H. A. D. News

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

Number 45 August 1998

A Season of Anniversaries: the HAD Meets in San Diego

Thomas Hockey (UNI)

Special Palomar Observatory Session

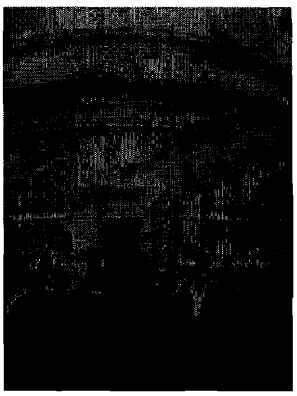
[all digital images this issue by Dick Walker]

June 7, 1998: Three bus-loads climbed the slope of Mount Palomar. At the top, the pilgrims on board walked into the clouds, the white dome enclosing the Hale 200-inch materializing as an apparition out of the fog. Once inside, we sat at tables and chairs dwarfed by the distinguished reflector above--much as had the crowd assembled to dedicate the instrument fifty years before.

Invited to the gallery for a demonstration of the telescope's motion, we watched it rotate before us. Wait in moment. *We* were the ones rotating. The immense facility disguised the relative motion.

When my elementary-school teacher taught me about telescopes, this was the World's Largest. It still *looked* like one. The Hale was built when domes resembled classic architecture, not machine sheds . . .

Our host was Bob Brucato, Associate Director of the Observatory. Wallace Sargent, Director, officially welcomed us to Palomar. Around us, television monitors showed recently discovered film footage of the construction. Because the dome was unseasonably cold, the gift shop did a steady business in PO sweatshirts!



The first invited speaker was Karl Hufbauer [UC Irvine], who challenged the popular idea that twentieth-century astronomy has been driven exclusively by increasing telescope aperture. New theory was likewise responsible--much of which also germinated in California institutions.

Donald Osterbrock [Lick] told the story of the 200-inch project itself. George Hale founded CIT in 1920. He had gone to California originally to establish the Mount Wilson

Observatory, but ill-health required him to retire. Once Hale recovered, he began to pitch the idea for his fourth grand telescope to the Rockefeller Foundation. One could not place a Rockefeller enterprise on a "Carnegie" mountain (Mount Wilson); Palomar was chosen instead. Planned in the 1930s, the telescope was not completed until 1948 due to the delay of World War II. Throughout his talk, Osterbrock could illustrate design decisions by pointing to the great instrument itself.

Lastly, S. G. Djorgovski [CIT] asked us to look ahead to the role of "small" telescopes (such as the Hale!) in the era of 8-10 meter reflectors. He spoke of a bright future in which Hale- class instruments provide support data for their larger-aperture counterparts, and undertake major projects and surveys that require more time than can be allocated on Keck-class 'scopes. (Also mentioned were "risky" or time-critical projects that cannot be scheduled on a Keck.) Djorgovski further listed support observations for space missions, technology testing, and the training of a new generation of astronomers. (That final comment stayed with me as we returned to the city; it caused me to recall my professional training--on a 24-inch!)

Thanks go to David DeVorkin [HAD] and the Palomar staff for arranging a most unusual and physically impressive AAS session.

New Telescopes and New Tools

The HAD also held sessions at the Town and Country Resort in San Diego. Kate Bracher chaired the monday-morning HAD II. A pair of papers led off the session, both on the history of astronomical computing.

K. H. Olsen [GCSI] spoke on "Beginning Computer Modeling for the Structure and Evolution of the Stars." At an institution that pointedly excluded experimental work, John von Neumann convinced the IAS to build the first stored-memory computer in the 1940s. Astrophysicists did not at first use this machine regularly (nor those of similar architecture) for other than orbital computations. It was Martin Schwarzschild who initially applied them to the evolution of post-MS stars.

J. P. Mutschlecner [LANL] continued the narrative with the work of Marshal Wrubel. Wrubel fought what he considered astronomers' conservative reluctance to use computers. Interestingly, 1998 could be thought of as a fiftieth anniversary of astrophysical computing, as well.

Returning to the golden anniversary of the 200-inch, David DeVorkin [Smithsonian] inquired, "Where to Put it?" George Hale was able to turn Henry Russell's original enthusiasm for a southern hemispheric site into backing for Hale's plan to locate the observatory near California's existing astronomical institutions. Hale argued that the Northern Hemisphere was better mapped and deserved the next level of astronomical investigation. In doing so, Hale and Russell faced the bitter opposition of Harlow Shapley.

Donald Osterbrock concluded the session by describing a telescope manufactured with great spherical aberration! No, it was not the HST. It was the Lick Observatory 37-inch, to be stationed in Chile. After much finger pointing, the problem was corrected in time, before deployment. Using this telescope, William Campbell was able to prove to his astronomical colleagues that reflecting telescopes were both practical and feasible for astrophysical (spectroscopic) work. (The 37-inch was dedicated to radial- velocity measurements.) Ultimately, though, Campbell's attempt to secure instrument funding by establishing the success of smaller

telescopes, rather than laying out designs for elaborate bigger ones, failed. He never received the large-scale private donations for which George Hale was famous.

Astronomical Journal Sesquicentennial

In keeping with the theme of anniversaries, Woody Sullivan [Washington] and Paul Hodge [Washington] organized HAD III. It was a special monday-afternoon session on the occasion of the *Astronomical Journal*'s 150th.

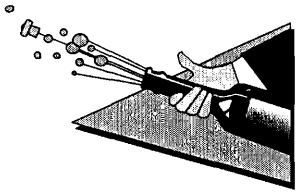
Marc Rothenberg [Smithsonian] began by establishing the state of domestic astronomy in the mid-nineteenth century: Fifty men and one woman could be considered American astronomers *circa* 1849. (These included Sears Walker, William and George Bond, and Benjamin Pierce.) There were twelve observatories in the United States, at least two world-class. This made the US second (in number) to the combined German states! Descriptive astronomy was a popular course at American colleges (as it is today); indeed, it often was a requirement . . .

The *Astronomical Journal* was founded by Benjamin Gould, specifically to increase astronomical knowledge--and not for the *diffusion* of such knowledge. It was part of his plan to professionalize American astronomy. Owen Gingerich [Harvard] described Gould as an ambitious Göttingen-trained astronomer. (Gould was a student of Gauss.) Yet there was no job at home for the United States' first astronomy PhD. Moreover, when a position was created for him by the establishment of the public observatory in Albany, Gould ultimately was driven out of town!

Gould invented his own niche in astronomy by launching the *Journal* (modeled after the *Astronomiche Nachrichten*). The *AJ*, under his editorship, went on to survive frequent financial distress, the Civil War, and Gould's long absence at the Argentine National Observatory.

By the mid-twentieth century, the *Astronomical Journal* had been acquired by the AAS. Dorrit Hoffleit [Yale] and Kate Bracher [Whitman] provided us with the scientometric history of this period, *via* the *Journal*'s bibliography. "Hot off the press" copies of the latest *AJ* issue were a fitting finale as we exited the room.

[This article was written in nearly real-time, at the AAS Meeting in San Diego. Any errors are mine and may be blamed on caffeine deprivation. - T. H.]



Your Chance to Shine at the Centenary

David DeVorkin (Smithsonian)
Virginia Trimble (Maryland and California-Irvine)

The June 1999 Centenary meeting of the AAS will include a number of historical events, both for the Society as a whole and for HAD members especially. Society-wide events include two plenary talks on the past and future of the AAS and a session of contributed talks and papers where your participation is encouraged.

Special HAD events include:

(1) A Special Visit to Yerkes Observatory Just for Us

Saturday, May 29: HAD tour to Yerkes. We expect to board busses (we expect to order 3,

44-seat busses, but this might change) about 1 p. m. for Yerkes. Once at the Observatory, everyone will receive a map for self-guided tours. Yerkes staff will be stationed at various locations as docents (the telescopes, historical artifacts, the Morgan Room, *etc.*). This will allow everyone to enjoy the place without crowding and to move at a comfortable pace to learn the story of what Yerkes is doing these days, and a bit about its history and lore. There might be a short presentation or two on the front steps of the observatory, weather permitting. Maybe a HAD member with a good wide-angle or good panoramic camera and tripod will be able to take a picture of the group! It would be great fun to place people as they were in the famous 1897 photo. *Who do you want to be?*

Plans are still developing for Yerkes, but this is the overall scheme. We'll have a catered evening dinner, inspect the telescopes and facilities, and then return in the mid-evening. Since it does not get dark enough for observing until late, we have been advised to forego observing in favor of getting back to the hotel at a decent hour to rest up for the sessions and celebrations on following days.

(2) A Half-day Special-topic Session

Sunday, May 30th: (either in the newly-renovated Adler Planetarium or at the headquarters Hilton Hotel) The sessions will not be in parallel with anything! They will depend upon themes suggested by members of the HAD. We expect to hold our usual two 90-minute sessions in the afternoon, and reserve the morning if demand requires it. This leaves plenty of room for other activities at the Adler, or the hotel, before registration opens.

(3) A day of Parallel Sessions

Monday, May 31: Contributed papers--oral and poster. Papers on historical topics unrelated to the centennial also will be appropriate here.

(4) Centennial Sessions

Tuesday, June 1: Sessions will be held on Centennial topics. These will be talks and posters where your participation will be encouraged by the Centennial Committee (to be discussed in a forthcoming *HAD News*).

Your jobs:

(a) Suggest a topic and some speakers for a special session. You will then have both the small amount of work and the small amount of glory involved in putting it together. Suggestions should reach the incoming Division Chair, Virginia Trimble, by 1 October (coordinates inside front cover of your AAS Directory). The Division Committee will select one (or two) of the proposals for Sunday afternoon and (perhaps) Monday morning.

(b) Send in the abstract of *your* contributed talk on time, and encourage your colleagues to do the same. Items related to the Centenary are especially encouraged, but all relevant contributions are welcome.

(c) Sign up for the Yerkes tour and hotel room early, when the AAS announces how to do it, since these may fill up rapidly.

Remember that you are allowed to speak both in an HAD session and in a regular technical AAS session (an exception to the "one bite per dog per meeting" rule of the Society).

There will be a great amount of history between Yerkes, Chicago, and the Adler. The Centennial book will be in your registration packets, and Sara Schechner Genuth's Centennial Exhibit will have its debut. No doubt there will also be informal rump sessions in the evenings. The HAD Committee will try to organize something for one of those nights.

From the HAD Chair

Virtual HAD Business Meeting, Austin, January 1999

As HAD members will recall, at the January 1998 Business Meeting we voted not to meet officially in January 1999 in Austin, mainly because of the Centennial Meetings in Chicago that June. There will still be an archaeoastronomy session in Austin this January [see this page], but no business meeting. However, the election of new officers takes place at the beginning of the 1999 calendar year, and is tied to the annual business meeting. The present Chair and Committee Members will be ending their terms, the Vice-Chair will assume the Chair, and a new Vice-Chair and two new Committee members will be installed.

The HAD Committee will, in the absence of an actual meeting, hold a virtual meeting during the Austin sessions. Under Article III, Section 2 of the By-Laws, the HAD Committee is empowered to make this decision, and Section 3 states that if less than 3 members are present at a meeting the Committee may act, as long as it is ratified by the entire committee by mail. We will therefore hold a virtual Business Meeting on January 5, 1999 (using some form of communication to be determined), where the gavel and "Ich Bin HAD" trappings of office will be transferred. The only item of business will be installation of new officers.

The results of the election will be communicated as quickly as possible to the HAD membership *via* the HAD Web Page.

Meanwhile, watch for the new slate. Every HAD member is encouraged to petition to add to this slate. According to the By-Laws, members may nominate names. They will be honored if the nominations are accompanied by a list of 10 percent (about 25) of the HAD membership. These petitions have to be in the secretary's hands within 30 days of the announcement of the slate.

David DeVorkin

News from the Archeoastronomy Committee

Hi all,

The time for the Session on Archaeoastronomy Techniques at the Austin Meeting of the American Astronomical Society has been set for Wed. 6 January 1999 from 10:00 to 11:30 a. m. There will also be a poster session, as well. I have received word from several of you who would like to present a paper, and I will be contacting you shortly for abstract information.

For those of you who may be thinking about a presentation or poster, please contact me ASAP. The session will deal with the actual data-collection techniques and data-reduction techniques used in archaeoastronomy research. This will be a "nuts and bolts" session.

[The abstract deadline for the January AAS Meeting is 21 October. The early registration deadline is 4 December. - T. H.]

David G. Iadevaia, Chair

From the HAD Secretary

The good news is that our new *News* format saves the HAD substantially on reproduction and mailing costs. The bad news is that it takes longer to produce--so I have not made good on my promise to speed up receipt. Part of the problem is that my University shuts down in latter May and August: just when we are trying to get the mailing out. Nonetheless, I will try again!

Comments on, or criticisms of, the new format are welcome.

Contributors: The submission deadline for issue #46 will be October 14, 1998.

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Fax: (319) 273-7124
I: hockey@uni.edu

P. S.: Last issue, if you had a red comet stamp on your mailing label, your dues were late. This time, if you have a red "big dipper" stamp, your dues are *really* late!

New Members

I'm the librarian (MLS University of Denver, 1980) and archivist (often assisted in this duty by my wonderful volunteer Martin Hecht) at Lowell Observatory. I've worked here for 8 years and in this time the archives are consuming more and more of my time.

Since 1990 we've been plugging away at processing the correspondence, working papers and manuscripts of Percival Lowell, V. M. Slipher, Carl Lampland, Roger Putnam and John Hall (to start with.) All of our processed collections have been indexed and entered into fully searchable databases. We hope to get these linked to the Lowell Library Homepage soon.

We also have made a start of re-enveloping our historic sky plates and have entered all the observational data from the envelopes into an Excel database linked to the Homepage. So far, the second Planet X survey (1911-1915) and the Invariable Plane surveys (1905-1915) have been completed. We have about 10,000 plates to go!

Finally, this summer we will be scanning all of the Observatory's historic photographs (including photos of Percival Lowell's Asian travels) and will link the scanned photos to a description of each, which also will be searchable from a link on the library's Homepage. These will be password protected and probably watermarked in some fashion.

Antoinette Beiser

Charles E. Worley: 1935-1998

R. L. Walker (USNO, Flagstaff Station)

I first met Charles in 1964. He growled at me; I growled back. His jaw dropped and we became close friends for a third of a century.

We worked in the *A&A* Division (a. k. a. Astrology and Alchemy), and served under three great directors: Steward Sharpless, Otto Franz and Victor Blanco, scientists and gentlemen to the core. Those were golden years in my life, and if the following tribute to Charles contains too many "I's," it's because I want to tell you a few personal anecdotes to illustrate why I loved him.

. . . . .

Charles Worley's feats of memory are legend. It pleased him no end that I expressed an interest in the art of visual double-star measurement. The 12-inch refractor was not used, and I was given permission to sign up for as much time as I wanted. I requested one year and showed up every clear night. Charles would always take a break about midnight and walk from the 26-inch to the 12-inch, which was then housed in the old 40-inch dome.

I could hear him coming up the stairs. His head would pop up from the trap door. He knew the time, and by glancing at the attitude of the telescope he would say, "Aha, you're measuring ADS 9904. Good pair." This amazed me, and it became a nightly ritual. He always knew the star I was working on.

I planned a practical joke. I had about three hundred binaries on my program. I located a double star not on that list about a half a degree from the one I would observe that night about the time of his visit. I can't remember the names of the two stars, but I know Charles would rattle them off if he were here. Let's call them ADS "A" and ADS "B."

Everything was set. When the door opened below I had the telescope pointed at my program star ADS "A." In the red light Charles' head floated above the floor. He looked at the telescope and said, "Ah you're measuring ADS "A."

With the aplomb of an arrogant fool I said, "How do you know it isn't ADS "B?" Instantly he said, "Because I saw your observing list two months ago and ADS "B" wasn't on it!"

. . . . .

Charles tore up my first papers. It broke my heart. He shredded them! Then, with infinite patience, he showed me how to rebuild them, and guided me with examples to construct a better publication. I still look back on those papers with pride. They were some of my best.

I loved Charles as much as any man can love a brother. I learned he too grew up in Iowa, about thirty miles from my home. It would have been wonderful to have met him as a kid. If I had, I could now boast that Charles and I traveled about the Sun in the same orbit for half a century.

Some day I'll get off this space ship and take a walk. Charles, I can't wait to see you again, but in the meantime don't trip over your halo.

[Charles Worley was a member of the HAD. This text was excerpted from a remembrance written to Dr. Worley's family. - T. H.]

Book Review

Dorrit Hoffleit, Yale University

Fire in the Sky: Comets and Meteors, the Decisive Centuries in British Art and Science, Roberta J. M. Olson and Jay M. Pasachoff. (Cambridge University Press, Cambridge, England, 1998). Pp. xiv + 369pp. + XXXII color plates. ($75 hardback).

"Fire in the Sky": Could this title be a misnomer? Can a "dirty snowball," as expert F. L. Whipple describes a comet, really be considered fire in the sky? Or the electronic ionized atmospheric trail of a fast flying small pebble, the meteor? But there are other meanings or connotations to the word fire: inspiration or brilliancy, and these do apply.

As a child, two of my main interests were fine arts and shooting stars. Hence I looked forward to reading this book, which combines those early interests. Nor was I disappointed! This book is at the crossroads of art (including cartooning), astronomy, literature (especially poetry), and history, with something to instruct and entertain specialists as well as laymen in each of these fields. One of the authors, Roberta Olson, a professor at Wheaton College, is a historian of art and author of numerous articles and the treatise, *Fire and Ice: a History of Comets in Art* (New York, 1985); her co-author, Jay Pasachoff, is an astronomy professor at Williams College and Director of its Hopkins Observatory. He has written numerous fascinating and profusely illustrated college text books on astronomy. The authors have done a tremendous amount of literature research, and their "selected bibliography" of some 600 titles (including a separate Appendix of 145 papers published in the *Philosophical Transactions of the Royal Society* between 1665 and 1840) adds to the value of their book as a reference source.

From fear and superstition about comets and meteors, to sarcasm revealed mainly in cartoons, to modern scientific enlightenment, the authors deal with all aspects of the observation and history of comets and meteors that appealed to artists. Comets have been portrayed in paintings illustrating literature, special attention being given Milton and Shakespeare, including numerous apt quotations. With the advent of photography, problems with aesthetics arose. For example, E. E. Barnard at Yerkes Observatory in 1895 found that while proof sheets were of excellent quality, the final printed copies were generally poor. Current reproductions of the earliest comet photographs additionally suffer from deterioration of the originals.

George Cruikshank (1792-1878) may generally be remembered as an illustrator of Charles Dickens' *Oliver Twist* and of Grimm's fairy tales. During his life-time he was mainly appreciated as caricaturist and satirist. Here he is represented by four examples: the cover page of a short-lived magazine *The Meteor* (1813), "Man in the Moon" (1820), and by two amusing cartoons ostensibly representing the comet of 1853. George was the son of cartoonist Isaac Cruikshank (1764-1810?) who is represented by one cartoon, "The Flying Bishop," showing the Bishop, on the back of the Devil, singeing his beard on a comet.

Two painters named Turner (unrelated) are featured, Joseph Mallord William Turner (1775-1851) and William Turner of Oxford (1789-1862). J. M. W. Turner is represented by two vignettes illustrating Milton's *Paradise Lost* and especially by a sad interpretation of the abdication of Napoleon at Fontainebleau. The tiny figure of Bonaparte is standing alone on a high platform in front of a tall building, while far below at a considerable distance a tremendous crowd is watching, and military on horseback are standing guard. Napoleon was a staunch believer that comets were omens of evil, so the artist included an evil-omen comet in the sky above the building. This is a very moving portrayal of the decline of a once powerful leader.

William Turner of Oxford painted beautiful landscapes, one of which, showing Donati's Comet of 1858, is pictured on the jacket of this

book. Donati's was the most spectacular comet of the 19th Century and was profusely represented in British art. Olson and Pasachoff reproduce ten examples, eight in color. Its period is estimated at about 2,000 years, and it has been suggested that this is the same comet as one observed by Seneca in 146 BC. Moreover, it is the first comet to have been photographed, on September 28, 1858, by George Bond at Harvard using the wet-plate collodion process. Bond gives British artist and photographer William Usherwood credit for having obtained a photograph of the comet a day earlier. Reproduction of the Harvard plate at this late date is no longer very clear; it shows a hazy nucleus but no tail, whereas Bond's comments on Usherwood's photograph indicate that it did show the tail. Donati's comet thus ushered in the era of comet photography, and with ever increasing perfection of techniques with the advent of dry-plate photography, artists showed decreasing interest in making direct paintings of comets. And very few cartoonists still found pleasure in satirizing these celestial events, especially as there was no longer incentive to ridicule them as evil omens.

When the return of Halley's comet in 1910 was being predicted, British as well as other astronomers were intent upon making improved predictions of the time of its perihelion passage. Also, concerns were expressed that hazards might result from the Earth's passing through the tail of the comet, as it had been revealed that the tail contained poisonous gases, hazards that were greatly exaggerated by the press. An atlas of photographs and drawings of the 1910 return of Halley's comet was prepared by B. Donn, J. Rahe, and J. C. Brandt in 1986. There it is stated that an earlier listing had indicated 1,580 photographs taken among 38 observatories. Many of these photographs were lost, and the atlas contains only some 1,000 photographs or drawings. Olson and Pasachoff comment, "Even though hundreds of photographs were taken of Halley's comet in 1910, when it came so close that the Earth went through the outer parts of its tail, not a single British photograph appears in the book of photographs of Halley 1910."

(They do not mention that the atlas contains 14 photographs taken in British Melbourne, Australia; however, none of those appears to be associated with British or other published works of art.) The only picture included relevant to Halley's comet in 1910 is a 1909 incredible but well executed cartoon by William Heath Robinson, entitled "Searching for Halley's Comet at Greenwich Observatory."

Meteors are less profusely represented in this treatise than are comets. One attractive lithograph illustrates the famous Leonid shower of 1866. Otherwise meteors are entered in illustrations for literary works, *e. g.*, Arthur Rackham's watercolor representing Hercules supporting the sky, an illustration for Hawthorne's *A Wonder Book.*

Meteorites are discussed briefly only in the Introduction, simply as background for the chapters that follow. None of the examples cited are represented by either British astronomical papers or British art. Before the 19th Century, it had generally been assumed that meteors were terrestrial atmospheric effects, and that meteorites were stones related to lightning. Then two events occurred to rectify the older theories: a fall of meteorites at L'Agile, France in 1803, and a similar event in 1807 at Weston, Connecticut. The second is mentioned on page 16, Note 25, where Thomas Jefferson is reported as having said he "would prefer to think that two Yankee professors would lie than that stones could fall from the sky." This is one of several versions I have encountered that mention "two Yankee professors," all of which have rightly been called apocryphal. Unfortunately the earliest and very probably the most authentic quotation is generally overlooked, namely Samuel L. Mitchell, *A Discourse on the Character and Services of Thomas Jefferson, More Especially as a Promoter of Natural and Physical Science,* New York, 1826.

Yale Professor Frank Schlesinger (1871-1943) once said that anyone who has read an article and not discovered any errors, has not read the article carefully. The only ones I have noted, if indeed they may be called errors, are omissions

in the Index. As neither Jefferson, Silliman, nor Weston occur in the Index, I sampled some 100 names in the Notes and found that about a third were not cited in either the Index or the References. Perhaps they were not considered sufficiently important to the major context of the treatise.

An Epilogue entitled "Comets and the New Millenium" by meteorite expert Colin T. Pillinger briefly discusses British contributions to cometary science in the past and indicates future progress, especially as governed by modern space flight researches. Britain is significantly involved through its collaboration with ESA, the European Space Agency. Its Rosetta Mission, aptly named after the stone that held the secrets of the ancient Egyptian monuments, is planned to follow a comet to aphelion, collect samples to identify its composition, and study the chemical and physical conditions of the solid cometary nucleus. Launch is expected in 2003, close encounter in 2011 and culmination of perihelion passage in 2013. The comet selected for such a mission is Wirtanen (1946). Meanwhile, however, other missions will fly past other comets: West-Kohoutek-Ikemura (1976) in 2000; Wild (1991) in 2004 (to bring back a dust sample); and Comet Temple (1909), with a landing planned in 2010. Exciting as these prospects are, Pillinger remarks, "Yet, it is difficult to believe that there ever will be a similarly integrated fascination and involvement with comets and meteors among scientists, artists, and the general culture like the ones in late eighteenth- and nineteenth-century Britain."

Here I have given only a few examples of the contents of this intriguing treatise. It is a pleasure to recommend it, both for enjoyment and edification, to anyone interested in comets or meteors--especially to historians of the Solar System.

Humanities Research Fellowships, 1998-99, at the Linda Hall Library of Science, Engineering, and Technology

Bruce Bradley (Linda Hall Library)

The Linda Hall Library invites applications for 1998-1999 humanities fellowships for research in the library's collections on the history and philosophy of science, engineering, and technology. Short term fellowships are available for up to eight weeks, offering a stipend of $450 per week to assist researchers with travel and living expenses. These fellowships support advanced and independent studies, dissertation research, and post-doctoral research.

The fellowship may be for two to eight weeks, and may be broken into more than one session if longer than two weeks. The project proposal should demonstrate that the Linda Hall Library has resources central to the research topic. Candidates are encouraged to inquire about the appropriateness of a proposed topic before applying, and to consult the library's online catalog, Leonardo, available through the library's homepage: http://www.lhl.lib.mo.us

To apply, please send a *curriculum vitae*, a one to two-page description of the proposed project, and a single letter of reference to:

Bruce Bradley
Librarian for History of Science
and Special Operations
Linda Hall Library, 5109 Cherry Street
Kansas City, Missouri 64110

Telephone: (816) 926-8737
Fax: (816) 926-8790.
E-mail: bradleyb@lhl.lib.mo.us

Applications may be sent at any time. Fellowships will be awarded quarterly, with the following deadlines for applications:

August 15, 1998 November 15, 1998

February 15, 1999 May 15, 1999

About the Library

The Linda Hall Library is one of the world's leading collections of science, engineering, and technology. With more than a million volumes, the collection dates from the fifteenth century to the present. Historical collections have been developed through more than 50 years of careful acquisitions. Particularly notable acquisitions were the library of the American Academy of Arts and Sciences in 1947, and the Engineering Societies Library in 1995. As a result, long runs of scientific and technical society journals dating from the seventeenth century are a special strength of the collection. Rare books dating from the fifteenth century offer a significant resource for most aspects of the history and philosophy of science and technology. Nearby resources at the University of Kansas offer complementary holdings at the Spencer Research Library and at the Clendening History of Medicine Library.

The Linda Hall Library is open to the public and funded primarily through trust funds left by Kansas City businessman Herbert F. Hall and his wife, Linda Hall, and by gifts from other private sources.

About the Fellowship Program

The research fellowships are funded by gifts from the Friends of the Linda Hall Library, and by a generous grant from The Gladys Krieble Delmas Foundation.

The Friends of the Linda Hall Library support the community outreach activities of the library by presenting lectures, tours, visiting fellowships, and other activities.

The Gladys Krieble Delmas Foundation promotes the advancement and perpetuation of humanistic inquiry and artistic creativity by encouraging excellence in scholarship and in the performing arts, and by supporting research libraries and other institutions that preserve the resources which transmit this cultural heritage.

See these online exhibitions for examples of research on specific topics in the collection:

The Face of the Moon: Galileo to Apollo
http://www.lhl.lib.mo.us/pubserv/hos/moon/cover.htm

Out of This World: The Golden Age of the Celestial Atlas
http://www.lhl.lib.mo.us/pubserv/hos/stars/welcome.htm

Paper Dinosaurs, 1824-1969
http://www.lhl.lib.mo.us/pubserv/hos/dino/welcome.htm

Linda Hall Library Home Page: http://www.lhl.lib.mo.us

Contents of the *Journal of Astronomical History and Heritage*, Volume 1, Number 1

Upcoming Meetings

[Extracted from the *Electronic Newsletter for the History of Astronomy,* edited by Wofgang Dick and translated by Donald Bellunduno]

September 14, 1998; Heidelberg, Germany
Splinter Meeting "History of Astronomy" in the framework of the Annual Meeting of the Astronomische Gesellschaft. The meeting of the Astronomische Gesellschaft will be held on the occasion of the 100th anniversary of the Landessternwarte [State Astronomical Observatory] Heidelberg-Koenigstuhl (1898 to 1998).
Coordinator: Dr. Reinhold Bien, Astronomisches Rechen-Institut, Mönchhofstr. 12-14, D-69120 Heidelberg, Germany, Phone: (06221) 405-120, Fax: (06221) 405-297, E-mail: reinhold@relay.ari.uni-heidelberg.de, URL: http://www.astro.unibonn.de/~pbrosche/aa/treffen1998.html

October 3-7, 1998; Berlin, Germany
IXth Symposium of the International Coronelli Society
Theme: Everything related to old globes, armillary spheres, planetaria and their makers.
Conference languages: German and English
Place: Staatsbibliothek zu Berlin (State Library at Berlin)
Further program: Excursion to Dresden to visit a special exhibition on maps, globes, and instruments; visits to globe collections in Berlin
Contacts: Internationale Coronelli-Gesellschaft, Dominikanerbastei 21/28, A-1010 Vienna, Austria, Fax +43 1 532 08 24.

October 23-24, 1998; Samarkand and Fargana, Uzbekistan
Celebrations of the 1,200th Anniversary of Ahmad al-Fargani (Alfraganus)
Further information: Dr. Shuhrat Ehgamberdiev, Director, Uzbek Academy of Sciences, Ulugh Beg Astronomical Institute, Astronomicheskaya Ul. 33, 700052 Tashkent, Uzbekistan, phone (0)3712-358102

October 23-25, 1998; Cambridge, MA, USA
Annual Meeting of the Antique Telescope Society
Place: Harvard University
Further information: Antique Telescope Society, Walter H. Breyer, Secretary, 1275 Poplar Grove Lane, Cumming, GA 30041, USA e-mail: whbreyer@mindspring.com

July 1-7, 1999; Toronto, Ontario, Canada
111th Annual Meeting of the Astronomical Society of the Pacific
Sunday, July 4: History Sessions: invited lectures
Monday, July 5: History Sessions: contributed papers
Inquires to: Joe Tenn, e-mail joe.tenn@sonoma.edu

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

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

- First Responses to the Telescope
- Astronomy as Technology?
- Early Stellar Spectroscopy
- Babylonian Knowledge of Precession?
- Ugaritic Eclipse Predictions?
- Early Studies of Eclipsing Binaries
- Evolution of Star Names
- Exhibition on Gravitational Astronomy
- Simon Newcomb in South Africa
- Star Map Found in a Japanese Tomb
- Historical Images of Supernovae
- Inspiration of Astronomical Phenomena
- Maria Reiche

- Immanuel Kant on the Beauty of the Sky
- "Dance of the Planets" for Cometary Orbits
- Tycho Brahe's Motivation
- Alvan Clark's Equatorial Mounts
- Ptolemy: Scientist or Astrologer?
- Photographs of Henrietta Leavitt

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

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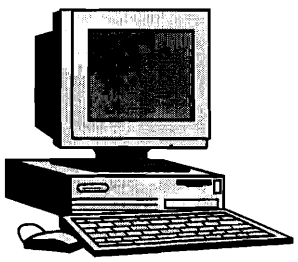
listserv@wvnvm.wvnet.edu

(not a) Web Page of the Summer

Instead of a WWW page, this time I [T. H.] offer you a "physical page," authored by Karl Hufbauer (pp. 15 & 16). Originally it was prepared as a handout for those attending his talk at the Palomar 50th Anniversary. At the session (see article, above), Dr. Hufbauer invited participants to construct their own "top ten list" and compare it to his "top twenty." Hufbauer invites comment from those whose list does or *does not* significantly overlap his. [Used with permission from K. H.]



"From the Lucubratory"

Woody Sullivan, University of Washington

The early history of radio astronomy has many fascinating stories, but none more so than that of Grote Reber, a young, iconoclastic radio engineer who lived in the Chicago suburbs. During 1932-35 Karl Jansky reported in the engineering literature a "faint, steady hiss" attributed to extraterrestrial radio emission from the Milky Way. Reber was fascinated and determined to somehow follow up. As it turned out, his observations were the only significant studies of Jansky's "star noise" until after World War II.

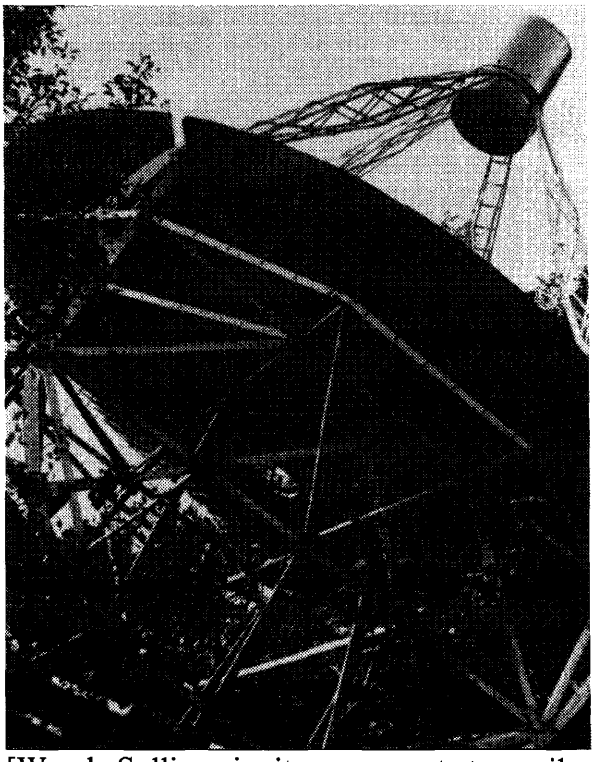
On his own time, with his own funds, and largely by the sweat of his own brow, Reber constructed the world's first radio telescope, a giant dish, in his backyard. No one before had made a parabolic reflector on anything close to this scale, and so Reber had many design decisions to make. The wonder is that he made them so successfully.

The design of the dish was constrained by a marvellous blend of the science that needed to be done and the practicalities of life. *What size?* Well, the longest available 2-by-4-inch boards were 20 feet. Since the backup structure of the dish was based on a square, that square became 20 ft. on a side, or 28 ft. on the diagonal; allow for a little overhang and the final diameter of the dish was 31.4 ft. (9.6 m). *What focal length?* It was clear that one too long would be mechanically unwieldy, while one too short would make it difficult to illuminate the dish with the feed. Reber settled on 20 ft. *What kind of mounting?* A traditional astronomical equatorial mounting would have been ideal, but the cost of such a civil-engineering headache was prohibitive. Considerations of cost and terrain finally led to a transit design, where the dish could only move along the meridian. *How accurate a reflector surface?* Optical principles indicated that it should follow a paraboloidal

form to within ~1/4 wavelength, or an accuracy of ~1-2 cm for his planned operating wavelength of 9 cm. This required extremely tight tolerances in the backup structure and in the surface itself, but in the end Reber achieved this through careful design and workmanship. *What kind of structure at the focus?* In many ways this was the trickiest question of all, and over the years Reber experimented with many types of drums and pick-up feeds.

In the summer of 1937, Reber was between jobs and for four months of twelve-hour days he built this goliath in his backyard with the parttime assistance of two laborers. It had a trellised, semi-circular wooden framework for its support structure, mounted on four 6 ft. concrete piers. The dish rolled north or south on crane wheels in response to a hand crank driving the rear axle of a junked Model T truck. The reflector surface comprised forty-five 0.02 inch galvanized iron sheets, fastened with screws to 72 radial, parabolic ribs. Bending of its shape was minimized by the large depth of the support framework. The dish was held together with 1,320 bolts and 1,665 screws. Cost of the foundations, steel, wood, and paint (two coats before assembly and two afterwards) was no more nor less than $676.96, about one-third of Reber's annual salary.

One can imagine the reaction of townsfolk as this machine rose some 50 feet into the air behind the house at 212 West Seminary Avenue--their responses must have been akin to those of Noah's neighbors when he started on the Ark. Eventually it became a local landmark, along with the water tower and courthouse, but at first rumors flew. Although Reber assured town officials that nothing sensational would happen once it was working, he was reluctant to say more about its purpose than that it was for experiments in the propagation of radio waves. But if it was supposedly for radio, why did it not have any familiar aerials associated with it? And what were those loud snapping and banging sounds ringing out at sunrise and sunset (metal panels adjusting to temperature changes)? Speculations included that it was an atom smasher, a device for launching rockets to the Moon, or a source of death rays for plane engines (Army-funded air raid defense work). Local housewives thought it would make a dandy rug dryer, and in fact Reber's mother often did use it to dry the wash. A rhubarb patch grew well under it. Kids climbed all over this semi-Ferris wheel, and curious strangers passing by in autos frequently stopped and rang the doorbell. During heavy rains, water gushed through a two-foot hole at the base of the dish (as provided for a Gregorian focus, but never used), and this led to ideas that it was a rainwater collector or a weather controller. Reber's reticence to discuss his machine was well-founded, for its actual purpose--to establish "contact" with the Milky Way--would indeed have appeared preposterous. After two years and several changes of receiver, eventually Reber did detect the Milky Way . . . but that's another story.



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

The *HAD News* is supported in part by the Department of Earth Science, University of Northern Iowa.

Computer assistance is provided by Dr. Kenneth DeNault.

AAS Meeting
Palomar Observatory
7 June 1998

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Twenty Important Steps in Research on Stars and Galaxies, 1910-1950

(B = data from big telescope crucial;
R = interpretive tools from recent theoretical physics crucial):

1913: Hertzsprung used proper-motion statistics to determine the intrinsic brightness of Cepheid variables and then estimate the distance to the Small Magellanic Cloud as 10 kpc.

1913-14: Russell employed an absolute magnitude-spectral class diagram to make a convincing argument stars evolve from diffuse giants to ordinary stars like the sun.

1913-14: Slipher detected shifts in the spectra of spiral nebulae which indicated that they have very high radial velocities.

1916-17: Eddington reinvigorated theorizing about the internal constitution of stars by showing that the theory of perfect-gas stars could be applied to giant stars.

1917: Ritchey and Curtis found novae in spirals; Curtis went on to argue that these novae must be 100 times more distant than novae in our galaxy. (B)

1918: Shapley, using Cepheid variables as standard candles and assuming that globular clusters define our galaxy, maintained that its center is 15 kpc from the sun in the direction of Sagittarius. (B)

1920: Michelson and Pease established the existence of giant stars by measuring Betelgeuse's diameter interferometrically. (B)

1923-24: Edwin Hubble found Cepheids in nearby spirals, then used them to argue that the spirals must be more than 240 kpc away and hence external to our galaxy. (B)

1924: Eddington extended the theory of perfect-gas stars from giant to ordinary stars, including the sun; following up an ancillary prediction by Eddington, Adams established that Sirius's faint companion is a white dwarf star of extreme density. (R, B)

1926-27: Lindblad and Oort developed a compelling analysis of our galaxy's rotation, estimating its mass as 100 billion solar masses and the sun's distance from its center as 7 kpc.

1929: Russell made a strong case that hydrogen and helium are the most abundant elements in the atmospheres of the sun and most other stars. (R, B)

1929-30: Hubble reported that spiral redshifts, and hence velocities, increased proportionally with their distance; Eddington interpreted this result as

evidence for a relativistic universe that started expanding billions—not trillions—of years ago. (B, R)

1930: Trumpler established that interstellar dust in the galactic plane is responsible for a three-fold overestimation of Cepheid distances and hence of our galaxy's size. (B)

1932: Hubble reported that Andromeda, like our galaxy, is surrounded by over 100 globular clusters. (B)

1937: Hubble and then Zwicky detected, as Baade and Zwicky had earlier predicted, "supernovae" in distant galaxies. (B)

1938: Bethe advanced a robust argument that helium synthesis, beginning with proton-proton fusion reactions or proton-carbon fusion reactions, powers main-sequence stars. (R)

1941: Edlén identified the ions giving rise to most of the solar corona's emission lines, indicating thereby that the corona has a temperature of about a million degrees. (R)

1944: Baade reported that there are two kinds of Cepheids, thereby indicating the need for a redetermination of the Hubble constant. (B)

1945-46: Hoyle used Mattauch's nuclear-mass data and Goldschmidt's atomic-abundance data to initiate theorizing about the synthesis of elements from hydrogen during the later stages of stellar evolution, including supernovae. (R, B)

1950: Schwarzschild and Schwarzschild found that relatively young stars are richer in metals than old stars. (R, B)

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	1st 10 Devs 1910-27	2nd 10 Devs 1929-50	All 20 Devs 1910-50	4 Most Signif Devs
Neither B, nor R:	5	0	5	0
Only B:	4	4	8	1
Only R:	0	2	2	1
Both B and R:	1	4	5	2