



Pleiades Occultation

President's Message

I remember my first contact with Society members in person was at a First Friday night at Christa McAuliffe Planetarium in January of 2003. Not a lot to see due to fog and haze, but Jupiter was visible and seeing it in a large telescope made a lasting impression on me. I joined the club and bought my first telescope shortly after. That first night linked the two organizations (CMP and NHAS) together forever for me.

Our fundamental mission in NHAS is to educate and promote Astronomy to the public within the state of NH. The primary vehicle we have used for public outreach has been CMP. With our monthly First Friday Sky Watches at CMP and by supporting formally organized CMP events such as Spacetacular Saturday (Astronomy Day to NHAS) we have built through the years a relationship that is both strong and mutually beneficial.

The members supporting these First Friday Sky Watches have been wonderful. Thanks you all for continuing to support our educational mission and our relationship with the Planetarium and their staff. I am proud to be your President for another year!

★ Gardner Gerry
NHAS President 2008

Highlights for this Month

Election of the 2008 club officers took place at the December NHAS Business Meeting, as did an important vote on obtaining property insurance.

A new year means a new series of Astro 101 and 201 courses.

This month's headline item is the lunar occultation of the Pleiades that takes place on 18 January.

Finally we have the latest installment in the series of **John Bishop's** "How They Did It" articles on technology in the ancient world.

★ Paul Winalski
NHAS Secretary 2008

2008 Election Results

At December's meeting we held the election for the 2008 officers and a three-year term as NHAS Director. Except for the Director's position, all ran unopposed. The results were:

President	Gardner Gerry
Vice President	Mike Townsend
Secretary	Paul Winalski
Treasurer	Chase McNiss
Board Member	John Bishop

We all look forward to serving the club in the coming year.

★ Paul Winalski

Property Insurance Motion Passes

The NHAS Board of Directors had moved that we acquire property insurance to protect significant Club assets such as YFOS. After soliciting proxies, at the December meeting we obtained the necessary quorum of the membership to decide the matter. The final vote was unanimous—64 to 0 in favor of acquiring insurance.

★ Paul Winalski

"Freeze Your Buns" Night

The monthly Coffee House Night at YFOS on 8 February 2008 will be our annual "Freeze Your Buns" night. Come dressed for the cold and enjoy

the clear winter observing (at last we hope so) and the warmth of the companionship of your fellow NHAS members.

★ Paul Winalski

Pleiades Lunar Occultation

A waxing gibbous Moon will occult the Pleiades star cluster in Taurus on the morning of Friday, 18 January. The occultation is predicted to occur from approximately 1:30 AM to 3:00 AM. From our latitude, the Moon will pass in front of the stars on the northwestern part of the cluster. Disappearance will be on the Moon's dark limb, which should be quite dramatic. Assuming, of course, that the weather cooperates and lets us see anything at all.

★ Paul Winalski

Comet 17P/Holmes

This object has become too large and diffuse to be easily enjoyed in a telescope, but as of 11 January it was just discernible naked eye at YFOS and was pretty spectacular in binoculars. It is just northwest of Algol in Perseus.

★ Paul Winalski

Membership and Astro 101/201

We have two new members since last newsletter. Please welcome **Joseph Henry** of Westford, MA and **David Getchell** of Salem, NH when you see them at meetings or hear them at sky watches.

We have started the year with Astro 101 and 201 offerings. The most recent was "Telescopes and Optics" presented at the January Coffeehouse. We had seven attendees, despite the cloudy beginning, and we were treated to

periods of clear skies when the presentation was complete.

Courses currently scheduled include:

Astro 101: February 15th: "History of Spectroscopy" will be presented by **R.P. Hale** at CMP following the NHAS Business Meeting.

Astro 201: February 22nd: "Stellar Evolution" will be presented by **John Blackwell** at Grainger Observatory at Phillips-Exeter Academy. Seating is limited, so send your reservation request to **Alan Shirey** if you wish to attend.

April 11th: "Collimation" will be presented by **John Bishop** at 7:00PM at YFOS. John would like clear skies for this hands-on course so registration is required as we may need to alert you to a reschedule.

May 2nd: "How to use your New Telescope" will be presented by Alan Shirey at 8:00PM at CMP coincident with our CMP Skywatch. This course is aimed at the public who have stored their telescopes due to frustration. I am looking for volunteers to help show attendees how to use the various scopes brought to CMP.

Astro 201: February 22nd: "Stellar Evolution" will be presented by John Blackwell at 7:00 PM, Grainger Observatory at Exeter Academy. This course has limited seating and 10 seats are currently available. Registration is required.

To register or volunteer please email me at membership.2008@nhastro.com

★ Alan Shirey

Astro Photons

Hello all!

The Astrophotography Committee has not met in a long time. I think it's time to give newer folks a chance to meet and discuss what's up with some of the more experienced imagers. And it's a chance to use the new projector!

Proposed dates are all Saturday afternoon at 3PM:

January 26
February 2
February 9

Please respond so we can set a date by this Friday's NHAS Business Meeting.

I would like to meet at YFOS so we could set up our gear and demonstrate afterwards. If that won't work I can arrange space at the Nashua Public Library.

★ Gardner Gerry

YFOS Status

I raked the roof.

I plowed the driveway and a couple of places for car. (I'm letting the plow service do the rest).

I shoveled the steps and ramps and made a path to the porta potty.

You might need to sand the driveway. Sand is inconveniently located in the garbage can next to the steps.

Paul Winalski installed an AC-powered (with battery backup) combination CO and explosive gas detector. The efficacy of the detector remains to be experimentally determined.

★ Larry Lopez

NHAS December 2007 Business Meeting

ATM

No report.

YFOS

No report.

Membership

Alan Shirey reports several new members. We are filling the Astro 101 and 201 calendars for the new year. First Astro 101 course will be "Telescopes and Optics" at the YFOS Coffee House Night in January. A session on "What to do with your new telescope" will be held in May in conjunction with CMP.

We are looking for more ideas and presenters for Astro 201 topics.

Public Observing

Paul Winalski gave a report on the observing sessions in late November and early December. Reports were in the December issue of the NHAS Observer

Web Administration

No report.

Radio Astronomy

No report.

Book of the Month

John Bishop presented Cosmic Butterflies, a collection by Sun Kwok of mostly Hubble images of planetary nebulae.

Magazine of the Month

Astronomy Technology Today, a new magazine published bi-monthly. It talks about new equipment, and has lots of adverts.

Scope of the Month

Mike Townsend presented his Vixen 70mm f/13 (900 ml focal length) achromat refractor that he obtained for \$69. It has single-coated lenses, 1/4 wave optics a bit undercorrected spherically. This was a special price from Rivers Camera. Synta is the manufacturer, but Vixen exercises good quality control.

Miscellaneous Business

We need to schedule the business meetings for the upcoming year.

Nominations for 2008 officers and a new member of the Board of Directors were closed. Election results are reported on the first page of this month's Observer.

Another vote was held on the proposal to authorize the Board of Directors to secure property insurance. This time we had a quorum (thanks to proxies) and the final vote was 64-0 in favor.

Evening Program

We were treated to many fine astro images taken by club members, many of whom were in attendance to explain the details of how the images were obtained and processed. Many more images are in the Member's Area on the NHAS website.

★ Paul Winalski

The Bottom Line

Starting Balance:	\$6583.32
Deposits/Credits:	165.00
(Membership)	
Accounts/Paid:	-246.67
(Peerless Insurance, LAB Plowing)	
Net Account Balance:	\$6401.65
Petty cash drawer:	\$100.00
Cash Balance:	\$6501.65

2008 Membership: 112

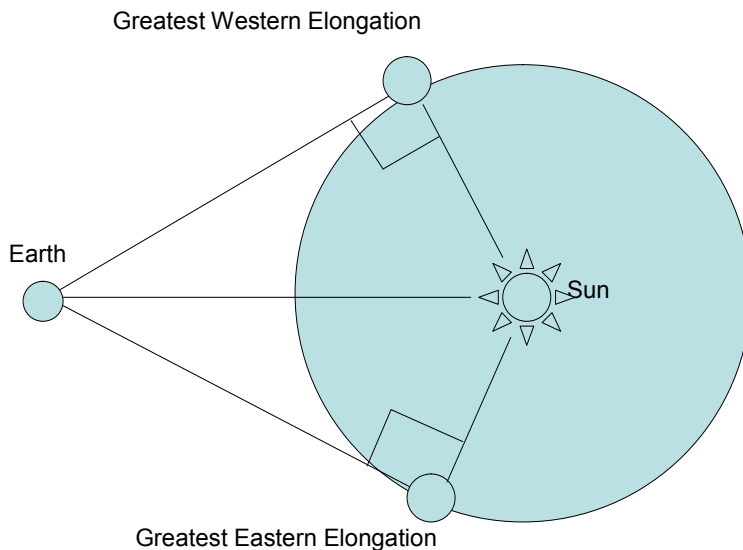
★ Chase McNiss

How They Figured It Out, Part IV

In the last installment I talked about measuring the distance to the Moon. Now let's move out a bit. As before, we assume we are gentlemen of leisure who are interested in astronomy in the ancient world, with time, old records and curiosity but no modern instruments. First, let's measure the distances to the planets.

We assume, as made intuitive sense to everyone in the past, that the planets go in circles. There were a number of reasons why people believed this, but the one that kept the belief going was that it led to very simple models that correctly explained what people saw. So while it was important as a starting point that circles were "perfect", if they had not led to productive models they would have been rejected as an assumption.

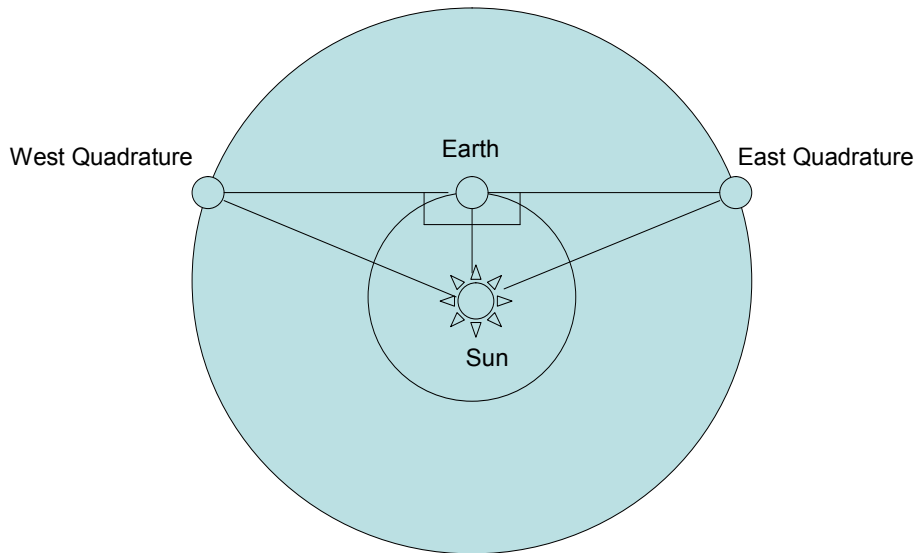
Let's start with an inner planet: Venus or Mercury. Over the years you'd see them move around but they would never move far from the Sun. They were therefore assumed to be closer to the Sun than the Earth, which accounts for the name "inner planets". Either would have a maximum distance it could be from the Sun, and from that you could calculate the radius of the inner planet's circular orbit in terms of the Earth's distance from the Sun. In the diagram below, the inner planet is moving counter-clockwise.



In this diagram, we know our line of sight from Earth to either "Greatest Elongation" is tangent to the circle of the planet's orbit. It's thus at a right angle to the line from the Sun to the planet. We can measure the angles directly or indirectly. Directly we can measure the angle between the planet and the Sun, though it is tricky to see a planet in the sky when the Sun is up. Indirectly we can assume that the planet moves with uniform velocity and measure the angle by considering the ratio of the number of days between the two elongations. Thus Venus's trip from West to East takes about 140 days, while the trip from East to West takes about 443 days. So the angle between West and East is $(360 * (140/(140+443)))$ or about 86 degrees. The Earth-Sun-Venus angle is half that, or 43 degrees. The Sun-Venus distance in terms of the Sun-Earth distance is thus the cosine of 43 degrees, or about .73. A similar argument works for Mercury's orbital radius.

Note that we are using the Earth-relative orbital periods for the inner planets. These are the "synodic" periods. The assumption that the Earth is not moving is a simplification which doesn't change the calculated distances. If we later decide the Earth is moving we don't have to throw out the results of this calculation.

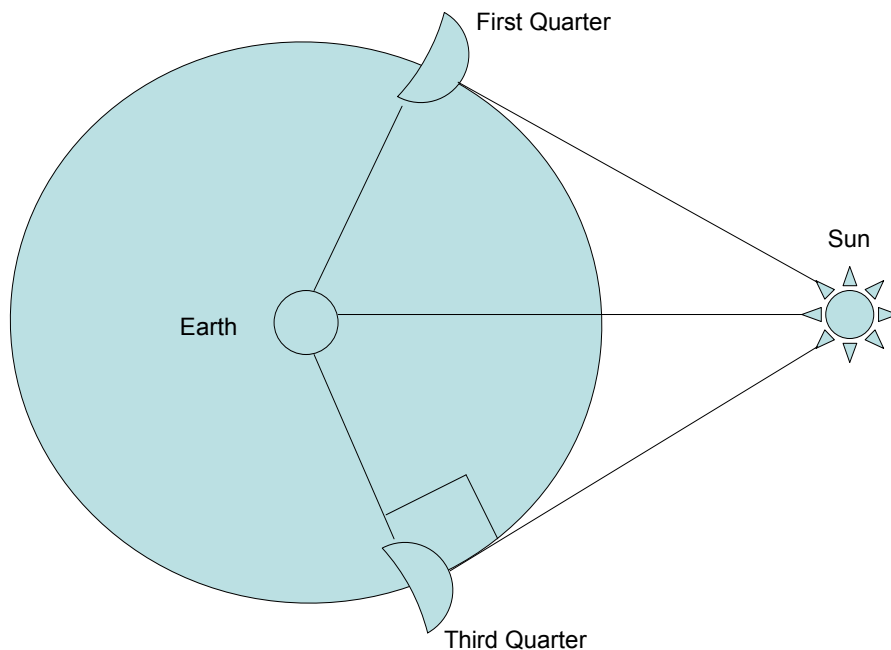
The outer planets involve a different calculation relating to quadrature (the moment when the Sun and the planet are 90 degrees from each other. This is a harder measurement to make so the accuracy is lower.



Again we count days between the two quadratures and express the smaller number as an angle. Half of that angle is the Earth-Sun-Quadrature angle, and from that we can calculate the orbital radius of the outer planet in terms of the Earth-Sun distance. In the case of Jupiter, 175 days from East to West and 224 days from West to East gives an angle of 78 degrees for the Jupiter-Sun-Earth angle. In terms of the Sun-Earth distance, the Sun-Jupiter distance is the inverse of the cosine of 78 degrees, or about 4.8.

You may note that these are all relative to the Earth-Sun distance. Until that is known, all the other distances in the solar system must be expressed in terms of that distance. Until very recently there were only guesses at the actual Earth-Sun distance, and people therefore used the "Astronomical Unit" as an unmeasured (but big) distance unit.

But we can still put some limits on that distance. To begin with, we know the Sun is further than the Moon (because of total solar eclipses). We draw this diagram and count the number of days (and fractions of a day) between first-quarter and third-quarter Moons:



If the Sun were as close as in the diagram, the time between third quarter and first quarter would be considerably shorter than the time between first quarter and third quarter. We don't observe that kind of big difference. We do know we might be as much as a day off in judging the exact moment of a quarter-Moon, so we can't reliably use the differences we do measure to

calculate a distance, but we can use our known inaccuracy to put a lower limit on the distance. The astronomers of the ancient world used this method to calculate that the Sun is at least 15 and probably more than 30 times further away than the Moon.

Even at 30 times, this is a wild underestimate (the true ratio is about 400!), but it's good enough to show that the Sun is much bigger than the Earth. That's one of the reasons why a good many Classic-era astronomers considered the Sun-centered system a better description of reality than an Earth-centered system.

At this point, let's sum up what could be figured out, using the consensus figures from the Classical era rather than my crude calculations:

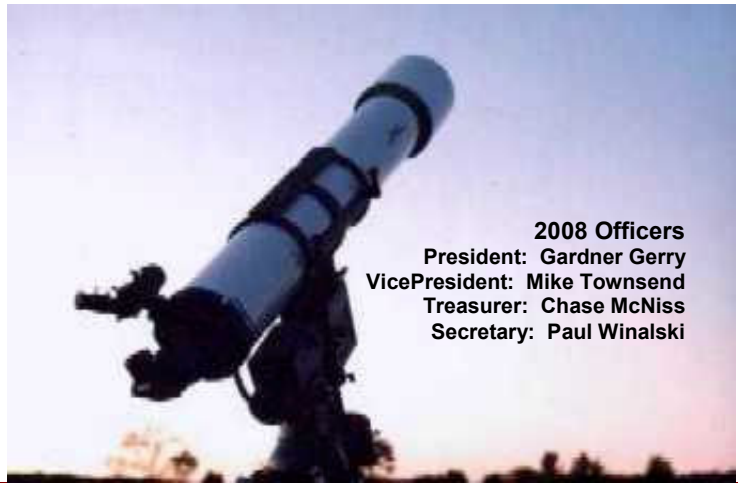
1. The Earth's radius is about 4000 miles;
2. The Moon is about 60 Earth-radii away (240,000 miles);
3. The Moon is about 2,000 miles in diameter;
4. The Sun is more than 30 Earth-Moon distances away (7,200,000 miles); this is one Astronomical Unit (AU);
5. The Sun is thus at least 60,000 miles in diameter;
6. Mercury is about .4 AU from the Sun, Venus .8, Mars 1.6, Jupiter 5.2 and Saturn 10;
7. The stars are further than Saturn and thus at least 10 AU away.

These are impressively good numbers. While the scale is off a bit, the size and scope of the Solar system is clearly understood. The Moon is a place. The Sun is huge. The distances are immense, quite out of the day-to-day human experience. Figuring all this out was a significant achievement in ancient science.

Note that if the stars were as close as 20 AU and the Earth moved around the Sun we would see stellar parallax. Since we didn't see any parallax, this was an apparent proof that the Earth did not move. If the Earth were in orbit around the Sun with a 14-million mile baseline, then in order for us not to see parallax, the stars would have to be hundreds of millions of miles away – an obvious absurdity!

In the next installment: how big the planets are and other things they could have figured out but didn't.

★ John Bishop



2008 Officers
President: Gardner Gerry
VicePresident: Mike Townsend
Treasurer: Chase McNiss
Secretary: Paul Winalski

DEADLINE February 2008 Issue: 5 PM February 13

E-mail articles to the Editor.

CHANGE OF ADDRESS – Notify the Treasurer of changes to postal or e-mail address.

How to Join N.H.A.S.

Write to us:

NHAS
P.O. Box 5823
Manchester, NH 03108-5823
Attn: Treasurer

Send E-mail to:

info@nhastro.com

Use our web site:

<http://www.nhastro.com/>

This month's contributors:

Gardner Gerry, Alan Shirey, Larry Lopez, John Bishop, Chase McNiss, Paul Winalski

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NHAS Upcoming Events

Event	Date	Time	Location
NHAS Business Meeting	Jan 18	7:30 PM	St. Anselm College
CMP Public Sky Watch	Feb 1	7:00 PM	Christa McAuliffe Planetarium
“Freeze Your Buns” Coffee House Night	Feb 8	5:00 PM	YFOS
NHAS Business Meeting	Feb 15	7:30 PM	Christa McAuliffe Planetarium
Astro 101: History of Spectroscopy	Feb 15	8:30 PM	Christa McAuliffe Planetarium
Astro 201: Stellar Evolution	Feb 22	7:00 PM	Grainger Observatory, Phillips-Exeter Academy
CMP Public Sky Watch	March 7	7:00 PM	Christa McAuliffe Planetarium