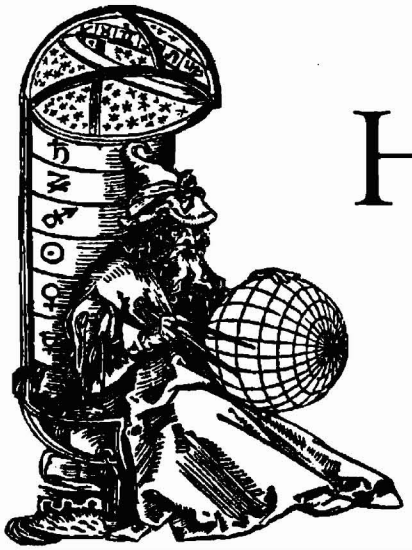

H·A·D NEWS

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

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Education and History in Tucson

Our Tucson meeting will begin on Saturday evening at the Steward Observatory with a lecture on Southwest archaeoastronomy by Ed Krupp. Weather permitting, this will be followed by a star party with a telescope at the Observatory. Tucson's amateur astronomers will be out in force, setting up their own telescopes on the lawn. Please note that the Observatory is *not* the site of the other AAS or HAD sessions. Steward Observatory is on the University of Arizona campus, near the Flandreau Planetarium. Parking is available.

With the AAS Education Officer, Mary Kay Hemenway, and the Working Group on Astronomy Education, we are sponsoring a pair of sessions on History in Astronomy Education. Abstracts for these sessions follow:

Saturday, Jan. 7, 7:00–8:00 p.m.

☆ ***Celestial Seasonings: Astronomy and Rock Art in the American Southwest***

Edwin C. Krupp (Griffith Observatory)

Astronomical interpretations of prehistoric rock art have played a significant part in the development of modern archaeoastronomy since 1975, when interest was renewed in the possibility that the Crab supernova explosion of 1054 A.D. was represented in rock art of the American Southwest. (This hypothesis was actually first formulated in 1955.) In the last two decades, a variety of astronomical functions for rock art have been proposed and investigated. These include representation of specific historical celestial events, symbolic representation of elements of celestial myths, star maps, markers for astronomical observing stations markers for celestially tempered shrines, images intended to invoke and exploit cosmo-magical power, seasonally significant light-and-shadow displays. Examples of astronomical connotations in prehistoric rock art from the Southwest and California illustrate the necessity of understanding the culture in any attempt to understand its astronomy.

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Schedule of HAD Sessions

Saturday, Jan. 7, 7:00–8:00 p.m.
Public lecture by Edwin C. Krupp
at Steward Observatory, followed by a star party.

Sunday, Jan. 8, 2:00–4:45 p.m.
History in Astronomy Education I
Barbara J. Becker
David S. P. Dearborn
Woodruff T. Sullivan III
David DeVorkin
Michael Zeilik & Shannon Hall

Monday, Jan. 9, 10:00–11:30 a.m.
Contributed papers

Monday, Jan 9, 1:00–2:00 p.m.
HAD Business Meeting

Monday, Jan. 9, 2:00–3:30 p.m.
History in Astronomy Education II
Owen Gingerich, Invited Rewiew Paper
Discussion Panel, including Sunday's speakers and Richard Berendzen.

Tucson Meeting continued from page 1.

Sunday, Jan. 8, 2:00–4:45 p.m.

☆ ***Constructing New World Views: Learning Science in a Historical Context***
Barbara J. Becker (SWRL)

Recent research has shown that children, like scientists, can tolerate a wide range of observations that do not match their expectations, or that even directly conflict with them, without abandoning their personally constructed system of beliefs about the natural world. Traditional approaches—even laboratory experiences that support textbook presentations of theories—do not guarantee students will alter their convictions concerning how things "ought" to work. In contrast, a history-grounded approach to presenting scientific concepts has the potential for doing precisely that. In this paper, the author argues that embedding science learning in a historical context engages students in thinking about science in a way that complements and enriches a "hands-on" approach to inquiry learning. It conveys the creative and very human character of scientific explanation—its tentative, probabilistic, and serendipitous nature. By integrating well-chosen historical images and ideas into traditional content-centered science units, educators can stimulate productive classroom discussion and establish a classroom atmosphere that nurtures students to think critically about the meaning of scientific activity in different cultures and times More importantly, the use of historic episodes in teaching science opens up opportunities for students to identify their own untutored beliefs about the workings of the natural world, to examine them critically in the light of considered historical debate, and to confront these beliefs in a way that results in positive, long-lasting conceptual change.

☆ ***Archaeoastronomy and Science Education***
David S. P. Dearborn (LLNL)

Acquisition and utilization of knowledge can be a determinate for survival and prosperity. As a process for exploring nature, science has enabled people with the tremendous capabilities of modern technology, but many students fail to see the connection between their lives and this process. Even those students that do appreciate a connection, frequently leave high school or non-major college classes, confusing the scientific process itself with a catalog of abstract facts.

Archaeoastronomy provides a vehicle to teach both scientific methodology, and the range of human reason for the pursuit of science. As a study of the interaction between societies and their science, it may included the development of mathematics, navigation, surveying, units of measurement, and urban planning. Astronomy serves as a focus across many cultures, because the need to respond to the seasons is biologically based, and these seasons are driven and defined by celestial motions. This connection between sky and earth exists for all people, and sophisticated sky watching activities developed on every inhabited continent.

At the foundation of archaeoastronomy studies are the mechanics of astronomical observation, methods for organizing those observations, and making interpretations. The celestial phenomena of interest are readily available and easily observable. This permits a discovery basis for teaching how the scientific method developed and how is used.

A course in archaeoastronomy permits students of wide disciplinary and cultural backgrounds to appreciate the interrelation between science and society. Additionally, students that will not pursue scientific research, who will instead become leaders in other areas, will be enriched with an understanding of how the process operates whether watching for the first appearance of the new moon, or attempting to detect the top quark.

☆ ***Time in History: Examples of Historical Issues of Time and Calendars Useful in Undergraduate Astronomy Teaching***
Woodruff T. Sullivan, III (U. Wash.)

The history of astronomy can be used as much more than a diversion in teaching the principles of astronomy. In this talk I will focus on several historical aspects of time and calendrics that teach both science and history, and in the process cause students to realize that things have not always been (nor are they likely to remain) as they now are in the late 20th century. Examples include: (1) records of ancient solar eclipses that, despite their crude nature, precisely indicate the long-term slowing of the earth's rotation (why do they have those puzzling "leap seconds" one often hears about on New Year's Eve?), (2) problems of constructing a solar

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Tucson Meeting continued from page 2.

or (especially) a lunisolar calendar and various solutions (why did the date 7 October 1582 never occur? Why did the Soviet Union celebrate the "Glorious October Revolution" in November?), (3) the 18th-19th century dilemmas surrounding sundial ("true") time, mean time, and standard time as clocks became more accurate and transportation faster (Which is the "correct" time, anyway?), and (4) the 18th c. quest to "discover the longitude", eventually fulfilled by a chronometer that was seaworthy and accurate for months (how can you and a distant friend easily determine your difference in longitude?).

☆ ***Textbooks and the Rise of Modern Astrophysics***
David DeVorkin (NASM)

One way to appreciate the problems associated with the emergence of a new discipline or specialty is to look at how the tools and techniques of the new line of research were transmitted from generation to generation. The emergence of theoretical astrophysics in the 1920s and 1930s provides a useful case study where one of the problems was how to create textbooks astronomers could read that also provided an adequate introduction to modern physical theory, especially quantum theory. Case studies of specific textbook projects, published and unpublished during the 1920s and 1930s, will highlight the obstacles textbook writers faced.

☆ ***Can Astronomy Be Taught Without History?***
Michael Zeilik & Shannon Hall (U. of NM)

Many introductory astronomy courses for the non-science major take a somewhat historical approach, especially at the start of the course. At the University of New Mexico, we are developing an innovative course in a large (about 300 students) lecture format. The main thrust has been to restructure the traditional "descriptive" astronomy course into one that focuses on the process of science by identifying and linking essential concepts. The goal: to teach explicitly the structural knowledge of astronomy, which is clear to experts but opaque to novices. To focus on the process of science, we have decided to minimize a historical treatment of the material. But this strategy results in a cognitive twist. We know that students bring into class their personal world views, largely unexamined, about how nature works. Some of these alternative conceptions mimic pre-Newtonian notions and in a loose sense recapitulate the history of astronomy. Is taking a historical approach a good heuristic device for teaching introductory astronomy? Or does it reinforce alternative concepts and so confuse students?

This work is supported in part by NSF grant DUE–9253983.

Monday, Jan. 9, 2:00–3:30 p.m.
Invited Review Paper and Panel Discussion

☆ ***The Use of History in Astronomy Education***
Owen Gingerich (Harvard-Smithsonian CfA)

Three persuasive reasons for using historical materials in astronomy education are:

- The simplest concepts are introduced first in natural sequence.
- For non-science students, history can bridge to other interests.
- The historical perspective shows the changing and iterative nature of scientific explanatory structures.

To illustrate these points, this invited review paper will present a series of specific examples from my core science course, "The Astronomical Perspective," believed to be Harvard's longest-running course still under the same management. (Contrary to some students' beliefs, it *does not* date back to the time of Ptolemy.)

An earlier version of this presentation is described in J.M. Pasachoff and J.R. Percy (eds.) *The Teaching of Astronomy: Proceedings of the 105th Colloquium of the International Astronomical Union.* (Cambridge, 1990), pp. 39–44.

In Memoriam

Erich Robert Paul, Professor of History of Science and Computer Science at Dickinson College in Carlisle, Pennsylvania, died October 12, 1994, of cancer. He was most recently the author of *The Milky Way Galaxy and Statistical Cosmology, 1890–1924,* (Cambridge University Press, 1993), and an annotated translation of Henrietta Hertzsprung-Kapteyn's *The Life and Works of J. C. Kapteyn* (Kluwer, 1993). A full obituary will appear in the *Bulletin of the American Astronomical Society.*

FSU Journal Fund

A year ago, Owen Gingerich and Albert Van Helden proposed that HAD establish a fund to purchase subscriptions to the *Journal for the History of Astronomy* for institutions in the Former Soviet Union. At IAU meetings this past August, FSU historians confirmed that financial pressures have forced leading institutions, such as the Russian Academy of Sciences and the Pulkovo Observatory, to drop subscriptions to Western journals. Not surprisingly, historical journals are among the first to go.

HAD's International Relations Committee (IRC) took this on as a special project. Michael Hoskin, editor of the *JHA*, cooperated by allowing us to purchase subscriptions for FSU institutions at the reduced "individuals" rate. So far, we have received $100 in contributions to this fund, enough to purchase a single subscription, with a bit left over.

Now that the end of the tax year is approaching, please consider contributing to the fund. Checks payable to H.A.D., with a designation to the FSU Journal Fund, should be sent to LeRoy Doggett Nautical Almanac Office, U. S. Naval Observatory, Washington, DC 20392. ☆

Second Notre Dame Conference

The Second Biennial History of Astronomy Workshop (HAW!!) will be held June 22–25, 1995 at the University of Notre Dame. Plans for the meeting were discussed by the History of Astronomy Special Interest Group of the History of Science Society at its recent meeting in New Orleans. Michael Crowe and Steven Dick will co-chair. Plans for sessions are still in the early stages of organization, and all ideas are welcome. You may write to either Michael Crowe, Program of Liberal Studies, University of Notre Dame, Notre Dame, IN 46556, or Steven Dick, U. S. Naval Observatory, 3450 Massachusetts Ave., NW, Washington, DC 20392–5420.

Those who attended the first meeting in 1993 will recall the splendid setting, excellent sessions, spirited formal and informal discussions, and reasonable room rates. More detailed information will be forthcoming in the next *HAD News*. Meanwhile, mark your calendar! ☆

June HAD Meeting

In June 1995, HAD will meet with the AAS in Pittsburgh. Since this will be the centennial of the *Astrophysical Journal*, we'll hold special sessions devoted to its history.

At first blush, Pittsburgh might seem like an unlikely place to celebrate the centennial of the *ApJ*. George Ellery Hale was the principal force behind its creation, and he is associated with Chicago. However, Hale convinced his friend James E. Keeler, Director of Allegheny Observatory, to serve as founding coeditor. Keeler, in fact, probably did much more editorial work than Hale in the long run. So Pittsburgh isn't so unlikely after all. Besides, in 1999 we'll celebrate the founding of the AAS, and for that the AAS will meet in Chicago, with a likely excursion to Williams Bay.

Ron Brashear, of The Huntington Library, is organizing our *ApJ* sessions. For more information, you should communicate with him. Plans for these sessions will be discussed at our business meeting in Tucson, of course. ☆

HASTRO

For the past year or more, Steve McCluskey at the University of West Virginia has been running an e-mail history of astronomy discussion group, HASTRO. We have occasionally reprinted items (with attribution, of course) in *HAD News*. Discussions have covered everything from methodology in archaeoastronomy to the arguments for adopting Copernican cosmology, to the origin of the light year and parsec. It is sometimes profound, sometimes trivial, and absolutely invaluable.

You can join by sending the following message to LISTSERV@WVNVM.WVNET.EDU:

SUB HASTRO-L your name

Example: SUB HASTRO-L Al Biruni

HAD Membership

When you fill out your AAS membership renewal, remember to renew for HAD. For AAS members, annual dues are $4.

If you don't belong to the AAS, Affiliate Membership in HAD is $10 a year. For information, contact LeRoy Doggett, Nautical Almanac Office, U.S. Naval Observatory, Washington, DC 20392 or doggett@ariel.usno.navy.mil. ☆

✓ 1/3/95

✓ 7/4/95