At the end of the 19th century, the same problem which had fired the enthusiasm of John Winthrop in 1761 and David Rittenhouse in 1769 - that of the average distance from Earth to the Sun - was still an unsettled question. In 1900, however, a close approach of the asteroid Eros to Earth allowed more precise measurements.

Simon Newcomb, addressing the American Astronomical Society, called for active, worldwide participation to obtain a precise determination of the asteroid's position. Applying Kepler's laws of planetary motion to this information would better establish the size of Earth's orbit, American participation in this effort was significant; all results were sent to A.R. Hinks in England for analysis. Hinks had the assistance of a young postgraduate student from Princeton who provided invaluable aid; the result was the creation of data reduction techniques which Hinks used to determine, in 1910, the average solar distance of 92.83 million miles. His young assistant was Henry Norris Russell, a man destined to be a dominant force in American astronomy for almost half a century.

Born in 1877 in Oyster Bay, New York, Russell was a student of Charles A. Young, and competently continued his mentor's life work - the spectroscopic examination of the Sun and stars, and the interpretation of these observations in the light of modern physical theory. Russell's first major study was to determine, by photographic means, the distances to stars by measuring their annual parallaxes. Once the distance to a star is known, its actual brightness can be determined. This physical quantity is a measure of how much energy is released by the star.

While Russell was in the process of evaluating his photographic parallax plates, he began a long correspondence with Edward Charles Pickering of Harvard, where the vast spectral classification project was now going full steam. Pickering suggested that Russell compare his luminosities to the spectra of the stars being studied; this was done using Harvard resources. Almost at once, Russell found, to his amazement, that among stars with red spectra, two very distinct types of stars existed: small, feeble stars and great luminous ones. But only bright ones existed among the blue stars. It soon became apparent that a very definite relationship existed for all stars when their spectra were compared to their luminosities. While a correlation like this was new to Russell, it had been anticipated by others, including Dutch astronomer Ejnar Hertzsprung in 1911. Russell, however, placed the relationship (now known as the Hertzsprung-Russell, or H-R diagram) on firm observational footing. Astronomers were now faced with having to explain how the two types of red stars could have grossly different luminosities. The answer resided in the very nature of the stars themselves. But so little was known at that time about the structure and generation of energy within a star that the answer was not apparent. The luminosity difference could be due to a difference in mass or size. More information was obviously needed about the physical characteristics of individual stars. Curiously, this type of information comes only from the study of double stars. There is a specific class of double stars where the two stars, in orbit around a common center of gravity, pass in front of one another as seen in our line of sight. A careful analysis of the variable amount of light coming from the stars as they eclipse one another was shown by Russell to yield the sought-after star dimensions. In 1910, Russell turned to these 'eclipsing binaries' (with the help of his student, Harlow Shapley) for the answer. Shapley industriously examined 87 double stars under the supervision of Russell.

The analysis of eclipsing binary systems yield the fascination results that some of the brighter red stars were of extremely low density, making them tens and sometimes hundreds of times larger than the Sun! These were truly giant stars when compared to their fainter red counterparts.

The relationship between luminosity and spectral class, made graphically clear by the H-R diagram, is in essence a correlation between the intrinsic brightness and surface temperatures of the stars. The nature of the correlation suggested that the prevailing theory of stellar evolution was incomplete. Instead of aging through a linear cooling and contracting process, beginning life as a blue star and ending it as a red one, Russell believed that his newly found red giants were the youngsters. They contracted and heated until they became blue hot; only then did they begin to cool upon further contraction. Russell's theory was a revival of one suggested by Norman Lockyer in 1890, but Russell's treatment was a masterful fitting of solid data. Its only drawback was the poor understanding of the behavior of matter under extreme conditions found in stellar interiors. While Russell's theory was never fully accepted, the
The WASP
Volume 23, Number 9 — September 1991

Published by:
Warren Astronomical Society, Inc.
P.O. Box 1505
Warren, Michigan 48090-1505

1991 OFFICERS

President: Marty Kunz 477-0546
1st Vice President: Frank McCullough 772-7917
2nd Vice President: Mike O'Dowd 268-7125
Secretary: Robert Halsall 781-6784
Treasurer: Jeff Bondono 731-4706
Librarian: Don Mick 779-2784

The Warren Astronomical Society, Inc. is a local, non-profit organization of amateur astronomers. The Society holds meetings on the first and third Thursdays of each month, starting at 7:30 p.m.

General meeting on first Thursdays:
Cranbrook Institute of Science
500 Lone Pine Road
Bloomfield Hills, Michigan

Business meeting on third Thursdays:
Ridgewood Recreation Center (summer location)
Racine Street
Warren, Michigan
(Located west of Schoenherr, 1/4 mile north of 12 Mile.)

MEMBERSHIP AND DUES

Membership in the Society is open to all. Annual dues are:
Student $10.00
College $15.00
Individual $20.00
Family $25.00
Senior Citizen $15.00

Among the many benefits of membership are:
- Discount magazine subscriptions:
  - Astronomy $14.00 (12 monthly issues)
  - Deep Sky $8.00 (4 quarterly issues)
  - Odyssey $12.50 (12 monthly issues)
  - Sky and Telescope $18.00 (12 monthly issues)
  - Telescope Making $8.00 (4 quarterly issues)
- Free copy of each WASP newsletter.
- Free use of Stargate Observatory.
- Special interest subgroups. (See subgroup chairpersons.)
- Call list - don't miss unexpected events.
- Free membership in Astronomical League.
- Free copy of Reflector (Astronomical League newsletter).
- Free use of W.A.S. library. (See Librarian.)
- Rental telescopes. (See Observatory Chairperson.)

Send membership applications and dues to:
Jeff Bondono 731-4706
51054 Kingwood
Shelby Township, Michigan 48316

WARREN ASTRONOMICAL SOCIETY PAPER

The WASP is the official monthly publication of the Society. Each new issue of the WASP is made available at the Macomb meeting on the third Thursday. Non-members will be charged $1.00 for each new issue. Back issues, when available, are free. Requests by other clubs to receive the WASP and other correspondence should be addressed to the editor.

Articles for inclusion in the WASP are strongly encouraged and should be submitted to the editor on or before the first Thursday of each month. For further information on contribution, see the "Instructions for Authors" box on page 4 of Volume 23, Number 5.

Send articles to the editor:
Douglas E. Goudie 680-0434
2420 Alexander
Troy, Michigan 48083-2405

STARGATE OBSERVATORY

The observatory is owned and operated by the Society in conjunction with Rotary International. Located on the grounds of Camp Rotary on 29 Mile Road, 1.8 miles east of Romeo Plank Road, Stargate features a 12.5 inch f/17 club-built Cassegrainian telescope under a steel dome. The observatory is open to all club members in accordance to the "Stargate Observatory Rules." Those wishing to use the observatory must call the Observatory Chairperson (2nd Vice President) by 7:00 p.m. on the evening of the session.

LIBRARY

The Society maintains a library of astronomy-related books and periodicals at the Macomb County Community College meeting room. See the Librarian for rules or to check out a book.

LECTURES

Lectures are given at Stargate Observatory each weekend. The lecture will be either Friday or Saturday evening, depending on the weather and the lecturer's personal schedule. Lecturers should check with the ranger at Camp Rotary early in the week to determine whether scouts will be using the camp and to inform the ranger of the day and time of the lecture. If the lecturer cannot speak on their scheduled weekend, they should please make arrangements to switch with another lecturer or call the chairperson.

SUBGROUPS

Special interest subgroups exist for those interested in specialized areas of astronomy. Contact the chairperson of each subgroup for more information on that group.

Computers: Larry Kalinowski 776-9720
Cosmology: Mike O'Dowd 268-7125
Deep Sky: Doug Bock 750-0273
Lunar / Planetary: Alan Rothenberg 624-9339
Solar: Ed Cressman 645-1837
Telescope making: Jim Houser 294-1952

CALL LIST

The Call List is a list of people who wish to be alerted of spectacular and unexpected astronomical events. Anyone who notices such an event calls the next person on the call list. That person in turn calls the next person, etc. A call list member can restrict callings to certain available times. Any Society member is welcome to join the call list.

To join the call list, please notify Jeff Bondono at 731-4706.
In the Beginning, Part 2

By Frank McCullough

Note: A version of this article first appeared in the WASP around 1970. -Ed.

The same year I moved to East Detroit I met a 'tom-boy.' She hated boys, but she liked me as long as we played baseball, football, four-square, and so forth. She was kind enough to let me borrow her 3 x 20 opera glasses which got me closer to the stars and other things. Needless to say, I didn't do much serious observation with those crummy little things, but the guys at Palomar would have rolled in their secondary if they could have seen me on Friday nights. That's really the only time I could use them for a long period of time. So, as I sat in the bleachers at our high school football games with lights saturating everything, I would gaze skyward for a glimpse of a bright star.

1968 came into being and I knew if I was to buy a telescope I would have to have a job. My first job was at a pizza parlor for 75 cents an hour. I worked after school month after month, trying to get enough money for my first telescope. It was $79.50 and would give me 220 power! I hit $50.00 as it was getting close to Christmas. The jerk (my boss) at the pizza parlor asked me each time he paid me my $18.00 a week (for six days), "What are you going to do with all this money I'm paying you?" I should have hit him with my pepperoni. But, instead, I burned too many pizzas and he laid me off.

I was up to $64.00. My dad checked the Ward's catalog and said, "Son," (that's what my dad used to call me - he was always kind of astronomical; he'd say, 'Frank, you're so bright, I'll call you 'Sunny,') 'you might as well go all the way and get the biggest telescope there is, the Tasco 4 1/2-inch 11Té reflector.' My dad threw in the rest of the money and ordered the $89.95 telescope from Ward's. (23 years later it is $399.00.) Needless to say, I had sleepless nights just knowing I would have what may be (as I told my mom) the fifth largest telescope in all of Michigan.

I remember picking up the telescope with my dad - what a thrill! I was not allowed to open it until Christmas Eve. Christmas Eve came and, looking inside, I examined this complex piece of equipment. It scared me just to think of touching it. It looked like a miniature hot water tank. Christmas Eve was a dud, though. It was snowing outside and even if it were clear, it would take me all night long to get up enough nerve to assemble the telescope. My eagerness was revived, but the weather stayed bad for another three days. Do you know what it's like having only one memory of seeing Saturn nearly three years before? Now I was ready to ravage the heavens with my scope: the Moon, Mars, nebulae, galaxies,... the universe!

Finally, on the fourth night, the weather cleared, the Moon was full and spread a bluish hue over the observation site. The telescope was ready. I hoped the finder scope was accurately aligned (since I aimed it at a picture and the tube was roughly along the same plane). The Moon popped into my 7 x 8 finder. It looked beautiful but small. Now for the eyepiece. No Moon! I kept scanning, pushing the scope, moving it ever so delicately. Just a white glow! Panic! My scope was broken! I've waited so long.... My mother was hollering, 'Frank, time for supper. If I won't tell you what I hollered back, I was crushed. I went in and tried to eat, but my telescope took my appetite away.

I went outside 20 minutes later to find a cloud cover over the sky. There were a few snowflakes falling. So as not to damage my telescope any more than it had already appeared to be damaged, I moved it on the front porch with the awning hanging over it while I stood in four inches of snow. I watched the Moon pop in and out of the clouds so I pointed skyward again. The Moon appeared in the finder. I prayed for the scope to work and soon the bright glow appeared in the eyepiece again. I pushed the scope around again and Wham! The Moon and Tycho's belly button hit me right in the eye! Beautiful! Colossal! Fantastic! Stupendous! I had never seen the Moon like this before. I trembled with excitement. The clouds dimmed it and then uncovered it.

The clouds raced right along with my emotions. I called my mother, brother and sister. "My scope works!" I cried. (I was really a dumb beginner.) I dragged my mother out in her slippers and robe. She was not always very emotional, but I remember the light falling on her pupil as I watched for some expression from her. "Oooo, that's nice," she paused for 10 seconds and remarked, "but it's too cold to stand out here." The clouds soon covered the Moon for good, but what a nice feeling to take inside with me.

The Moon has never looked the same to me since that night. It has a special appearance to it: gray, cold and exciting as the clouds raced across. It was a dream come true!

Astronomy had become my full-fledged hobby and I could not get enough fast enough. I recall the month of January when my scope was not even two years old. I had only seen the Moon. I did not know where or what else to look for. The only guide I had was 'Star Time' in The Detroit News. I remember reading, "The bright object near the Moon tonight is the planet Jupiter." Wow! Here was my second object waiting for me. That evening I went on a hay ride under a very clear sky. As the wagon made its way back to the barn, the Moon was starting to rise. But still no Jupiter. A few minutes later a bright star broke the horizon. This had to be Jupiter. I figured by the time I got home it would be well up to observe. It was 3:00 in the morning and now the star was nearly overhead. Yes, I was sure this was Jupiter. I assembled the telescope and set it pointing upward, centering the star in my finder scope. Through my eyepiece was the most breath-taking sight! There was a ball with four white specks, two on each side. I remember the Moon was so close that the sky was a pale blue, but as I looked closer at Jupiter I saw two dark belts around its middle and a dark polar area I was looking at the largest planet in our solar system! Now I swept the telescope west and gazed at that big, bright, beautiful Moon. Eventually I felt frozen from the cold. As I went back in the house I can remember a blurry haze lingering in my right eye.

X

(to be continued next time)
WASP Announces New Editorial Policy

A n editorial policy is nothing more than a set of guidelines for a publication. It defines who the publication serves and the nature of the content one would expect to find in that publication. The WASP now has a new official editorial policy. It reflects a subtle but important shift in focus for our newsletter. I believe it will help make the WASP an even better and more valuable newsletter for its readers. (No doubt many of you may have read this same sort of message from practically any other amateur publication editor on the planet. Don't worry about it: It's something editors have to get out of their systems from time to time. The message itself still rings true.)

I have observed (at least in recent issues) a heavy reliance on so-called 'feature' articles in the WASP - writings on specific, specialized subjects in astronomy. These include informative articles, informal essays, how-to articles and so forth. Feature articles are valuable. They are a vehicle through which an author can present something he or she finds intriguing, and they elicit interest and excitement about the topic in other readers. Features keep the spark of interest in a subject burning. But I believe the foremost purpose of a newsletter such as the WASP is to provide news - in our case, news about the Warren Astronomical Society and what it does for society members and others. News articles involve the reader because they keep him and her knowledgeable about events and offer opportunities to many who may not know about them otherwise. News keeps the WASP vital for its readers because they are informed about the society. Where a feature article is like gravy, news articles are the meat and potatoes. The new editorial policy should help the WASP foster this feeling of togetherness and mutuality among all its readers. We all have the common bond of an interest in astronomy and some of its many aspects. The policy should help to show that all of us have something to offer each other.

Wanted

It is this editor's opinion that the WASP could stand to make a stronger effort toward keeping society members better informed about society events. But what sorts of news am I looking for? Here's a beginning list that should help your thoughts along:

- Meeting minutes. (These do not have to be formal minutes - just a paragraph or two describing the more important and interesting events would be far better than nothing - and may make for more interesting and enjoyable reading, too)
- Announcements of future meetings, including a probable agenda and interesting topics planned for discussion.
- Subgroup meeting minutes and future meeting announcements. (See the suggestions above.)
- New Society member recognition and membership list updates.
- Statements from Society officers.
- Reviews of astronomical books, articles appearing in other periodicals, educational television programs and computer programs.
- Stargate Observatory updates and upgrades.
- Stargate Observatory lecture schedule and planned topics for discussion.
- Rules and procedures on the use of Stargate Observatory. (This could even appear annually.)
- Rules and procedures for the Society library. (Again, this could appear annually.)
- Lists of new library acquisitions and interesting older holdings, including lists of newsletters from other astronomy clubs.
- Letters to the Editor regarding WASP content, including suggestions and article ideas.
- Astronomy questions, or, 'What I always wanted to know about something astronomical, but was afraid to ask...'.
- All sorts of news ideas I haven't thought of....

The WASP, of course, is here to serve you. That's why it depends on you so strongly. Please help out.

And, hey! don't forget the gravy! Ever since people looked up and saw those points of light splashed across the night sky, they wondered about them and what they were. Maybe you've wondered about something up there. And if you've learned something about your interest, how about sharing it with somebody else? Write it down as a feature article. We might even try to publish a little original science fiction, too - if it's good enough .... It's really up to you. I hope to hear from you soon!

One important part of the new editorial policy is reviewed under 'Legal Matters.' Title 17 of the United States Code is the U.S. Copyright Act. Section 106 of this Act generally gives the owner of copyright the exclusive right to and to authorize others to reproduce, prepare derivative works and distribute copies of the protected work, among other things. In short, the Act is designed to protect the rights of authors, etc. to prevent others from taking unfair advantage of that author, etc. This includes collecting monies or other goods from the sale of somebody else's work. It is illegal for anyone to violate any of the rights provided by the Act to the owner of the copyright, Of course, as with most law, ignorance is no excuse.

What happens when you want to quote from someone else's copyrighted work? The Act provides a provision for this in Section 107, known as the doctrine of 'fair use.' It places limitations or specific exemptions on copyright liability. The fair use provision allows quotation of short passages (generally defined as not more than two sentences of prose) in a scholarly or technical work for illustration, clarification or confirmation of the author's observations; and quotations of excerpts (more than two sentences) in a responsible and bona-fide review or criticism of a book for the purpose of illustration or comment. The fair use of a copyrighted work is not considered an infringement of copyright. It is illegal to reprint anything from a copyrighted publication in any other circumstances without the written permission from the person or institution that owns the publication rights.

The new editorial policy includes a section that states all authors and illustrators shall respect the law and be responsible for their work, assuring that it falls within the laws of the Copyright Act.

If you have produced a work that you feel is valuable or important, by all means, protect it under Copyright.

Anyone interested in the official editorial policy should contact the Editor to request a copy.

Thank you.

Unfolding Universe

diagram he created became the observational proving ground against which all subsequent theories have been tested.

The problem of stellar evolution was soon attacked by scores of theoretical and observational astronomers. In England, Arthur Eddington, James Jeans and John Milne endlessly debated the behavior of matter inside stars and how energy might be transferred from within the star throughout its atmosphere. Everyone wondered what the unknown source of energy was that made the Sun and stars glow. While no generally accepted theories appeared for some time, one major contribution, suggested in part by Russell, was that the structure of a star and its position on the H-R diagram was determined by its mass and chemical composition.

The energy source problem was partially solved in the late 1930s by Hans Bethe and George Gamow. They found that the fusion of hydrogen to helium could account for the prodigious amount of energy released by the Sun. Notable contributions from American astronomers in the 1950s finally yielded the present-day, generally acceptable theory of stellar evolution. Today, stars are “seen” to be born, live their lives and die in the flash of a nova on hundreds of high-speed electronic computers found at many universities and observatories in America and around the world. No one has ever seen a star go through its life cycle in reality. Our computers are the only places where billions of years of life can be contracted into a few moments.

(to be continued next issue.)
**Warren Astronomical Society Calendar 1991**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday</td>
<td><strong>General meeting</strong> at Cranbrook Institute of Science.</td>
</tr>
<tr>
<td>September 5</td>
<td><strong>Computer Group</strong> meeting at Larry Kalinowski's house.</td>
</tr>
<tr>
<td>September 6-8</td>
<td><strong>Astrofest '91</strong>, Camp Shaw-Waw-Nas-See 4-H Camp, Kankakee, Illinois. Sponsored by the Chicago Astronomical Society. Contact: Astrofest, P.O.Box 596, Tinley Park, IL, 60477.</td>
</tr>
<tr>
<td>Thursday</td>
<td><strong>Cosmology Group</strong> meeting at Mike O'Dowd's house.</td>
</tr>
<tr>
<td>September 12</td>
<td><strong>Deep Sky Group</strong> meeting at Doug Bock's house.</td>
</tr>
<tr>
<td>Thursday</td>
<td><strong>Business meeting.</strong> Note new summer location: Ridgewood Recreation Center. See page 2.</td>
</tr>
<tr>
<td>September 19</td>
<td><strong>Computer Group</strong> meeting at Larry Kalinowski's house, <strong>Hidden Hollow '91</strong>, near Mansfield, Ohio. Sponsored by the Richland Astronomical Society. Contact: Hidden Hollow '91, P.O.Box 653, Ashland, OH.</td>
</tr>
<tr>
<td>September 26</td>
<td><strong>Computer Group</strong> meeting at Larry Kalinowski's house, <strong>Hidden Hollow '91</strong>, near Mansfield, Ohio. Sponsored by the Richland Astronomical Society. Contact: Hidden Hollow '91, P.O.Box 653, Ashland, OH.</td>
</tr>
<tr>
<td>October 11-12</td>
<td><strong>Computer Group</strong> meeting at Larry Kalinowski's house, <strong>Hidden Hollow '91</strong>, near Mansfield, Ohio. Sponsored by the Richland Astronomical Society. Contact: Hidden Hollow '91, P.O.Box 653, Ashland, OH.</td>
</tr>
</tbody>
</table>