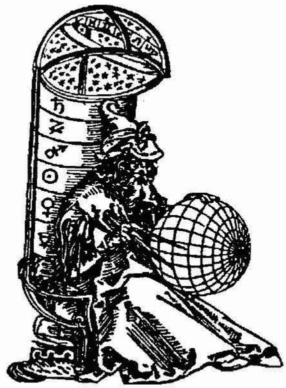
H. A. D. News

The Newsletter of the Historical Astronomy
Division of the American Astronomical Society



Number 47 February 1999

Kristy Kaiser, Manson, Iowa (original charcoal)

Biennial History of Astronomy Workshop, To Be Co-sponsored by the HAD

Steven Dick

The Fourth Biennial History of Astronomy Workshop will be held July 1-4, 1999 at the University of Notre Dame. The workshop is sponsored by Notre Dame's Graduate Program in History and Philosophy of Science, Notre Dame's Reilly Center for Science, Technology, and Values, the History of Astronomy Special Interest Group of the History of Science Society, and the Historical Astronomy Division of the American Astronomical Society.

Steven Dick and Michael Crowe are program co-chairs. Persons wishing to present work-in-progress papers, or poster papers, should submit a title and abstract of approximately 200 words to one of the program co-chairs by February 15, 1999, indicating preference for oral or poster presentation. Proposals will be accepted in a number of forms, but because the abstracts of papers accepted for the conference will appear on the conference website, we prefer electronic submissions. Write either Steven J. Dick, United States Naval Observatory, 3450 Massachusetts Avenue NW, Washington, DC 20392-5420, E-mail: dick@ariel.usno.navy.mil, tel. 202-762-0379; or Michael J. Crowe, Program of Liberal Studies, University of Notre Dame, Notre Dame, IN 46556, E-mail: Crowe.1@nd.edu, tel. 219-631-6212.

The local arrangements chair for the workshop is Matt Dowd, who can be reached at the Graduate Program in History and Philosophy of Science, University of Notre Dame, Notre Dame, IN 46556, or E-mail: Matthew.F.Dowd.11@nd.edu.

Persons wishing to register should contact: Astronomy, Center for Continuing Education, University of Notre Dame, Notre Dame, IN 46556, E-mail: cce.cce.1@nd.edu. The registration fee of $70 includes the cost of the banquet. Housing is available in new air-conditioned dormitories at $27 per night for a single, $21 per night for a double.

The conference will include a book exhibit and display tables. Participants are welcome to bring materials to display. Contact Matt Dowd with regard to how much space will be needed.

Regarding transportation, flights come to South Bend from a number of major cities. Persons arriving *via* Chicago can take the United Limo Bus, which runs from the United Terminal at O'Hare Airport directly to the Notre Dame campus. Round-trip fare is $52. For a schedule and reservations, call United Limo at (800) 833-5555. For those driving, ample parking is available. A campus map and parking information will be sent in the CCE information packet.

To supply periodically updated information and a downloadable registration form, Matt Dowd has prepared a webpage for the workshop. The URL is given below.
http://www.nd.edu/~histast4

The sixty-five historians of astronomy who attended the Third Biennial History of Astronomy Workshop, held at Notre Dame in June, 1997, praised the lively and informed sessions, the comfortable and informal atmosphere, and the reasonable room rates.

The HAD in Chicago: Monday at a Glance

Virginia Trimble

Monday morning invited session: Other Significant Anniversaries

Chris Corbally - Thomas Digges and Giordano Bruno: 400 years of Plurality of Worlds
Harry Lustig - Highlights from the First Century of the American Physical Society
Eugene Parker - Fifty years for the Galactic Magnetic Field
Don Osterbrock - The 50th Anniversary Meeting of the AAS

Monday afternoon contributed session: (All members are urged to contribute!)

A Centennial Celebration of the Life and Work of George Ellery Hale

Judith Karpen (SPD)

A special session of invited talks on George Ellery Hale (1868-1938) will be held on Tuesday, June 1, from 10:45 a. m. to 12:30 p. m. Hale played vital roles in the birth of the American Astronomical Society, in the establishment of astronomical research at the University of Chicago and elsewhere, and in the development of modern solar physics. Therefore it is particularly apt that we honor his accomplishments at this Centennial occasion, when the AAS is meeting jointly with the Historical Astronomy and Solar Physics Divisions.

Don Osterbrock will speak on Hale's early solar research at Chicago, Kenwood, Harvard, and Yerkes Observatories, before he departed for Mount Wilson in 1904. His telescopes, instruments, methods, and resulting papers will be described and illustrated by numerous slides. Growing up in Chicago, Hale was a precocious boy scientist, deeply interested in spectroscopy and solar astrophysics from an early age. As a teenager and young adult, Hale met several leading solar physicists of his day, including Charles A. Young, Jules Janssen, Samuel P. Langley, and Henry Rowland. He acquired his first telescope when he was 14, and for his MIT bachelor's thesis he invented and (at Harvard College Observatory, in 1892) demonstrated the first spectroheliograph. At his own Kenwood Observatory (located between the present site of the University of Chicago and the meeting hotel), he used his new spectroheliograph to perform pioneering studies of many key elements of solar activity, including prominences, spicules, plages, and the chromospheric network. Later, Hale designed Yerkes Observatory specifically for solar and stellar research and directed the solar investigations there himself.

The next phase of Hale's solar research--starting with Hale's arrival in Pasadena and his installation of the Snow horizontal telescope at Mount Wilson--will be reviewed and profusely illustrated by John W. Briggs. The Snow telescope began as an expedition from Yerkes Observatory funded personally by Hale, but the facility evolved quickly into the Mount Wilson Solar Observatory, which was funded by the Carnegie Institution from late 1904 on. Thereafter Hale continued to develop new instruments, from the 60- and 150-foot solar tower telescopes to the all-reflecting instrument at his remarkable solar laboratory in Pasadena. Perhaps the most beautiful of Hale's solar telescopes was, in fact, the most obscure--a small 'scope built into the new National Academy of Sciences facility in Washington, D. C., in 1924.

Our exploration of Hale's fundamental contributions to solar physics will be brought up to date and beyond by our final speaker. Eugene Parker will summarize the significance of Hale's discoveries in the context of our current understanding of the Sun, and will outline the technological and theoretical advances required to make progress on the remaining unsolved problems. Everyone is invited to attend this fascinating and inspiring session.

Remember Your Most Memorable Meeting!

Donald Osterbrock
AAS Centennial Committee Chair

At the AAS Centennial Meeting, to be held in Chicago next May 30- June 3, there will be a special AAS session on "My Most Memorable AAS Meeting," organized by the Society itself. All AAS members are invited to submit an abstract for such a "show and tell" paper, which they can give *in addition to* whatever regular scientific (or historical) paper they present at the meeting. Many members, no doubt, will give the paper on their first AAS meeting, and others perhaps will choose another meeting at which something important for them happened, like getting a job! This special session will include a poster session, on Tuesday June 1, and oral sessions on that afternoon and the next, Wednesday June 2.

All AAS members may submit abstracts, and from these abstracts a committee will choose approximately six or eight papers, covering a cross section of members from various fields, sections of the country, types of institution, *etc.*, for oral presentation. Everyone else who has submitted an abstract, but was not asked to present it orally, will instead be invited to present his or her paper as a poster. We hope to have a large number of papers, poster and oral, combining memories of many AAS meetings, from far back in the past right up to the most recent meeting in Austin this winter.

I hope that many members of the AAS who attend the Centennial meeting will give one of these "My Most Memorable Meeting" papers. Start thinking about it now, writing down your reminiscences, finding any old photographs, programs, or badges you might have from that meeting, the abstract of the paper you gave, *etc.*

And tell your friends about it too; we want to alert everyone in the AAS to this once-in-a-century type of session!

1998 HAD Treasurer's Report (Provisional)

Local Savings Account

Starting Balance[1] (1/5/98)	$25.33
Income	
Dividends	$0.60
Total Income	$0.60
Expenses	$0.00
Ending Balance (12/31/98)	$25.93

Local Share Draft Account

Starting Balance (1/5/98)	$308.19
Income	
Dividends	$11.89
Dues (paid directly to Treasurer)	$48.00
Transfer from AAS Treasury	$3,000.00
Total Income	$3,368.08
Expenses	
Printing, Postage, Supplies	$2,042.63
Artwork	$25.00
Doggett Prize	$500.00
Chair, Doggett Session Expenses	$98.27
Total Expenses	$2,665.90
Ending Balance (12/31/98)	$702.18

[1]per quarterly statement ending September 30, 1997

From the HAD Chair

"HAD Treasurer Visits West Coast, Gets Audited"

HAD Treasurer Thomas Hockey was in Southern California recently, and was very kindly invited to the home of Dave Pierce, Professor of Astronomy at El Camino Community College, ostensibly for lunch with Dave and E. Myles Standish of JPL. Lunch was served, and all reports indicate it was most hospitable and very welcome. From this point on, the story gets cloudy, but when Tom emerged from Dave's home, he found he had been audited! "Never," Tom breathlessly reported to outgoing Chair David DeVorkin, "has a HAD audit been so pleasant[!!]" Tom will report elsewhere on the state of the books. Here I only wish to record my indebtedness to two old friends and colleagues who have now been added to the long list of loyal HAD members who have donated their time as an audit committee.

David DeVorkin

From the HAD Secretary

About once per year, I give myself a "soapbox" in the *HAD News*. Elsewhere in this issue, I revive the "Class Notes"--brief historical tidbits for possible classroom discussion.

Speed of delivery was important in sending out the recent HAD election ballot. To be certain every member received their ballot in time, we used First Class mail (more expensive than bulk mail). Thanks to all who (as I write) are casting their ballots using e-mail, FAX, or their own postage stamp. Your willingness to do so will result in considerable savings for the HAD treasury. (Election results will be available at the time of the next HAD business meeting, now scheduled for February 14, 1999.)

Contributors: The deadline for submission to *HAD News* #48 will be April 12, 1999.

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From the Prize Committee

The LeRoy Doggett Prize for Historical Astronomy was established in 1996 with a $10,000 donation to recognize good works and workers in the history of astronomy. Its goal is to act as a stimulus to the field generally, in the manner in which LeRoy Doggett did in his own life. Contributions can be in any amount, but will be recognized in distinct categories. Additional donations received by the AAS Office during the period May 1998 to December 1998 are listed below, with much appreciation. Those made in the name of a person or an organization have that name in parentheses.

500: Roy Garstang
250: Tom Williams
200: Ruth Freitag
150: David DeVorkin
100: Diana Alexander; Dorrit Hoffleit; Irving Lindenblad (in honor of Jane Ozenberger); Curtis Wilson; Frank and Margaret Edmondson (in memory of Sam Westfall); Marie Lukac; Elizabeth Roemer (in memory of Charles Worley); Virginia Trimble; Joe Tenn 50: Ed Krupp (in memory of George Abell); Roy Laubscher (in memory of Sidney W. McCuskey); Don Yeomans 25: Alan Harris; Steve Maran; Bella Chiu

David DeVorkin

Book Review

Dorrit Hoffleit
Yale University

The Heavens on Fire: The Great Leonid Meteor Storms, Mark Littmann. (Cambridge University Press, Cambridge, England, 1998.) x + 349 pp. ($39.95 hardback.)

Denison Olmsted (1791-1859) of Yale, then age 42, was fortunate to observe the Leonid meteor shower of November 1833. He promptly reported his observations to the *New Haven Daily Herald*, and expressed his hope that other observers would report their observations to him. The response was overwhelming. He described the experience as the defining moment of his career (Littmann p. 3). It was an event that stimulated scientific investigations of shooting stars in America. Now, in anticipation of the 1998-2000 return of the Leonids, Mark Littmann, both scholarly and entertainingly, traces the history of the earliest observations and interpretations of meteor showers.

The title of the book, *Heavens on Fire*, stems from the term *fireball*. Peter Millman, the president of the Meteoritical Society in 1963, gave a paper on "Terminology in Meteoric Astronomy" in which he gave the accepted definition of fireball as "a bright meteor with luminosity which equals or exceeds that of the brightest planets." Merriam-Webster's latest *Delux Dictionary* (10th edn. 1998) gives several definitions of the term fireball:

1: A ball of fire; also: something resembling such a ball <the primeval fireball associated with the beginning of the universe - *Scientific American*>
2: a brilliant meteor that may trail bright sparks
3: the highly luminous cloud of vapor and dust created by a nuclear explosion
4: a highly energetic person

Van Nostrand's *Scientific Encyclopedia* (1938) defines a fireball as "a term used in astronomy to designate those meteors which are large enough to be apparently brighter than the planet Jupiter. They frequently leave a trail which may be visible for several minutes. Not infrequently a distinct sound is heard either during, or shortly after, the observation of a fireball."

Littmann's text does not cover all of the Merriam-Webster definitions, nor does it limit itself to Van Nostrand's. In a Glossary Littmann defines fireball as "A very bright meteor that rivals or exceeds Venus (the brightest planet) in brightness. The magnitude is variously defined as -5 or -4." With specific reference to the Leonids, his text does not restrict itself to the brightest meteors that qualify for the usual conception of fireball. The greatest value of the text is the history of the association of meteor showers (or the more spectacular meteor storms) to specific comets, especially of the Leonids to Comet Temple-Tuttle, but also the October Orionids and the May eta Aquarids to Comet Halley, the Perseids to Comet Swift-Tuttle, and others.

Olmsted strained in vain to hear some sounds from the bright meteors of 1833. A few of the meteors were even about as bright as the Full Moon, yet there were no audible effects; the meteors were probably too far away. Striking the Earth's atmosphere with the fastest relative velocity of any known showers, the Leonids would have burned up at an average altitude higher than that of the other known showers. Importantly, Olmsted did notice that nearly all the meteors appeared to radiate from a small area in the constellation Leo, and he is credited as the first to interpret this as meaning that the meteors were travelling in parallel paths. As the meteors reappeared several years in succession, he believed their period of revolution should be close to a year or half a year, a conclusion strongly refuted a generation later when his successor at Yale, H. A. Newton, in 1864 established the relation of the meteors to Comet Temple-Tuttle. While the shooting stars do occur several years in succession, they are not distributed throughout the comet's orbit, hence the many successive years when few if any Leonids are observed.

Italian Giovanni Schiaparelli (1835-1910) contributed much to the understanding of comet-meteor relationships. Having computed an orbit in 1867 for the meteors he named Perseids, he found that it agreed with Oppolzer's orbit for comet 1862III (Swift-Tuttle). He then assumed that Comet 1862III was one of the Perseids, mistakenly concluding that the meteors were the building blocks from which comets were derived, rather than that they are the debris of the comets. Elementary astronomy students are taught mainly the successes in discoveries and their interpretations; Littmann gives us the backgrounds of early theories and how they became rectified. Apparently logical first impressions may not always be correct. For example, Littmann gives us the sad story of the devoted British amateur, W. F. Denning, and his mistaken belief in stationary radiants for all meteors.

Historians have traced the Leonids back to AD 902. Corresponding to 33 passages of the comet from 902 through 1966, meteor displays were recorded at 25 returns. Records of meteors are lacking for approximate years 1065, 1133, 1166, 1266, 1300, 1333, 1433, and 1732. At meteor storms (as contrasted with showers), upwards of 1,000 meteors per hour are observed. Of the 25 Leonid displays for which observations were recorded, 17 have been described as storms. Of course, at some localities, storms occur; whereas from other localities of the same Leonid returns, only minor showers, or even no meteors, may be seen. It is not always easy to predict from which locality on Earth the maximum displays are the most likely to occur.

In view of the swift speed of a meteor across the sky, the early application of photography to meteors did not seem too promising. Nevertheless, Ladislaus Weinek at Prague was the first to plan to capture meteor trails by photography from two stations 75 miles apart, during the Andromedid shower on November 27, 1885, hoping thereby to get good determinations of their heights. He succeed ed in photographing one meteor from Prague but none from the second station. This is the first known photograph of a meteor trail. The second (not mentioned in this text) is a Harvard photograph taken during an expedition to Colorado for finding an observing site better than Cambridge, Massachusetts. That trail, obtained on September 12, 1887, at Colorado Springs, is of a sporadic meteor captured by pure chance on a plate exposed for other purposes (Hoffleit 1941). Systematic stellar photography at Harvard began in 1882, but the first plates exposed expressly for meteor photography started in anticipation of the Leonids between 1897 and 1901, when 44 Leonid trails were photographed, 34 of them on November 14, 1898. The visual results for 1898 were so rewarding that expectations were high for 1899; but that year very few Leonids were observed and none photographed. A disappointed public did not watch in 1900 and then missed displays in 1901, when eight photographic trails were obtained at Harvard (Fisher and Olmsted 1931).

Meanwhile Lewis Elkin (1855-1913) at Yale experimented with the photography of meteors through a rapidly rotating shutter that broke the trails into segments of equal duration. By photographing simultaneously from two stations he hoped to get, not only the heights of the meteors, but also their velocities. Unfortunately his stations (only a few miles apart) were too close together for height determinations; hence he could get only angular velocities, not true speeds through the atmosphere. But his technique was much later (1936) successfully applied by Harvard's Fred Whipple--the man famous for his "dirty snowball" theory for the composition of comets. With stations separated by over 20 miles, Whipple could get reliable determinations of heights and velocities.

Observing the spectra of meteors was, of course, much more difficult. Sir John Herschel (1792-1871) in 1864 was examining stellar spectra visually when he was unexpectedly rewarded by being the first to observe the spectrum of a meteor. Later one of his sons, Alexander S. Herschel (1836-1907), devised a spectroscope especially for observing meteors. With his instrument maker, John Browning, he observed 17 Perseid spectra in August 1866, and kept observing during meteor showers for the next 20 years, observing some 350 meteor spectra.

But for more precise results on identifying the elements represented, one had to await celestial photography. When in 1885 Harvard started taking objective prism plates for the Henry Draper Memorial (for classifying the spectra of stars to about 10th magnitude), a few plates also happened to show the spectra of meteors. The first was captured on June 18, 1897, and the second on May 18, 1909, both sporadic, taken at the southern station in Arequipa, Peru. Before 1929 a total of eight meteor spectra had been photographed: at Harvard (2), Moscow (3), Mount Wilson (2), and Bergedorf (1). Peter M. Millman (1906-1990), then a graduate student at Harvard, began his pioneering thesis work on the spectra of meteors, initiating special programs for obtaining more spectra. His first success was the 9th photographic spectrum of a meteor, on December 15, 1931. Analyses of the nine known spectra were the basis for his Ph.D. thesis in 1932. (Littmann says only eight spectra were known by 1932; actually the first eight were known by September 1924, and Millman acquired the ninth in 1931.) Millman continued his investigations after going to the David Dunlap Observatory, where he analyzed 14 more spectra. He concluded that the Leonids, for which he had acquired eight spectra, are mainly stony meteoroids (Millman 1932, and 1935).

The treatise, *The Heavens on Fire*, also tells about the advent of radar and radio astronomy in the field of meteoritics. As early as 1929, Japan's Hantaro Nagaoka noted that radio fluctuations from the ionosphere could be attributed to meteors; and in 1931 Albert M. Skellett and colleagues at Bell Laboratories found that some radio fluctuations corresponded exactly to simultaneously observed visual meteors. Then J. Stanley Hey and Gordon Stewart found that, during V2 attacks on Britain during WWII, there occurred ionic radio signals that were unrelated to the war but again depended on meteors. They continued their observations and were the first to discover a daytime meteor shower (Arietids), June 6-13, 1945. The Draconids, associated with Comet Giacobinid-Zinner, were discovered by radar in 1946 and were the first whose velocities (14.2 miles a second) were determined from radar measurements. When the 250-foot radio telescope at Jodrell Bank was being erected in the 1950s, Bernard Lovell's first intention was to apply it to meteor astronomy. For years meteor experts had been pondering whether or not sporadic meteors could have arrived from outer space, from beyond the bounds of the solar system. If so, their velocities would be so great that their orbits would be hyperbolas. Only after the application of radio astronomy could it be proved that meteors in hyperbolic orbits were very rare, if indeed any at all had ever actually been observed.

We might mention that in addition to the astronomers cited specifically for radar astronomy, Peter Millman, noted mainly for his work on meteor spectra, was highly influential in advancing radar techniques for meteor observations in Canada. His bibliography (Halliday 1991) includes 19 articles on radar meteor observations. The first two articles, by Millman and D. W. R. McKinley, were published in 1948, giving results of observations instituted in 1947 for seeking intercorrelations between visual, photographic, and radar observations. In 1947 alone they acquired 45 photographs, both direct and spectroscopic, 1850 visual plots of meteors, and over 100,000 meteor radar echoes!

Largely because of the sub-title, *The Great Leonid Storms,* I have concentrated on the discussions of meteor showers. But the book contains additional fascinating history of all the related types of meteoritic bodies from micrometeorites to the huge masses that have caused large craters. Ernst Chladni (1756-1827), a musician and magician, by 1794 had strong convictions that meteorites did not originate in the Earth's atmosphere, but were heavenly bodies entering the atmosphere. One that was seen to fall in Siberia weighed 1,600 pounds. Chladni considered such bodies the largest, and ordinary meteors as the smallest of the fireballs. He was presumably the first to realize that all were of a kind, differing only in size or mass. For his ideas he got little sympathy until after the fall of the L'Agile meteorites in France in 1803. In 1908 a fireball as bright as the Full Moon was observed in flight. It crashed in a forest at Tunguska, in Siberia, causing an explosion that felled trees radially outward from the impact point for miles around--fortunately in a sparsely populated area. And in America a mining engineer, D. M. Barringer, struggled to convince scientists that his Crater in Arizona was not an extinct volcanic crater but had been gouged by a massive meteorite, fragments of which were sprayed for miles around the crater. Some 150 large fossil meteorite craters have now been discovered (p. 222). But these striking discoveries have in recent years been declared as small in comparison with a presumed asteroid that must have hit the Earth some 65 million years ago, extinguishing in particular the large dinosaurs whose fossil bones are now museum attractions. So, from microscopic meteoritic dust to massive asteroids, it has been estimated that the Earth has been adding an average of some 500 tons of meteoritic material to its bulk every day (p. 225). Yet over a span of four and a half billion years this accumulation amounts to less than one percent of the present mass of the Earth!

Edmond Halley (1656-1742) had been aware of the possibility that a comet might strike the Earth, and pondered on how disastrous the result might be. In 1694 he read a paper at the Philosophical Society of London speculating that such an event might account for the formation of the Caspian sea and even the biblical flood. Fearing opposition by the church, he did not publish the paper until 1724. His conclusions were subsequently disproved (p. 222). However, I wonder if Halley's speculations may not have inspired geologist David Moreau Barringer, Jr. in 1956 to write his own, differing, speculations in a novel, *And the Waters Prevailed* (not cited by Littmann). The elder Barringer having struggled to prove that the Barringer Crater in Arizona was of meteoritic origin, the younger Barringer hypothesized that what is now the Mediterranean Sea was once a deep green valley, at the western extremity of which there was high land bridging Spain and North Africa. He postulated that a giant meteorite (like the one that created Meteor Crater in Arizona) struck that part of land, creating the Strait of Gibraltar, thereby causing the Atlantic Ocean to spill over to form the Meditteréanian Sea. (It was delightful thought provoking fiction, which went through three printings.)

In his Chapter 14, "Killer comets and dis-asteroids," Littmann discusses modern concerns and expectations related to the close approaches, and possible impacts, of comets or asteroids on the Earth. What measures must be taken to prevent a major catastrophy? On the other hand, can such a body be kept at a safe distance and utilized for a future space station, and especially for mining its metals, which are now scarce but needed on Earth? Lovers of detective stories should enjoy reading this chapter.

A unique innovative feature in *The Heavens on Fire* is the profuse insertions of lengthy direct quotations, inserted on grey (not white) areas, relevant to, but separating them from, the continuous main text. This seems a preferable way for including important lengthy quotations over the ordinary usage of fine-point foot notes. These precious quotations cover the equivalent of about 38% of all the pages of the text.

Of especial value to any historian of meteoritics is Littmann's Bibliography of some 425 articles. It is hard to believe that any more could have been added! Some that he seems to have missed are, however, included in the references he does cite. For example, Hughes' 1982 paper, "The History of Meteors and Meteor Showers" (cited by Littmann), has 80 references of which only 34 are common to Littmann's bibliography. I made a check of the bibliography given in an article, "Meteors," by Millman and McKinley (1963, not cited by Littmann). Of the 296 references in that paper, just 15 are common to Littmann's bibliography, but many of the others cover too technical or mathematical articles for proper inclusion in a descriptive historical treatise. The literature on meteors and their relation to comets is indeed very extensive. Littmann's selections are more than sufficient for most prospective readers of this book.

The Heavens on Fire should fascinate both professional astronomers of the Solar System and casual amateurs, especially those who enjoyed observing meteors and therefore became interested in finding out what meteors are all about. The final chapter summarizes current conceptions of the life of a meteoroid from an icy birth place in what is called the Oort Cloud, surrounding the outskirts of the solar system, to its collision with our atmosphere, ending in a fiery death, reduced, in most cases, to mere evanescent vapors. The book is well illustrated by some 100 black-and-white photographs and diagrams.

The penultimate chapter advises us about observing the Leonid meteors in November 1998-2000. The predictions, though not guaranteed, appear favorable. Now that the 1998 season for the Leonids has passed, let us ponder on the success or otherwise of the predictions for November 17-18, 1998, and then look forward to November of 1999 and 2000. Littmann gives a table summarizing predictions by seven different authors for the best observing sites. For 1998 only one author predicted best displays in Eastern North America; the others ranged from Eastern Europe through Asia, Japan and the Western Pacific, most preferring Asia. To date, the best reports of meteor storms came from the Canary Islands, approximately 2,000 meteors pér hour, in contrast to only an average of about 20 an hour as observed by each of two members of the amateur New Haven Astronomical Society. (As yet no reports from Asiatic locations have been received.) Brian Marsden summarized a general maximum zenithal hourly rate of perhaps 500, adding, "Although impressive, the display was a far cry from the Leonid storms of 1799, 1833 and 1966."

As for the expected 1999 display, predictions as to the best observing sites, dependent on how close the Earth comes to the comet, range from the Eastern USA to Europe, North Africa, Russia, and China. One author even goes so far as to predict a peak of 100,000 meteors an hour to occur over the Northern Pacific Ocean. (Hope for this, but don't count on it!) For the Year 2000 the predicted best sites vary from Western Europe, to Eastern and Central America, the Pacific Ocean, and Central Asia. However, the Moon will interfere with good observations.

Alas, not only the actual occurrences of meteor showers but also prevalent weather conditions at the various best-predicted sites must be taken into consideration. Few places in the States have cloud coverage in November under about 50%. At this time of year, clear skies occur on the average less than 30% of the time in most of Canada, New England, and Washington-Oregon. It is recommended that observers go South. Weatherwise the most favorable locations in the United States are in New Mexico and Arizona. However, one expert cautions (p. 296), "Still, the only thing certain is that the Leonid meteors are full of surprises." Leonids have been described as "the world's safest fireworks display." Do not let adverse predictions deter you from looking for them: In science negative results are as important as the hoped- for positive. And remember the failure in 1899 that discouraged observers in 1900 and prevented their seeing the recurrence in 1901.

December 9, 1998.

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Class Notes

Thomas Hockey

Much has been made of the discovery of the Galilean Satellites, and how their motion supported the heliocentric theory. Bodies revolving about an object other than the Earth pointed toward Copernicanism. The Galileans clearly *revolved* about Jupiter. But what of planetary *rotation* itself?

The idea that a planet like Jupiter rotated seemed likely to good Copernicans but was not assumed. The suspicion that it did was based only on an analogy: Johannes Kepler had said that because the planets revolve around the Sun, the Sun should rotate. Kepler's pre-Newtonian theory of planetary motion held that some sort of magnetic-like eminence from the Sun propelled the planets. Thus, the Sun could be likened to a rotating hub pulling the planets transversely. The Sun's rotation was later observationally confirmed, and so planetary observers, who liked to identify the jovian system and its moons as a scale model of the Solar System, also believed that Jupiter should rotate because its satellites orbit it.

The first celestial planet acknowledged to rotate on its axis was, in fact, Jupiter. This discovery was made by Italian instrument-maker Giuseppe Campani and astronomer Giovanni Cassini. In the *Philosophical Transactions of the Royal Society* (1665) we read that Campani ". . . observed by the goodness of his Glasses, certain protuberancies and inequalities, much greater than those that have been seen therein hitherto . . ." Campani and Cassini studied these irregularities to see if they would move, and so betray the fact that Jupiter rotates. Eventually, Cassini used jovian features to measure the planet's rotation period.

Ironically, Cassini himself was a conservative when it came to the structure of the Solar System. (He resisted Keplerian ellipses.) Cassini favored a model that in many ways resembled the Earth-centered one of Tycho Brahe.

Now that there were at least two rotating bodies in the Solar System--and all had satellites (or, in the case of the Sun, planets)--it was hoped that Saturn with *its* recently spotted satellite (Titan, by Christian Huygens in 1655) also would be shown to rotate. This inductive approach succeeded, and eventually it was supposed that all planets, regardless of the presence of satellites, were rotating. Again, from the *Philosophical Transactions* (1666):

> This observation ought to excite all curious persons to endeavor the perfecting of optick glasses, to the end that it may be discovered, whether the other Planets, as Mars, Venus, and Mercury, about whom no Moon hath as yet turn about their axes, and in how much time they do so; especially Mars, in whom some Spot is discover'd . . .

Correspondence

For those of you who plan to attend the Biennial History of Astronomy Workshop (see above), I [T. H.] have pulled out Ruth Freitag's description of the Hesburgh Library at Notre Dame:

"The staff there were nice enough to pull three items from the cataloging stream so that I could look at them. (Of course there were plenty of things already on the shelves!) The ND library is truly magnificent and a pleasure to use--especially in the summer; I can imagine it would be somewhat crowded during the regular school year. The campus is busy during the summer, of course, but I believe a lot of folks are in programs that don't require much library work." (July 23, 1997)

Ruth is, of course, well-known to HAD members. It is she who combs libraries, periodicals, and indexing services to produce the valuable Bibliography that appears at the end of most *HAD News*. See you in South Bend!

New Members

W. Patrick McCray is a Research Associate in the program on Culture, Science, Technology, and Society at the University of Arizona. He writes that his research on the Steward Mirror Lab, and the development of plans to build a new, national very large telescope (1975-1993), is coming along well. He plans to present some conclusions at an upcoming HAD session.

Members in the News

Incoming HAD Chair, Virginia Trimble, writes the cover story for February's *Sky and Telescope* ("Cosmic Discoveries: the Year in Review"). Don Olson's work on historical tides was featured in the *Chicago Tribune.*

Upcoming Meetings

Konkoly Observatory Centennial

Peter Hingley (RAS)

The Konkoly Observatory, Budapest, Hungary, plans to celebrate the centenary of its foundation (actually the gift to the Hungarian state by its founder, Miklos Konkoly Thege, of his private observatory and collections) with a conference at the resort of Tihany, entitled "One Hundred Years of Observational Astronomy and Astrophysics." The dates are 1999 August 13-15 and will follow on from an IAU Colloquium planned to coincide with the Total Eclipse of 1999 August 11.

This will feature papers on aspects of astronomy and astrophysics in the years 1870-1920 and, as I understand it, will emphasize the scientific content of the work described rather than just the anecdotal history. Especially featured will be international collaboration and the great co-operative programs started at that time.

The SOC comprises Dr. C. Sterken (Belgium) and Dr. J. Hearnshaw (New Zealand); the LOC comprises Magda Vargha, Laszlo Szabados and Endre Zsoldos. The list of speakers at present includes 14 names of very high repute internationally.

There is a Web site with much more detail at

http://www.vub.ac.be/STER/KONKOLY/tihany.html

This includes registration forms.

I would strongly advise you to get your registration form in quickly, if interested, as the number of places appears to be very limited, unfortunately.

IAU Colloquium 178

"Polar Motion: Historical and Scientific Problems"
September 27-30, 1999
Cagliari, Sardinia, Italy
Contact Address: Local Organizing Committee, IAU Colloquium 178, Stazione Astronomica, Loc. Poggio dei Pini, Str. 54, 09012 Capoterra (Cagliari), Italy
Tel: ++39-070-725246
Fax: ++39-070-725425
e-mail: iauco178@ca.astro.it
URL: http://www.ca.astro.it/iau178/

[New listings for this column are solicited. - T. H.]

Recent Discussion "Threads" on the History of Astronomy Discussion Group (HASTRO-L)

- Nicholas Copernicus
- Coligny Calendar
- Moondials
- "Up" Convention for North
- Texts for Survey Courses
- Meteor Showers in Myths and Legends
- Sun as a Star
- Uranus' Symbol
- Internet Transmission from Maes Howe
- Fastest Camera in the World
- Pliny--Astronomer or Historian?
- Division of the Day and Night
- When Did "c" become the Speed of Light?
- Need for a Biographical Encyclopedia
- Names of Astronomers (Miswritten)
- Stolen Copernicus
- Hipparchus and Supernovae
- MR-4 Mission
- A 16th Century Sundial
- The Analema
- Constellation of the "Frying Pan"?
- When the Millenium Starts
- *Figures du Ciel*
- Maria Cunitz (1610-1664)
- Foucault's Pendulum
- Twelvth-century Irish Dates
- Afrikaner Astronomy
- The Origin of "Uraniborg"

HASTRO-L is provided by Stephen McCluskey at the University of West Virginia. Subscribe by send the following e-mail message:

SUB HASTRO-L [your name]

to:

listserv@wvnvm.wvnet.edu

Web Page of the Winter

The editor does not routinely post job listings. However, the following page does advertise two postdoctoral fellowships!

Center for History of Recent Science
George Washington University

http://www.gwu.edu/~recsci/

From the Lucubratory

Woody Sullivan

Oxford University Press has just publishd a marvellous book, which I unreservedly recommend for each and every HADite's shelf, especially if you teach any aspects of astronomy before 1600. It is *The History and Practice of Ancient Astronomy* by Jim Evans, a physicist and historian of science at the University of Puget Sound in Tacoma, Washington. I'll admit that Jim is a good friend of mine, but if this causes you to suspect my high regard for this book, then all I ask is that you check it out for yourself and see how quickly you'll be willing to plunk down $65.

It is a beautifully designed book, comprising 475 8-by-11 inch pages with clearly drawn illustrations and attractively wide margins in which folks like me can nicely scribble. (Oops, I meant "annotate.")

Based on twenty years of teaching his students not just ideas, but the actual nitty-gritty of historic models, Jim has masterfully explicated a tremendous range of historical astronomy, stretching from the Babylonians to Kepler. The focus is on the Greeks and Ptolemy, but much else is also covered. In each case he explains the astronomy in a modern sense and then carefully shows what the ancient astronomers actually *did*. Relying on tables and graphical methods more than geometry and trigonometry, he gives examples and provides exercises that allow the reader to enter worlds of the past. In addition, patterns and instructions are given so that one can construct and use cardboard versions of an astrolabe and of Ptolemaic slats.

History and Practice will become your primary source when you find yourself asking questions such as:

- What did the Babylonian sexagesimal number system actually *look* like, and how was the arithmetic done on a cuneiform tablet?

- How does one work out the number of Egyptian years and days between (a) Epiphi 18 in the 83rd year after Alexander's death, and (b) Athyr 21, in the first year of Antoninus?

- What exactly was the theory of *trepidation* put forth by 9th c. Arabic astronomers in order to explain a precession rate that apparently varied over the centuries?

- Using an astrolabe, how does one figure out where on the horizon Rigel rises?

- Using Ptolemy's theory, how does one work out the ecliptic longitude of the Sun (or Mars) on 4 November 1973?

- How is it that the empty focus of a Keplerian ellipse is equivalent to the equant point of Ptolemy's model?

Rarely does one see such a combination of usefulness, elegance, accuracy, and scholarship . . . OK, I'll stop.

[Woody Sullivan invites comment at e-mail: woody@astro.washing ton.edu - T. H.]

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Layout by John Alexander