVATIONS

by Greg Burnett

Preface: On the occasion of Astronomy Day 1997, the Ford Amateur Astronomy Club provided a public display of astrophotographs and equipment at The Nature Company, Sommerset Collection North. The following thoughts are in response to one of the visitors that day, who insinuated that our present understanding of the age of the Universe amounted to a lot of "guesswork"...

How do we know that the Universe is roughly 15 billion years old and not, as some accounts would have it, a mere ten thousand? We know because, with all the different ways we have learned to see—in radio, infrared, and even in the ethereal "light" of neutrinos—our Universe looks like it has been around for something like 15 billion years, certainly no less than 12 billion. What does it mean to "know" something like this?

We accept into our collective body of human knowledge those ideas that are testable and verifiable. More important, they must be "falsifiable," that is, there must be some definitive way to show that an idea is wrong if indeed it is. Ideas that have these qualities we accept as "knowledge." Other ideas, appealing as they may often be, are necessarily relegated to the category of "beliefs." In fact, most of what we call "science" is actually the process of testing, again and again, those ideas that aspire to become knowledge. Knowledge can be verified, beliefs can not.

Knowledge allows us to make useful predictions about the world. Your car starts in the morning because the knowledge of physics and chemistry that went into its construction is largely correct knowledge: what it predicts is what really happens. Your car does not run because someone says so, or because you trust and believe in a philosophy or moral code that states that it will. It runs because our understanding of materials, metallurgy, electronics, and so forth, is correct. "Perfect" certainly not, but correct enough that your car is likely to still be running after 100,000 miles, and that represents a substantial accumulation of correct, useful knowledge.

Likewise, the knowledge that tells us the age of the Universe need not be taken on faith; it is not all guesswork. You do not have to accept that the Universe is 15 billion years old because someone in authority says so. The underlying knowledge is based on facts that you could verify, given the appropriate circumstances. Right now there are many people—people much like yourself: intelligent, skeptical, and curious—busily engaged in doing exactly that: testing, again and again, the correctness of our knowledge about the Universe, and making adjustments to that knowledge where necessary.

It has become popular these days to use the word "theory" as if it meant "belief" or "guess." But these definitions are wrong when applied to ideas like the "Theory of Relativity" or the "Theory of Evolution." These ideas, and several others, are still called "theories" only because of historical circumstance. They are no more guesses than the idea that the Earth is round is a guess. Today no rational person would discount the "Germ Theory of Disease," first advanced in 1546 by Girolamo Fracastoro, but not finally proven to the satisfaction of most of its detractors (Christian Scientists notwithstanding) until the late 19-th century by Jenner, Koch, and Pasteur. You are free, of course, to regard these "theories" as beliefs and decline to accept them, but you would do so in the face of a monumental accumulation of knowledge that indicates otherwise; knowledge based on observable facts that, again, you could personally verify if you chose to do so. These theories, and others, have been tested over and over and over again, and have survived the most penetrating scrutiny with very little damage. Indeed, from time to time we might make some adjustment, some refinement, to the knowledge they represent, but they are by-and-large as worthy of acceptance into our body of human "knowledge" as any of the most obvious everyday notions.

Like wise, the idea that our Universe is about 15 billion years old is based on knowledge that has been and continues to be mercilessly hammered upon by the finest minds humankind can muster, and yet it survives. As Matthew Tindal once observed, "Matters of fact are very stubborn things." ☆

STATISTICALLY SPEAKING

Location (Dearborn, MI): 42°19'12" N, 83°10'48" W, 180 meters elevation
Local Time = Universal Time - 4 hours (Eastern Daylight Savings Time)

Abbreviations used in reports:

FM	Full Moon	FQ	First Qtr Moon	LQ	Last Qtr Moon
MR	Moon Rise	MS	Moon Set	SR	Sun Rise
NM	New Moon			SS	Sun Set

Calendar Report for July 1997

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1 SR: 6:00 SS: 21:13 MR: 3:45 MS: 18:14	2 SR: 6:00 SS: 21:13 MR: 4:29 MS: 19:13	3 SR: 6:01 SS: 21:13 MR: 5:17 MS: 20:07	4 SR: 6:02 SS: 21:13 MR: 6:08 MS: 20:56	5 SR: 6:02 SS: 21:12 MR: 7:03 MS: 21:39
6 SR: 6:03 SS: 21:12 MR: 7:59 MS: 22:17	7 SR: 6:03 SS: 21:12 MR: 8:56 MS: 22:51	8 SR: 6:04 SS: 21:11 MR: 9:53 MS: 23:22	9 SR: 6:05 SS: 21:11 MR: 10:50 MS: 23:51	10 SR: 6:06 SS: 21:10 MR: 11:47 MS: None	11 SR: 6:06 SS: 21:10 MR: 12:44 MS: 0:19	12 SR: 6:07 SS: 21:09 MR: 13:41 MS: 0:48
13 SR: 6:08 SS: 21:09 MR: 14:40 MS: 1:17	14 SR: 6:09 SS: 21:08 MR: 15:40 MS: 1:48	15 SR: 6:09 SS: 21:07 MR: 16:41 MS: 2:24	16 SR: 6:10 SS: 21:07 MR: 17:43 MS: 3:04	17 SR: 6:11 SS: 21:06 MR: 18:43 MS: 3:50	18 SR: 6:12 SS: 21:05 MR: 19:41 MS: 4:44	19 SR: 6:13 SS: 21:05 MR: 20:34 MS: 5:45
20 SR: 6:14 SS: 21:04 MR: 21:22 MS: 6:52	21 SR: 6:15 SS: 21:03 MR: 22:05 MS: 8:04	22 SR: 6:16 SS: 21:02 MR: 22:45 MS: 9:17	23 SR: 6:17 SS: 21:01 MR: 23:21 MS: 10:29	24 SR: 6:18 SS: 21:00 MR: 23:56 MS: 11:41	25 SR: 6:18 SS: 20:59 MR: None MS: 12:51	26 SR: 6:19 SS: 20:58 MR: 0:31 MS: 13:59
27 SR: 6:20 SS: 20:57 MR: 1:08 MS: 15:05	28 SR: 6:21 SS: 20:56 MR: 1:46 MS: 16:08	29 SR: 6:22 SS: 20:55 MR: 2:28 MS: 17:07	30 SR: 6:23 SS: 20:54 MR: 3:14 MS: 18:02	31 SR: 6:24 SS: 20:53 MR: 4:04 MS: 18:52	Lunar Events: Jul 04 NM: 14:42 Jul 12 FQ: 17:45 Jul 19 FM: 23:23 Jul 26 LQ: 14:31	

Planet View Info Report for July 1997

Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
Mercury							
7/ 1/1997	6:27	21:49	7h08m01s	24°12'57"	6°29'29"	0.968	1.31530
7/ 8/1997	7:10	22:10	8h08m38s	22°03'01"	13°49'01"	0.872	1.25686
7/15/1997	7:49	22:16	9h00m11s	18°34'42"	19°38'34"	0.764	1.17017
7/22/1997	8:21	22:13	9h42m48s	14°28'26"	23°53'57"	0.664	1.07173
7/29/1997	8:43	22:02	10h17m09s	10°14'46"	26°32'00"	0.566	0.96926
Venus							
7/ 1/1997	7:53	22:44	8h21m30s	21°05'08"	23°33'08"	0.912	1.52507
7/ 8/1997	8:10	22:41	8h56m33s	18°58'58"	25°22'19"	0.898	1.49109
7/15/1997	8:27	22:37	9h30m31s	16°27'48"	27°10'08"	0.882	1.45476
7/22/1997	8:44	22:30	10h03m27s	13°35'40"	28°56'12"	0.866	1.41629
7/29/1997	9:01	22:22	10h35m24s	10°26'39"	30°40'08"	0.848	1.37589
Mars							
7/ 1/1997	13:19	1:11	12h19m55s	-1°59'45"	86°09'01"	0.880	1.25412
7/ 8/1997	13:10	0:51	12h32m31s	-3°30'08"	82°57'35"	0.880	1.30363
7/15/1997	13:02	0:31	12h45m49s	-5°03'22"	79°56'37"	0.881	1.35190
7/22/1997	12:54	0:12	12h59m46s	-6°38'39"	77°04'46"	0.882	1.39879
7/29/1997	12:47	23:50	13h14m20s	-8°15'11"	74°20'45"	0.884	1.44431
Jupiter							
7/ 1/1997	23:22	9:36	21h36m03s	-15°11'05"	137°51'40"	0.995	4.27008
7/ 8/1997	22:53	9:06	21h34m02s	-15°22'41"	145°03'25"	0.997	4.20087
7/15/1997	22:24	8:35	21h31m31s	-15°36'32"	152°22'36"	0.998	4.14308
7/22/1997	21:54	8:03	21h28m35s	-15°52'09"	159°48'04"	0.999	4.09777
7/29/1997	21:25	7:31	21h25m18s	-16°09'01"	167°18'32"	1.000	4.06580
Saturn							
7/ 1/1997	1:47	14:30	1h14m15s	5°14'54"	80°06'11"	0.997	9.55375
7/ 8/1997	1:21	14:04	1h15m30s	5°20'30"	86°27'02"	0.997	9.43838
7/15/1997	0:54	13:38	1h16m27s	5°24'17"	92°52'31"	0.997	9.32225
7/22/1997	0:27	13:11	1h17m07s	5°26'11"	99°22'56"	0.997	9.20685
7/29/1997	23:56	12:44	1h17m28s	5°26'13"	105°58'48"	0.997	9.09358
Uranus							
7/ 1/1997	22:43	8:26	20h41m30s	-18°56'15"	151°25'17"	1.000	18.92333
7/ 8/1997	22:15	7:58	20h40m30s	-19°00'09"	158°20'20"	1.000	18.87454
7/15/1997	21:46	7:29	20h39m27s	-19°04'15"	165°16'14"	1.000	18.83918
7/22/1997	21:18	7:00	20h38m20s	-19°08'29"	172°12'26"	1.000	18.81772
7/29/1997	20:50	6:31	20h37m11s	-19°12'46"	178°58'09"	1.000	18.81050
Neptune							
7/ 1/1997	22:10	7:45	20h04m39s	-19°55'13"	160°06'09"	1.000	29.19245
7/ 8/1997	21:42	7:17	20h03m54s	-19°57'28"	166°57'21"	1.000	29.15888
7/15/1997	21:14	6:49	20h03m08s	-19°59'49"	173°48'36"	1.000	29.13930
7/22/1997	20:46	6:20	20h02m20s	-20°02'11"	179°11'35"	1.000	29.13393
7/29/1997	20:18	5:52	20h01m33s	-20°04'34"	172°25'24"	1.000	29.14284
Pluto							
7/ 1/1997	17:35	4:43	16h14m57s	-8°12'47"	142°09'53"	1.000	29.17766
7/ 8/1997	17:07	4:15	16h14m23s	-8°13'49"	135°45'58"	1.000	29.25181
7/15/1997	16:39	3:47	16h13m54s	-8°15'19"	129°17'52"	1.000	29.33616
7/22/1997	16:11	3:18	16h13m30s	-8°17'16"	122°47'28"	1.000	29.42942
7/29/1997	15:43	2:51	16h13m11s	-8°19'39"	116°15'36"	1.000	29.53034

Planet/Moon Events Report for July 1997

7/ 4/1997	Earth @ Aphelion	Distance from Sun: 1.02 AU	
7/ 9/1997	Moon @ Apogee	Hour: 19	Distance: 404954 km Diameter: 0.4918°
7/21/1997	Moon @ Perigee	Hour: 19	Distance: 361585 km Diameter: 0.5508°
7/21/1997	Neptune @ Opposition	Hour: 3	
7/29/1997	Uranus @ Opposition	Hour: 20	

Meteor Showers Report for July 1997

Date	Meteor Shower	ZHR	RA	DEC	Illum. Frac.	Longitude
7/ 7/1997	Capricornids	5			0.09	106°
7/14/1997	Capricornids	5	20h44m	-15°	0.69	113°
7/20/1997	alpha-Cygnids	5	21h00m	48°	0.99	118°
7/25/1997	Capricornids	5	21h00m	-15°	0.61	123°
7/28/1997	delta-Aquarids	20	22h36m	-17°	0.28	126°
7/30/1997	Piscis Australids	5	22h40m	-30°	0.12	128°

Twilight Report for July 1997

Date	Sun Rise	Sun Set	Astronomical Begin	Astronomical End	Nautical Begin	Nautical End	Civil Begin	Civil End
7/ 1/1997	6:00	21:13	3:42	23:31	4:36	22:37	5:20	21:53
7/ 8/1997	6:04	21:11	3:49	23:26	4:41	22:34	5:25	21:50
7/15/1997	6:09	21:07	3:58	23:18	4:48	22:29	5:31	21:46
7/22/1997	6:16	21:02	4:09	23:09	4:57	22:21	5:38	21:40
7/29/1997	6:22	20:55	4:20	22:57	5:06	22:12	5:45	21:32

SKY & TELESCOPE NEWS BULLETINS

from the editors of Sky & Telescope magazine

MARTIAN LIFE RECONSIDERED

New evidence argues against a Martian meteorite containing microscopic fossils, as has been suggested by a NASA/Stanford research group. In a paper published in the May 15th issue of the journal NATURE, Edward R. D. Scott (University of Hawaii) and two colleagues report that bits of carbonate that harbor the putative fossils were created not by some warm, babbling brook but rather during a high-powered impact some four billion years ago. The blast heated the carbonate to at least 1,000 C and injected it while molten into tiny rock crevices. However, Scott's group did not find any of the round, multizoned carbonate globules seen by the NASA/Stanford team. Thus it may be that some parts of the meteorite was affected by shock, while others escaped damage.

RETURN OF THE MINI-COMETS

Based on newly released images, Earth is being pelted more or less continuously by small comet-like objects. A camera on the orbiting spacecraft called Polar recorded the intruders has they sliced through Earth's uppermost atmosphere. The interlopers are thought to weigh 20 to 40 tons and consist of almost pure ice. They begin to break up at altitudes at least 10,000 km above Earth, so they never reach Earth's surface. Their water creates neutralized "holes" in the ionosphere that are seen by Polar's cameras. The comets strike at rates of five to 30 *per minute.* If this rate has been steady over billions of years, they have contributed much of Earth's water and perhaps a large proportion of its organic constituents. Physicist Louis Frank (Univ. of Iowa) first called attention to these mini-comets in 1986, based on their appearance in other spacecraft data. But his idea was widely criticized at the time because there was no other observational evidence for the comets' existence.

EUROPA's MAGNETIC PERSONALITY

One key Galileo experiment involves no detector but merely monitoring the spacecraft's radio beacon as it flies close by one of Jupiter's Galilean satellites. Subtle accelerations due to gravity imprint Doppler shifts in the transmissions and can be used to derive the mass of each moon and crudely map the internal structure. Galileo investigators report that Callisto appears to be rather homogeneous throughout and has no magnetic field of its own. By contrast, the deep interior of Europa is either a mixture of rock and iron, or an iron core enveloped in a rocky lower mantle. The exterior shell, 100 to 200 km thick, consists of ice and/or water, adding to the mounting evidence that Europa has a subsurface ocean of water. This world also has a weak magnetic field, which is only a fraction of the strength of Ganymede's. Europa's field does not appear to align with its spin axis but is instead tipped 45 deg to the side.

A DRY MOON AFTER ALL?

A new report, published in SCIENCE for June 6th, suggests that there might not be any water at the lunar poles after all. Radar echoes collected during the Clementine mission in April 1994 hinted that patches of ice might lie near the lunar south pole, mixed with dust in the frigid floors of permanently shadowed craters. But additional radar work with the 1,000-foot Arecibo radio dish has dimmed that prospect. Exploiting favorable Earth-Moon geometry in 1992, Donald Campbell and Nicholas J. S. Stacy used Arecibo's radar beam to peer into the shadowed craters. The presence of water ice would have changed the returning beam's polarization in a telltale way, but that was not seen. "We don't see anything that suggests ice," says Campbell. However, Clementine scientists are standing by their results. The truth may be learned later this year, when a spacecraft called Lunar Prospector returns to the Moon to conduct a sensitive search for ice in the polar regions. If the Moon proves to be bone dry, as the Arecibo data suggest, it would place stringent constraints on the amount of water that could be delivered to the lunar surface by infalling comets — miniature or otherwise.

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JUPITER: WET & DRY

Results from the Galileo spacecraft have restored scientists' belief that the clouds of Jupiter contain water. This view had been shaken when Galileo's probe found virtually no water during its December 1995 descent into the clouds. However, trhe orbiter's near-infrared mapper has found some areas so humid that, according to investigator Robert Carlson, "it's either going to rain or it's raining right now." Apparently the probe chanced to enter the atmosphere in one of a few very dry parcels, which together cover only about 2% to 5% of the planet. These dry spots appear to be areas of downwelling gas. "Winds rise from the deep atmosphere and lose water and ammonia," explains Glenn Orton (JPL). "At the top, when they converge and drop back down, nothing is left to condense into clouds, and a dry clearing is created."

CLOSE-CALL STAR

Using newly released data from the Hipparcos satellite, a team of astronomers led by Joan Garcia-Sanchez (JPL) has found a small handful stars that did or will pass within 10 light-years of us. The closest future approacher will be Gliese 710, now a 10th-magnitude red dwarf 63 light-years away in Ophiuchus. About a million years from now this star will be only about a light-year from the Sun and will shine at a brilliant magnitude 0.6. At that distance it may actually pass through the outer Oort Cloud, sending a deadly shower of comets our way. Statistically, over time other stars should have come as close or closer, and the infall of distant comets may have triggered some of the mass extinctions that have plagued life on our planet.

KING OF THE KUIPER BELT

A sizable body discovered last October in the Kuiper Belt beyond Neptune has a unique orbit with links to the distant Oort Cloud of comets. Designated 1996 TL66, this object is currently some 5.2 billion kilometers (35 astronomical units) from the Sun. Assuming it has a dark surface, the new find is rather large and could be up to 500 km across. Discoverers Jane Luu (Harvard University) and her colleagues calculate that 1996 TL66 is now close to the perihelion of a much more eccentric orbit, one with a semimajor axis of 84 a.u. and a period of nearly 800 years. No other known object bridges the void between the Kuiper Belt and the far more distant Oort Cloud. Whatever its origin, 1996 TL66 undoubtedly represents the first of many such discoveries. Luu's group estimates that thousands more bodies of comparable size and distance await discovery within 30 degrees of the ecliptic plane.

EARTH's COMPANION ASTEROID

Two interesting asteroids are in the news this month. One of them is unnamed but designated 3753. Discovered in 1986, this 5-km-wide body has an inclined and eccentric path that crosses the orbits of both Earth and Venus. Simulations by Paul Wiegert (York University) and two colleagues show that 3753 circles the Sun in what's termed a horseshoe orbit with respect to Earth. It works like this: the asteroid circles the Sun in just a bit under 1 year. Over time this slight mismatch allows it to overtake Earth, every 385 years to be exact. But as it comes near the Earth's gravity adds a little energy, expanding its orbit. Suddenly circling the Sun in just *over* 1 year, the asteroid never quite catches Earth and moves away. Then, 385 years later, Earth catches up, this time *robs* 3753 of a little energy, and drops it into a smaller, faster orbit. The asteroid thus appears to be a companion of sorts, under Earth's control. The only other known example of horseshoe orbits involve Janus and Epimetheus, two small satellites of Saturn located just beyond the ring system. Sometime within the next 100 million years, however, asteroid 3753 will escape its captivity, either crashing onto one of the inner planets or being flung away onto a totally new path.

DOUBLED DIONYSUS?

The second newsy asteroid is 3671 Dionysus, an Earth-crosser in a 3.25-year orbit. When astronomers Stefano Mottola and Gerhard Hahn (German Aerospace Research, Berlin) observed its rotational light curve earlier in June, they noticed that every 1.15 days the asteroid's brightness would suddenly drop by 0.08 magnitude. But the asteroid itself is known to rotate every 2.7 hours. So they've concluded that Dionysus probably has a satellite, and we're looking right along its orbital plane. If they're right, every 28 hours this little moon either passes in front of or behind the main asteroid. Mottola and Hahn point out that Dionysus will come within about 17 million km of Earth in early July, when it will brighten to 15th magnitude. Astronomers around the world are trying to learn more in the coming weeks, as the asteroid won't be near us again for 13 years.

BLACK HOLES SPIN

In the June 20th issue of the Astrophysical Journal Letters, Shuang Nan Zhang (NASA/Marshall) and others report that two black holes they've been studying are spinning 100,000 times per second. They deduced this by accurately determining the closest stable orbit to a given black hole, which depends on the latter's spin rate. Zhang notes that this knowledge will be helpful in determining how much angular momentum a black hole has "swallowed" during its lifetime. The observations also confirm Einstein's prediction that black holes spin. ☆

Ford Amateur Astronomy Club
Star Stuff Newsletter
P.O. Box 7527
Dearborn, MI 48121