Madison Astronomical Society

Capitol Skies

The newsletter of the Madison Astronomical Society February/March 2003

From the President's Desktop

by Neil Robinson

Greetings MAS'ers. Although the coldest season is upon us, the MAS spirit remains warm as evidenced by the members who turned out to make the US Bank Eve event at the UW Space Place a big success with over 500 members of the public in attendance, many of whom looked through the 4 instruments brought by our members.

The evening of January 11 brought out our members again to participate in an earth science fair at the McKay center in the UW Arboretum with 4 instruments available for the mostly young audience to enjoy. This sort of participation is very important for our group, not only as a source of potential recruitment of new members but also as fulfillment of our responsibility as a Wis Section 500 c(3) non-profit corporation to do public outreach activities which benefit the community. So keep the volunteer efforts coming!

The first class in CCD astronomy taught by our Greg Selleck was conducted successfully in the first week of January. Many more people have expressed interest in attending so look for more classes to be scheduled soon.

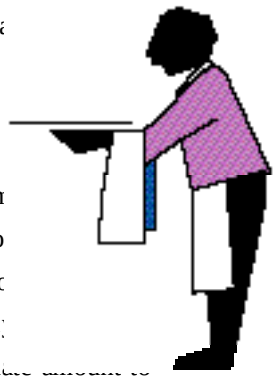
And finally, MAS warmly welcomes a few new members this month: Joe Getty, Wolfram Nolten and David Odell.

Upcoming Events

February 11	Space Place Guest Speaker: "A Decade of Discovery with Hubble Space Telescope: Extending Our Understanding of Forces That Shape the Universe," Dr. Keivan Stassun, Astronomy Department. 7:00 PM 1605 S. Park St.
February 14	MAS monthly meeting. 7:00 pm board meeting, 7:30 main presentation: Professor Joe Cassinelli, "Results from the Chandra X-Ray Observatory." Space Place, 1605 S. Park St.
February 19	Madison Metropolitan School District Planetarium – Public show. Solar System Update. One program only, 7:00 PM. Tickets $2. Tickets go on sale approximately 20 minutes prior to the show. First come, first served. Memorial High School, 201 S. Gammon Rd., 663-6102 or www.mmsd.org/planetarium for info.
February 25	Space Place "Eyes on the Skies" with Jim Lattis. 7:00 PM 1605 S. Park St.
March 14	MAS monthly meeting. 7:00 pm board meeting, 7:30 main presentation: Professor Ed Churchwell, "SIRTF: Space Infrared Telescope Facility." Space Place, 1605 S. Park St.
March 19	Madison Metropolitan School District Planetarium – Public Show. One show only, 7:00 pm. Tickets $2. Tickets go on sale approximately 20 minutes prior to the show. First come, first served. Memorial High School, 201 S. Gammon Rd., 663-6102 or www.mmsd.org/planetarium for info.
April 4	Spring Banquet: see announcement at right for details.

Annual MAS Banquet, April 11

The Annual Spring Banquet will be Friday, April 11 at JT Whitney's, 674 S. Whitney Way. The bar will open at 6 p.m. a will be served at tree selections: chicken cordon bleu for $18, prin au jus for $18, o etarian lasagna fc Send a check pa for the appropri Jane Breun, 1990 Oak Wood View Drive, Verona, WI 53593 before Friday, April 4. Speaker to be announced.



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Madison Astronomical Society members are active in sharing the pleasures of astronomy with the public, acting as a resource for students and teachers, and exchanging information at Society meetings which occur monthly. The Society continues to pursue its original goal to "promote the science of astronomy and to educate the public in the wonders of the universe."
For more information about the Society, please contact one of the officers listed above.

MAS thanks
Internet Dynamics Corporation for hosting our web presence. Visit MAS on the web at:

www.madisonastro.org

Book Reviews

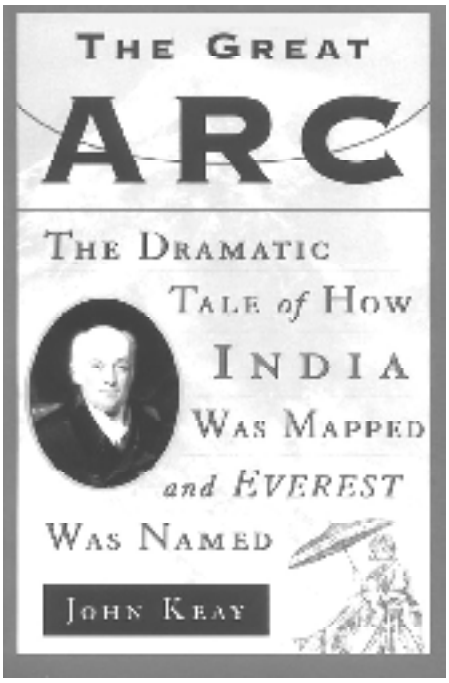
The Great Arc: The Dramatic Tale of How India was Mapped and Everest was Named by John Keay, 2000

The Map That Changed the World: William Smith and the Birth of Modern Geology by Simon Winchester, 2001

Explorer of the Universe : A Biography of George Ellery Hale by Helen Wright, 1994

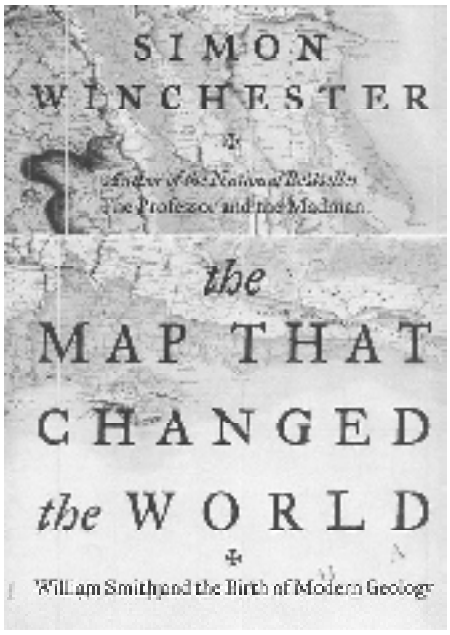
The line of longitude at 78º E pretty much cuts the Indian peninsula in half. Beginning in the early 1800's and continuing for the next fifty years, the British surveyed this longitude line and the areas on either side of it, all the way to the Himalayas. Two men–William Lambton and George Everest–lead the effort. The had several purposes. The longitude line from the tip of the peninsula to the Himalayas presented an opportunity to measure the curvature of the earth over an extensive distance. The survey and mapping of the Indian subcontinent went hand in hand with the British conquest of India. The British hoped to discover the reason behind discrepancies in smaller surveys of England and France between the surveyors' triangulations and the astronomical determination of latitude and longitude.

Lambton was an unassuming personality who began the survey in 1802, working northward from the southern tip of the Indian peninsula. On occasion, he would disappear into the field for several years. When inconsistencies appeared, he would remeasure. Everest, a much more arrogant man, became Lambton's chief assistant and then took over when Lambton died. Survey teams slashed through the jungles, dealt with wild tigers, and came down with malaria. To deal with the haze and dust, Everest had them switch to night time work, using bonfires to mark the spot for the survey line. As many as 700 porters were used to carry the equipment, which included a theodolite that weighed half a ton. The inconsistencies between the surveying measurements and the astronomical observations became greater as the survey approached the Himalayas. The mass of the mountains was pulling the plumb line off vertical.



I would have appreciated more detail about the astronomical observations. Every time the author wants to emphasize the extreme accuracy of the measurements, he mentions that they were accurate to "a hundredth of a second of a minute of a degree of arc." Maybe that's how surveyors talk, but it bothered me to keep reading this phrase. Beyond these few quibbles, I found the book very interesting and recommend it. (*Reviewed by Jane Breun*)

William Smith was the son of a blacksmith, born in rural England in 1769. Smith became a surveyor for the coal companies that were building canals to haul their product to market. Later he was to become a first rate drainer, constructing drainage ditches for marshes and lowlands for agricultural purposes. When an employee of the coal companies, he had descended into numerous coal mines. Interested in fossils since childhood, he realized that each strata in the mines was distinguished by the fossils in it. He saw the same fossils in other parts of England as he traveled from job to job. By



1815 he had produced a map of the underground strata for the whole of England. Four years later, Smith was in debtors' prison. Only in 1831, at the end of his life, was Smith recognized by the Geological Society for his work.

Although I found the author's writing style rather pedantic at first, after a few chapters, I was so taken with the story, that I simply didn't notice the writing style any more. Although this is not a book about astronomy, I highly recommend it to anyone with an interest in the history of science. (*Reviewed by Jane Breun*)

(*Editor's note: R.A. Greiner reviewed this book in* Capitol Skies *about two years ago. It's such an impressive and important book that I'm running a longer review this issue.*)

By definition, biographies have as their subjects those who have achieved greatness. Biographies of well known scientists rank among the best of the genre: Einstein, Newton, Galileo, Darwin, Pasteur, Curie, Feynman, etc.

Few, however, can compete with the list of accomplishments of George Ellery Hale. Perhaps justifiably he is remembered as the builder of giant telescopes. He built three of the greatest of all time, and spearheaded a fourth–the Palomar 200 inch–though he did not live to see it completed and named in his honor. However, Hale's considerable life's work goes much further. He was a groundbreaking solar astronomer, inventing new instruments and methods of studying the sun's activity. His invention of the spectroheliograph and subsequent discovery of the magnetic field lines of sunspots nearly earned him a Nobel prize (Hale was nominated for the Nobel prize in physics by many other recipients of that award–including Millikan.). The Nobel Prize was the only major scientific honor that eluded Hale. He won the Copley Medal of the Royal Society of London, the Janssen Medal of the Paris Academy of Sciences (twice), the Rumford Medal, the Gold Medal of the RAS, the Draper Medal of the NAS, the Bruce Medal, the list goes on.

He founded the Astrophysical Journal; was foundational in forming the International Astronomical Union and the American Astronomical Society. He was instrumental in the transformation of the Throop Institute of Pasadena into the venerable California Institute of Technology and attracting top-notch talent to its teaching and research staff. He had a vision for the cooperation of the sciences and the National Academy of Sciences and the National Research Council were the result.

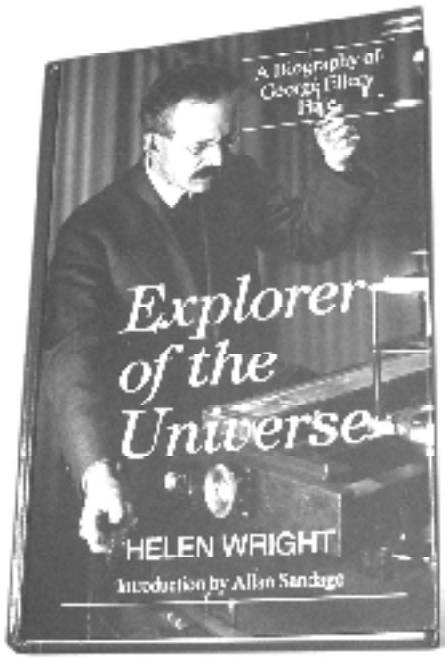
As great as his organizational abilities were, his true love always remained that of plumbing the depths of stellar evolution, and he was always anxious to return to his own research. In the process he turned down the presidency of MIT. He took a pass when offered the position of Secretary of the Smithsonian Institution. He also eventually resigned as director of the Mt. Wilson Observatory, both for health reasons and to allow him time to return to his own solar observatory.

Hale also had a passion for sharing the sciences with the public. Early on he was determined that the Yerkes refractor be opened to the public one night a week. He authored a half-dozen popular books on astronomy. He was an avid admirer of art, music and history, and was central in the establishment of the Huntington Library and Art Gallery in San Marino, CA.

Perhaps Hale's greatest achievement was bridging the gap between the observational astronomy of the 19th century (and before) to the 20th century study of physics and physical phenomena. More than any other individual, Hale recognized that astronomy and physics made the perfect marriage, and he pioneered methods to bring the physical laboratory and the astronomer's telescope together.

As good as it is, and Wright's is one of the best scientific biographies available, she does stand guilty of starting a terrible misconception about Hale's mental state. It is generally well known that Hale suffered from nervous breakdowns that were at times completely incapacitating. Wright gets the credit for starting the story about Hale's supposed little "elf" that visited and talked to him, and who has come to represent his illness. Historians William Sheehan and Donald Osterbrock trace it to a misunderstanding of one of Hale's letters to a friend and note that the "'demon' (the word he actually used) was a metaphor, referring either to his conscience or to his depressed mood (like Winston Churchill's 'black dog'), and certainly not an apparition."

For more information on Hale and a more modern reading of the building of Palomar, see Ronald Florence's excellent "The Perfect Machine." Osterbrock's two outstanding books "Yerkes Observatory, 1892-1950: The Birth, Near Death, and Resurrection of a Scientific Research Institution" and "Pauper & Prince : Ritchey, Hale, & Big American Telescopes" also contain much valuable information about the man the New York Times called "one of the most eminent men of science this country ever produced." (*Reviewed by John Rummel*)



The Plurality Of Worlds: Part 2, The Beginning

by Wynn Wacker

I was almost 8 years old when the Space Age began with the launching of the Russian Sputnik satellite on October 4, 1957. I remember my own "October Skies" moment, when my father and I went out on the flat roof behind our second-story apartment at 2610 Monroe St. and gazed at the night sky trying to spot the satellite. Whether due to poor prediction (no space tracking network then!) or our own inexperience, we didn't manage to see it. I was too young to understand the political consternation surrounding this demonstration of ICBM throw-weight, but I did listen when the President said we needed more scientists and it influenced direction of my schooling.

While Sputnik was a Communist triumph, the immediate attempts to cash-in on it were pure market capitalism. The image of the small spherical satellite with four radio antennas in a cross quickly appeared in a number of toys and other products (I had a glow-in-the-dark sputnik hanging from the ceiling light in my bedroom for several years). This even extended to food. I recall some particularly atrocious spherical green chewing gum in spacey packaging. One attempt with a Dairy State twist was the FizzNik. This consisted of two plastic hollow hemispheres with short tubes protruding from the center of each. The bottom tube was inserted into the neck of a bottle of root beer or other soda. A scoop of ice cream was then placed in the lower hemisphere and the upper hemisphere snapped into place. When you tipped the bottle to drink, the soda would flow around the ice cream and deliver a delicious ice cream soda to your mouth. The TV ads carefully avoided showing the messy ice cream slurry which flowed back into the bottle when you lowered it. In an era of glass deposit bottles, the orbital decay of FizzNik was faster than its namesake's. The manned space program eventually gave us some real "space food", including Tang (also atrocious) and freeze-dried foods (usually acceptable). None are what would generally be termed an epicurean delight, which is an extremely roundabout way of bringing up the Epicureans, the ancient school of Greek philosophy which is generally credited with promulgating the idea of a plurality of worlds.

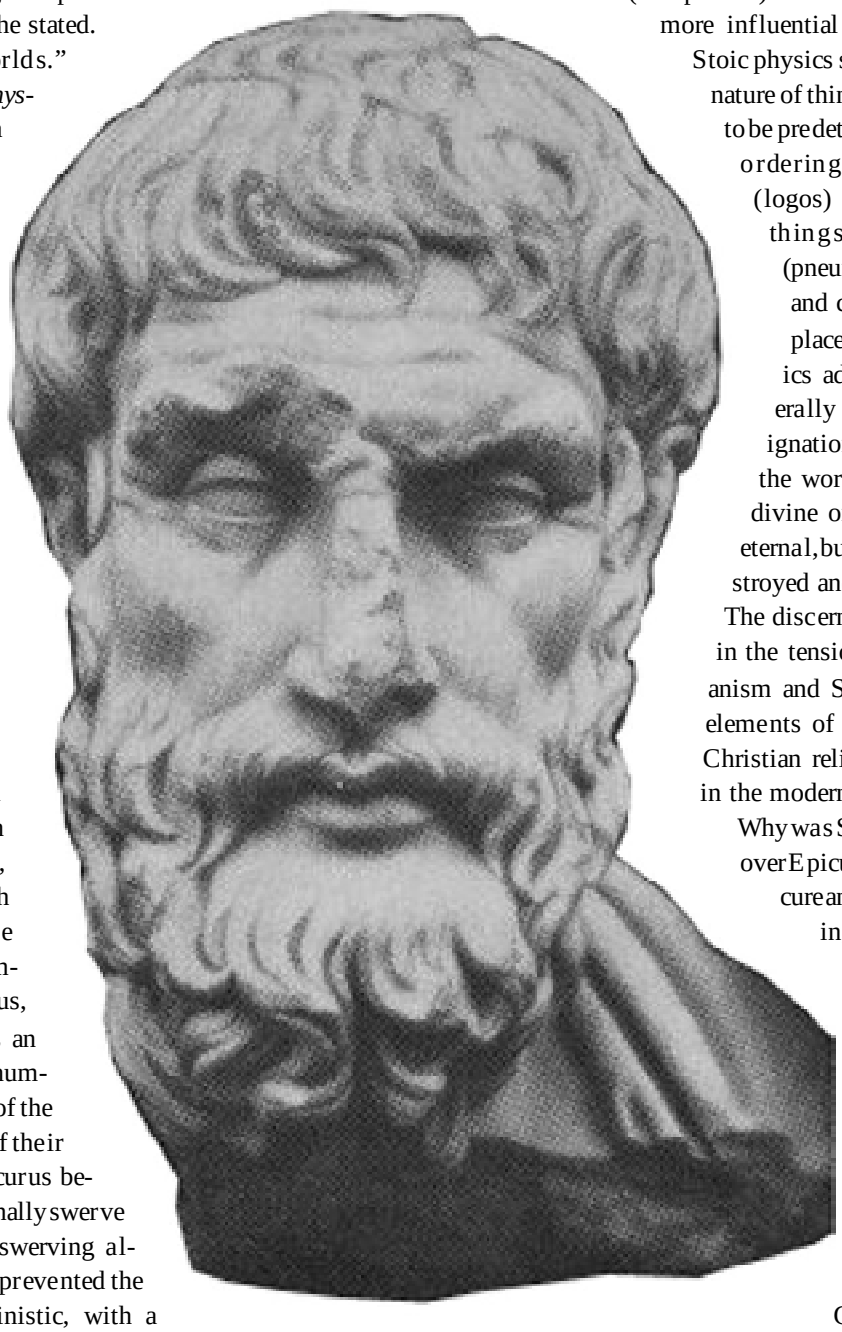
> *"…the first Greek philosophers were astronomers."*
>
> Will Durant, The Story of Philosophy (1961)

It's ironic that ancient Greece, where uncountable gods controlled every aspect of nature and human behavior (reportedly including an Athenian altar "to gods unknown"), spawned Western philosophy which in its earliest phase seems to have been largely concerned with eliminating gods from the explanation of ordinary events. True, the exposure to a diversity of cultures in sea trading ports like Athens must have highlighted the contradictions between various mythologies. However, other great civilizations also had active trade and exposure to different cultures. Perhaps it was encouraged by the Greek systems of governance, which tended away from theocratic rule by a semi-divine potentate. Whatever the cause, Greek thinkers, starting with Thales of Miletus (640-546 BC), developed a number of materialistic theories explaining the universe. Among these were Leucippus and his disciple, Democritus of Abdera (460–370 BC). Their writings exist only in fragments, but they are recognized as the first atomists. Their primary principles were that 1) the fundamental constituents of reality are uncuttable "atoms" in the form of solid particles interspersed with empty void, 2) the atoms are naturally in motion and vary in velocity, size, shape, and ability to link together, 3) there is a causal necessity governing the changes in locations and arrangement of the atoms (e.g. they obey laws), 4) the motions of the atoms cause vortices out of which worlds can condense. There are constantly worlds forming and worlds dissolving or being destroyed by collision. 5) Life develops out of slime and is related to warmth and fire. This part of the philosophy sounds very much like modern science (except that our atoms are divisible). When writing about natural processes, Democritus even points out the shadows on the Moon as being caused by mountains, making it clear that he regards this as a physical body similar to the Earth. As for the soul, it also is composed of soul-atoms and when we lose all of these we die. There is no personal immortality. Good and useful are recognized from bad and harmful by the pleasure or pain they bring, though moderation is recognized as the appropriate way of attaining the ideal state of being, ataraxia, a condition of serene, untroubled pleasure. The ideal form of government in which to pursue this state is (what else) democracy.

Because the atoms vary in their properties, the atomist theory is called pluralistic in distinction from monistic theories, such as that of Thales, in which the world derives from one substance (water). Democritus didn't receive a very warm welcome when he visited Athens, complaining "no one recognized me." His

philosophy wasn't warmly received there either. He was attacked by Plato (428-348 BC) who wrote in the Timaeus "There is and ever will be one only-begotten and created heaven", a statement deriving from his belief in a unique Creator. Plato's student, Aristotle (384-322 BC), was even more vehemently against pluralism. "The world must be unique" he stated. "There cannot be several worlds." Aristotle's writings, including the *Physics*, and *On the Heavens*, provided a physical basis to the world which discouraged the idea of more than one world.

Epicurus



Atomism was widely spread in the philosophy of Epicurus (341-270 BC). Born in Samos, where he was influenced by Democritus, he moved to Athens and opened his own school, located in a garden, in 306 BC. Much to the scandal of the locals, his school admitted women and slaves. This resulted in rumors of debauchery, but in fact the lifestyle of the students was plain and subdued given the philosophy's belief that ataraxia was the goal and prudence was the guide to achieving it. Epicureanism stressed that philosophy is to begin with the clear evidence of the senses, the plain facts (compare this with Plato's allegory of the cave, where the senses show only distorted images of reality.) Like Democritus, Epicurus believed the cosmos was an infinite void filled with an infinite number of atoms. The ceaseless motion of the atoms gave rise to worlds and all of their contents. Unlike Democritus, Epicurus believed that the atoms would occasionally swerve uncaused by anything else. This swerving allowed free will to exist in Man and prevented the world from being totally deterministic, with a future both partially fixed and partially free.

Although the emphasis of Epicureanism went through changes over time, it survived the decline in Greek power and the rise of Rome. The Roman poet Lucretius (Titus Lucretius Carus 99–55 BC) expounded Epicurean philosophy in his epic and influential poem, *De Rerum Natura* (On the Nature of Things) and influential Epicurean philosophers can be found the 2nd and 3rd centuries AD, though not without opposition. In addition to the Academics, the Epicureans were opposed by the Stoics. Founded by Zeno of Citium (335-264 BC) and named after the painted colonnade (stoa poikile) where he lectured, it was far more influential than Epicureanism. Stoic physics stressed the corporeal nature of things and held the world to be predetermined, the result of ordering by divine reason (logos) which controls all things through "breath" (pneuma) which animates and controls all matter. In place of ataraxia, the Stoics advocated apathia (literally "not suffering"), resignation to one's situation in the world as a reflection of divine order. The world was eternal, but was periodically destroyed and resurrected by fire. The discerning reader will note in the tension between Epicureanism and Stoicism some of the elements of the tension between Christian religion and humanism in the modern world.

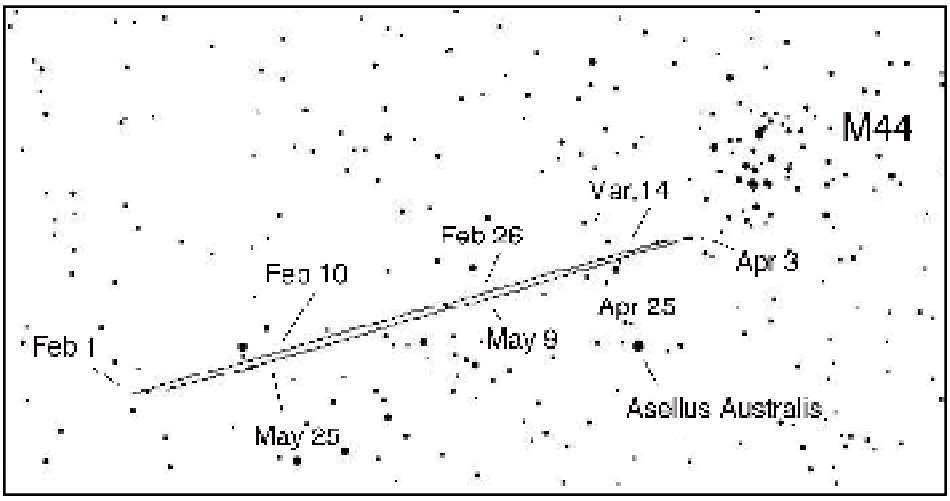
Why was Stoicism predominant over Epicureanism? Why is epicurean an adjective denoting gross indulgence, while stoic denotes an admirable quality of endurance? In part it may have been a reaction of Greek philosophy to the decline of Greek power following the death of Alexander the Great shortly after that of Aristotle. There may also have been a reluctance to acknowledge the random nature of Man's creation and the purposelessness of his existence implied in the atomist theory. But no doubt it was in large part the general acceptance of Aristotle's physics -as will be explored in the next installment.

Something in the Way It Moves: Observing Retrograde Motion

by John Rummel

"... When I trace at my pleasure the windings to and fro of the heavenly bodies I no longer touch the earth with my feet: I stand in the presence of Zeus himself and take my fill of ambrosia, food of the gods."

– Claudius Ptolemy



Jupiter's motions from February 1st to June 1st, 2003. Diagram made with Starry Night Pro.

Carefully observing the motions of the classical planets was something our ancestors did with great solemnity. Because the geometry of our solar system is so well understood now, it's rarely done anymore. Nowadays, amateur astronomers are much more interested in looking *at* the planets rather than at how they move.

All of the superior planets trace out retrograde loops around the time of their oppositions. Since we usually observe the planets anyway around this time, we are invariably looking during the time of their retrograding. However, unless it is pointed out to us, or unless we make it a point to chart their motions against a conspicuous landmark, we usually fail to notice the direction of motion.

I recall watching the Mars opposition of 1999. It was not a great opposition since Mars was never larger than about 16 arcseconds. Remember, however, that we're not as interested in looking at the planet, but how it moves. That year Mars ended its retrograde loop very close to the first magnitude star Spica. Mars is quite speedy, and watching this U-turn was very easy, and quite satisfying. There's just something deeply gratifying to me about watching the mechanics of our solar system play out night by night. Maybe I'm imagining a spiritual connection with Kepler or Tycho.

Jupiter spends about 4 months out of every 12 going backwards, or eastward among the stars. Marking Jupiter's progress this year would seem more difficult than most years. Spending the majority of its time in the constellation Cancer, with no bright stars to mark its path, Jupiter seems to be floating in the void between Leo and Gemini. There is a wonderful landmark in Cancer though–M44 or the Beehive Cluster–and Jupiter will approach and give it a "kiss" as it finishes retrograding this spring.

The ideal way to track Jupiter's progress as it approaches and then hesitates before the Beehive is with binoculars. The wide field of view will be perfect for viewing Jupiter in the context of the star field surrounding M44. Telescopes are also fine, but use low power so you can get the widest field of view possible.

February opens with Jupiter at opposition (and right in the middle of its retrograde loop), so it's at its brightest and up all night. At this point it's about 6 degrees east of the Beehive, but it will close that distance by a little each night.

As February slowly proceeds, Jupiter closes on the cluster gradually, moving about 10 times its own diameter each night. This is sufficiently rapid movement that you should be able to follow its progress easily with binoculars or a small telescope. The closer it gets to the Beehive–and to its stationary point–the slower it will move. By the middle of March, it's moving only about four times its own diameter each night, and will continue to slow until it finally stops, hesitates, and reverses direction around April 3rd. When it reverses course, it's only about a degree away from the center of the Beehive, so you should be able to observe both in the same telescopic or binocular field of view.

Will Jupiter's brightness overwhelm the stars of the cluster? Not at all. Though Jupiter is about 2000 times brighter than the brightest stars in the M44, your eye can easily observe this range of brightness. In June of 1999, I observed Venus in Cancer while vacationing in Door County. At magnitude -4.3, over six times brighter than Jupiter, the stars of the Beehive were still clearly visible as Venus passed almost directly in front of the cluster.

Telescopic viewers will have several chances to observe Jupiter's progress as the planet passes some sixth magnitude stars on its journey. On February 8-10, Jupiter passes just to the south of two magnitude 6 stars, which should be visible in the same field of view on those nights. Again on March 12-14, it passes through a mini cluster of stars ranging from magnitude 7 to 9. About this same time it's passing about a degree to the north of Asellus Australis, the 2nd brightest star in Cancer, at magnitude 4.

An exercise such as this is not something you're likely to impress your neighbors with. If they want thrills, show them Saturn. If you enjoy the more sublime pleasures of amateur astronomy, it's hard to beat the subtleties of celestial mechanics at work.

Back to School: CCD Imaging at YRS

by Matt Mills

I received Greg Sellek's email at work. He was going to YRS to upgrade the AKO for CCD imaging. Greg offered me the first one-on-one session with the CCD camera.

It wasn't until 3:30 PM before I finished work. Would I have time to study? I knew if I didn't take this opportunity the next slot might be quite a while before I would be given another chance.

I decide to go for it. I started cramming just like finals in college. I drove to YRS and found Greg adding his many improvements to the scope, CCD and software. He probably could tell I was a little nervous. It had been a long time since I had been in the AKO. The telescope has been out of service and there hasn't been a CCD on the scope for almost a year. My past experience with the CCD/LX-200 set up was mainly looking over Greg's shoulder. Now I had to go from start up to finish without any help.

Put away your notes–it is time to take the exam.

I found the AKO observatory locked and everything turned off, just like I would any night. I memorized the main points in Greg's opening session hand-outs. Now I had to keep them straight. It helps to visualize the different steps. First the order in which things must be turned on and started up. Then the scope is slewed to a known star to focus on and sync on. Fine focus was next using the subframe and inspect features of the imaging software.

By the time I was to this point my fingers had frozen and I had trouble using the mouse. Greg was now looking over my shoulder just like I had his. I knew the most important steps were ahead and I decided to go on.

Imaging a star field and plate solving the image are the meat and potatoes of CCD imaging. If I could just get though this part all I would have to do is save my image and shut the whole thing down. Be calm and take a deep breath of frigid air. Now take a light frame for sixty seconds, plate solve it and sync the scope. The plate solve worked and I synced the scope. I was in business now. All I had to do was slew to the object of my choice and image it. I chose an easy target–M1, it was in the same area as my focus star. Thirty more seconds to the image then shut down. Congratulations, I just imaged my first object!

MAS Offers CCD Training Class

by Greg Sellek

The MAS has recently acquired the use of a SBIG ST-7E CCD camera, which is now mounted on the 12" LX200 at YRS. A computer inside the dome controls all aspects of imaging, including telescope, camera, and dome control. The whole system can be run from inside the dome or inside the (much warmer) clubhouse.

This equipment can be used by any MAS observing member just like the other equipment at YRS. However, members must complete a short training course and become 'certified' to use the equipment before doing so. By the time you're reading this, we should have completed our second CCD class at Space Place with a third in the works. If you are interested in learning more about CCD astronomy, or would like to sign up for a class, please contact me at orion2598@hotmail.com, or at 848-6301.

Update on Telescope Review: Konusmotor 90 and Konusmotor 114

By AJ Carver

This creatively titled note is an update on my also creatively title article, "Telescope Review; Konusmotor 90 and Konusmotor 114" from the June/July 2002 issue of Capitol Skies. Since the publication of my review it seems Konus has modified these telescopes for the worse. Instead of going into depth on the modifications I will share two thoughts for consideration.

First, determining what telescope is best for you is very important to your level of satisfaction. This selection can be difficult. By being a member of the MAS you are connected with people holding a common interest who have collective experience, strong opinions, knowledge, resources, and equipment. Interaction with members and their telescopes can help guide you in telescope selection.

Second, if you choose to purchase a telescope make sure to purchase from a dealer with an excellent return policy. The policy should allow you to test the telescope in the field and, if needed, return it without penalty.

I hope this note prevents bewilderment that could be caused from a comparison between a recently bought Konusmotor and my review. I also hope that Konus' modifications are temporary and my review will again be accurate.

Capitol Skies
2810 Mason Street
Madison, WI 53705

First Class

MAS would like to thank:

Tim Stanton and IMAGES UNLIMITED
for printing the newsletter
and IDC
for hosting our web presence

This resource list is made up of people who have special interests which they are willing, even eager, to share with others in the Society. Many members, not listed, also are interested in particular aspects of astronomy and have considerable expertise in viewing and imaging the skies. Members are encouraged to come to the monthly meetings, not only to get to know the other members, but to discuss and enjoy their special or general interests in various aspects of astronomy. This is a Society of beginners and experienced amateurs. From time to time we have seasoned professionals attending. The meetings are a good time to meet these people as well. See you there.

Resource People and Special Interests

- Newsletter Editor: open to appointment
- LX200 Observatory: Dick Greiner 233-6882 (ragreiner@mailbag.com)
- Photo Editor: Tim Ellestad 233-3305 (ellestad@mailbag.com)
- Webmaster: Dan Strome 241-3775 (dan.strome@mpcug.com)
- Variable Stars: Dave Weier 241-1444 (daveweier@att.net)
- CCD Imaging: Dick Greiner 233-6882 (ragreiner@mailbag.com)
- Jupiter Observations: Wynn Wacker 274-1829 (wkw@mailbag.com)
- Deep Sky Observing: Tom Brissette 833-4225 (tom.brissette@midplains.net)
- Minor Planet Search: Greg Sellek 848-6301 (orion98@charter.net)

MAS Membership Form

Name: _____

Address: _____

City/State/Zip: _____

Phone: _____

Email: _____

Please circle membership type: *Enclose check and make payable to the Madison Astronomical Society. Mail to MAS Attention: Mary Ellestad, 2810 Mason Street Madison, WI 53705*

Student ($5.00)
Regular ($25.00)
Observing ($60.00)