



STAR FIELDS

Newsletter of the
Amateur Telescope Makers of Boston
Including the Bond Astronomical Club
Established in 1934
In the Interest of Telescope Making & Using

Vol. 34, No. 7 July 2022

This Month's Meeting . . .

Thursday, July 14th, 2022 at 8:00 PM

[Zoom On-line Meeting](#)

All ATMoB meetings scheduled for the Center for Astrophysics (Harvard & Smithsonian) in Cambridge, MA have been **canceled indefinitely** due to concerns over the [coronavirus](#) outbreak.

We are holding virtual on-line meetings using the Zoom application. Please refer to the [ATMoB website](#) for future meetings. Members should check their email on the ATMOB-ANNOUNCE list for additional information. Please [select this Zoom link to attend the 954th Meeting of the Amateur Telescope Makers of Boston.](#)

Members Night

July is our Members Night meeting, where we tap into our membership for presentations on topics of interest and personal project work. The members' meeting is a favorite. It's always interesting to see what other members are working on, or what they are passionate about. This time we will hear from Christine Zacharer on high power amateur rocketry, and from Tom Consi on amateur radio astronomy.

An Overview of Amateur Rocketry

Christine Zacharer's talk will focus on an overview of amateur rocketry, from the low power model rockets which many of us built as kids, all the way up to amateur high powered rocketry which requires licensing and regulation. The talk will be more of an overview, as opposed to delving into any particular detail.

Vice President Christine Zacharer is a science and math teacher at the Bromfield School in Harvard, Massachusetts, where she is the advisor to the school's GSA and advisor to its rocket science club. She is an out and proud nerd, certified rocket science educator mentor, and is licensed to fly high powered

amateur rockets. In her spare time, when she is not gazing through her binocular telescopes, or designing some gadget for 3D printing, she prepares lessons for school. Christine is an outspoken advocate in the LGBTQ+ community and has been on numerous panels regarding best practices for transgender related health care.

Exploring the Universe in the Frequency Domain

Tom Consi's talk will explore the universe in the frequency domain. Tom will discuss his first foray into amateur radio astronomy with the goal of detecting the Neutral Hydrogen or H1 signal from the Milky Way. He will present the design of his simple radio telescope consisting of a 1m parabolic mesh antenna, software defined radio (SDR) module and open-source software. He will also give a brief introduction to software defined radio.

Tom Consi is a teaching professor in the Dept. of Electrical and Computer Engineering at Northeastern University. An ATMoB member since 2016, Tom's astronomical interests include planetary imaging, spectroscopy, and radio astronomy.

~ *Cory Mooney* – *President* ~

President's Message . . .

I remember the first ATMoB meeting I attended in 2017. It was so exciting to find such a large group of people who were all so passionate and knowledgeable about astronomy. Everyone I spoke to was so friendly and welcoming. It was easy to strike up conversations, trading tips and tricks, learning about projects, and hearing about the incredible stories and careers of many of our members. This club is such a welcoming community; it did not take long to develop a real sense of belonging. If you had asked me then, I never would have guessed that I would one day become president of the club. I thank you all for this unbelievable opportunity.

I'd like to thank our outgoing President Rich Nugent for his two years of guiding us through the challenges brought on by COVID-19. There was a lot to adjust to, and he kept us in high spirits going through it. All the while Rich brought us a wide ranging list of interesting speakers from across the country, and even across the sea! He leaves a tough act to follow; I hope I can do half as well.

I also want to acknowledge and thank the board and committee members for all of their efforts over the preceding years. Make no mistake, when it comes to keeping the club running daily, these are some of the real heavy lifters. We are very lucky to have such committed volunteers behind the scenes.

As I step into the presidential role I'm looking forward to searching for and bringing in some interesting and varied speakers for our meetings. I also hope to organize some small field trips or outings to nearby observatories or parks after dark.

I'd like to bolster our in-club engagement and participation, as well as our outreach and community exposure. A lot of this will depend on how COVID-19 progresses.

COVID-19 is still a significant and variable concern, so we will continue to meet remotely with Zoom for the time being. I really hope things improve to the point where we can resume in-person meetings this year, but it's hard to guarantee anything with so much uncertainty.

Regardless, I hope to serve the club well in the coming year. Thank you all.

~ *Cory Mooney – President* ~

Summary of the ATMoB Board Meeting . . .

The ATMoB Board met on Thursday, June 23, 2022 from 8 pm to 10:40 pm. Most of the agenda was to approve the annual budget for 2022-2023. The FY2023 budget was approved by a unanimous vote. Budgeted improvements to facilities include:

- A filter slider with O-III and UHC filters for the 25" Dob, as well as an 8mm Ethos eyepiece to complete the donated set of eyepieces.
- Toomey Observatory improvements including a new computer, and completing the mounting of the donated 5" APO telescope.
- Mittelman-ATMoB Observatory improvements including buying our own Johnson-Cousins B and V filters (to replace those loaned to us by Arne Hendon of AAVSO), mounting our all-sky camera on a tall mast, and installing a pannable and zoomable outdoor video camera on the clubhouse to allow us to assess the state of the grounds from our website.

Accounting for all of this, there will be a small loss at the end of 2022-2023, more than offset by the surplus we enjoyed at the end of 2021-2022.

Other discussion items included:

- We discussed offering several surplus items for sale, including
 - A TeleVue 31mm Nagler eyepiece, which has an undesirable exit pupil when paired with most of our telescopes.
 - The Celestron 14-inch SCT that previously occupied the Toomey Observatory, along with selected accessories.
- Whether we should replace the furnace in the Clubhouse with a heat-pump or other electric heating. MIT would like to replace the oil tank, and is meeting with club members soon to discuss options.

- Approving the proposed website design as provided by the Website Committee. New features of the website include embedded videos of our most recent public video.

- Whether ATMoB might be interested in sponsoring or co-sponsoring "The Conjunction" after its currently planned final event next year. The Board was in favor of this provided that we can find volunteers to help.

- How long we should wait for the Harvard Center for Astrophysics to re-open before considering other options. If anyone has other ideas about where the club could meet, please let the Board know!

~ *Alva Couch – Secretary* ~

Meeting Recordings . . .

The recording of ATMoB meeting #953 is available on YouTube: <https://youtu.be/INM6PIWilgw>

I would like to thank Phil Levine for giving his talk.

This link is to the publicly available cut of the meeting recording. To view the original version of the meetings, please see the Announce Forum on the ATMoB Website <https://www.atmob.org/forums>

~ *Chris Elledge - Membership Secretary* ~

Membership Report . . .

I am pleased to welcome our newest members: Donald Beahm; Jesse Carter; Sumana Gopinath, Shekhar Bangalore Sastry, & Kriti Kashyap; Paresch Khanapurkar; Yoav Orot & Skyler Inman; Nathan Paquet; Patricia Pignata; Allan Scalise; David Schwartz; & Rasil Sheikh.

As of July 1st, 2022 we have 366 memberships covering 459 members. This is broken down as follows:

- 154 Regular Members
- 143 Senior Members
- 12 Student Members
- 55 Family Memberships covering 148 Members
- 2 Honorary Members

Renewals for all members began on June 1st except for members who joined after January 1st this year. Please visit the website at <https://www.atmob.org/renew> to begin your renewal. You may need to login and revisit the link to proceed. If you want a printed newsletter mailed to you each month, then you need to select one of the membership levels that include "with Mailed Newsletter" in the type.

You can also download the membership application from the website at <https://www.atmob.org/signup> by clicking on the "Download an application" link.

Please contact me if you need any help with renewing or logging into the website.

~ *Chris Elledge – Membership Secretary* ~

June Meeting Minutes . . .



Phil Levine on Zoom. *

ATMoB 953rd Meeting Minutes June 9, 2022

Rich Nugent presented the President's welcome. He thanked everyone who made the past two years a success. The election of club officers will be ongoing until June 12. COVID-19 update: Friday/Saturday Clubhouse duty will resume in September. There are now 27 A-list volunteers available to open and close the Clubhouse. Saturday work parties have resumed. The Center for Astrophysics remains closed to outside groups.

- Alva Couch presented the Secretary's report, including a summary of the in-depth analysis of environmental and health effects of light pollution by Mario Motta.
- Eileen Myers presented the Treasurer's report for the month of May, and reported budgeted outflows for MAO supplies, with inflows from membership and donations.
- Eileen Myers also presented the annual Treasurer's Report, including an overview of inflow and outflow for the entire year, showing net income despite expenses in deploying the Mittelman-ATMoB Observatory (MAO) and installing an EQ platform on the 25-inch Dobsonian. Thanks to those who donated to ATMoB in the past year!
- Chris Elledge presented the Membership report and welcomed new members Daniel Abraham; Jane Barrett; Jesse Carter; Stephen Deal; Sumana Gopinath, Shekhar Bangalore Sastry, and Kriti Kashyap; Jiaming Huang; Nathan Paquet; and Patricia Pignata.
- Rich Nugent presented the Observer's report. June highlights include close encounters between the Moon and the planets Saturn and Jupiter. Variable star SS Cygni's next outburst is expected near June 25. Glenn Chaple continues to generate monthly recommendations for observation and recommends a monthly challenge object. Rich Nugent continues to contribute the monthly mailing "19+ objects to observe" and generates alerts for interesting solar events in h-Alpha.

Total lunar eclipse images from May 15-16, 2022 were contributed by Sal LaRiccia, Mark Helton, Bert Halstead, Joseph Rothchild, Bruce Berger, and Doug Paul.

The June Observer's Challenge was NGC 5474, with images contributed by Doug Paul, Mario Motta, David Rust, and Chris Elledge, and a sketch contributed by Glenn Chaple.

The July Observer's Challenge is NGC 6210, a Planetary Nebula in Hercules. Please email Rich or Glenn your images before the next club meeting!

- Steve Clougherty presented the Clubhouse Committee yearly report. This year there were 9 work parties with an average of 20 volunteers each. In preparation for resuming Clubhouse operations after a long coronavirus-induced hiatus, clubhouse projects included general cleaning, de-cluttering the barn, organizing donated equipment and ATM parts, rebuilding the front door of the barn, and replacing the fan in the bathroom. A new riding mower greatly eases clubhouse grounds maintenance. The equatorial platform for the 25-inch Dob was installed and has worked flawlessly since its installation. We are grateful to member Jim Mahoney, who generously donated a set of TeleVue Ethos eyepieces with which one can now observe objects at up to 600 power through the 25-inch Dob, assisted by the tracking provided by the new equatorial platform. In addition, we are grateful to the members who, at short notice, came to the clubhouse to assist in snow removal last winter.
- Chris Elledge presented the Mittelman-ATMoB Observatory (MAO) year-end report. The MAO committee has been meeting weekly since we began the project. This year, Al Takeda cleaned out the electronics shop and transformed it into a MAO control room. Bruce Berger and friends installed new networking equipment for the MAO and Toomey Observatory; we now have 10 gb connectivity to the control room. James Chamberlain created an observing conditions status system using a single-board computer, which is displayed on a monitor in the control room. A new deck was designed by Alan Sliski and built by several club members. Both the control room and telescope room are protected by Uninterruptible Power Supplies (UPS's). The above names are a small sample of the sustained efforts of a much larger MAO working group.

The system is now running in automated mode using the ACP scheduler, thanks to the efforts of Chris Elledge. Several club members are requesting scientific data collection, to be submitted to AAVSO and other organizations. Chris Elledge has been translating spreadsheets containing observation requests into ACP jobs to be scheduled for observing. For example, Exoplanet data collected by the MAO was analyzed by Gary Shaw; MAO images were contributed by Chris Elledge and Christine Zacharer.

Next steps include installing an all-sky camera to be accessible on the ATMoB website, improving cable management in the telescope room, testing flat image methods, developing a [web-based] imaging request form, and inviting more users to use the MAO and Toomey

Observatory. Projects that require volunteers include installing gadgets such as the all-sky camera; planning scientific observation, including proposals to observe exoplanet transits and asteroid occultations; and analyzing the images we already collected to practice image processing and scientific data extraction.

- Rich Nugent presented the Outreach Committee yearly report. All planned school outreach events this year were canceled due to either scheduling conflicts or inclement weather. Rich Nugent brought a telescope to the Tower Hill Botanical gardens in Berlin, MA for lunar observing on three evenings during July and August 2021.

Meanwhile, the Library Telescope Program has been very successful this year. ATMoB has placed a total of 17 library telescopes:

- 12 to the Boston Public Library branches
- 2 in Chelmsford
- 1 in each to Belmont, Everett, and Chelsea.
- Two placements are pending in Medford, MA and Saco, ME.

We held a successful library telescope modification party at the New England Sci-Tech center on April 9, 2022, and prepared 12 telescopes for library deployment.

The Outreach Committee seeks an ATMoB member to help with library telescope outreach efforts on the South Shore and Cape Cod.

The Outreach Committee plans upcoming events for the Billerica Elks Club and the Tower Hill Botanical Gardens.

- Maria Batista presented the year-end report for the Website Committee, which has met bi-weekly since July 2021. Activities included page content updates and content reorganization. Next steps include presenting the website to the board, switching to the new version after approval, and updating existing pages for new information and opportunities.
- Old business: <https://smile.amazon.com> is a great way to donate to ATMoB while shopping on Amazon.
- New Business: None

This month's presentation by Phil Levine discussed the history and contributions of astronomer Sir Fred Hoyle. From a young age, Fred Hoyle was a non-conformist; after a disagreement with his teacher, he skipped school and instead visited the canal engineering works near his home in Gilstead, West Yorkshire. After attending college at Emmanuel College, St. John's College, and Cambridge University, Fred Hoyle solved the difficult problem of identifying aircraft at sea from their radar profiles.

Although Hoyle was famous for coining the term "Big Bang", he actually intended this term to be disparaging of the theory, and spent his whole career instead advocating for variants of the

steady state theory of the universe. Among his most significant contributions was the landmark paper "Synthesis of the Elements in Stars" (1957), a collaboration with Margaret Burbidge, Geoffrey Burbidge and William Fowler. The paper describes how stars burn lighter elements into successively heavier atoms. Those atoms are then expelled to form other structures in the universe, structures such as stars and planets. Although the Nobel Prize was given to co-author Fowler for the description of how elements in the periodic table are created via fusion, Hoyle was not named as a co-contributor, possibly because in recent history he had published disparaging remarks about the Nobel Committee. Fowler wrote that Hoyle deserved to be named as a co-awardee.

Later in Sir Hoyle's career, he published several visionary and controversial papers, including writing about the possibility that DNA arrived from space, as well as his doubts about the accuracy of Darwin's theory of evolution. The evidence for his view includes that carbon, the basis of all life on Earth, is very unlikely to form by chance, and if any one of several physical constants changes just a little, carbon does not form in the fusion of stars. He also calculated that the probability of life and DNA arising from evolutionary processes was one in 10^{40} : 1 with 40 zeros after it. Thus, he believed that some external intervention was necessary for life to exist on the Earth.

Corrections: Phil Levine wrote to us after the talk and stated that he mischaracterized the work of Bell, Ryan, and Hewitt as the study of "quasi-stellar objects." The work of all three concerned pulsars, and the Nobel Prize that was presented to Ryan and Hewitt without acknowledging Bell was for pulsar research. Thanks to Phil for this correction!

~ Alva Couch – Secretary ~

Clubhouse Report . . .



Joe Dechene using a Spherometer *

Our monthly Clubhouse work session was held on Saturday, June 11 under cloudy skies and mild temperatures. A total of 22 members were on hand to help out. Our first priority was lawn mowing, which was completed by late morning. Our riding mower has been a wonderful addition to the manual power mowers making short work of this task. Weed whacking and trimming around the Clubhouse and observatories was also completed.

Inside the Clubhouse several volunteers tackled the second floor Office/Archive room which had many years' worth of accumulated stuff cluttering the room to the point where it had been rendered completely unusable. Old furniture and office equipment was removed while a couple of volunteers made a "dump run." The old desk in the room was uncovered and is now usable. Although not yet finished, the office will be functional in the near future. We have now completed the reorganization of every room in the clubhouse, including the barn and barn loft!

Our 25-inch Dobsonian has a newly installed handle to help resetting the EQ platform. Tracking has been spot on with our platform. A new dew controller was also installed along with 4 dew heater strips.

A new cable guide for the Mittelman-ATMoB Observatory's lifting pier was installed. Hopefully this improvement will prevent cable entanglements with the pier.

We would like to thank Eileen Myers for making a wonderful home cooked meal!

Thanks go out to the following member-volunteers for all the work accomplished at the June work session: John Blomquist, Paul Cicchetti, Steve Clougherty, Alva Couch, Joe Dechene, Chris Elledge, Eric Johannsen, Dick Koolish, Phil Levine, John Maher, Jim McLaren, Steve Mock, Corey and Kiera Mooney, Eileen Myers, Paul Norris, Rich Nugent, John Reed, Phil Rounseville, Alan Sliski, Art Swedlow, and Al Takeda.

Our next work session will be held on Saturday, July 16.

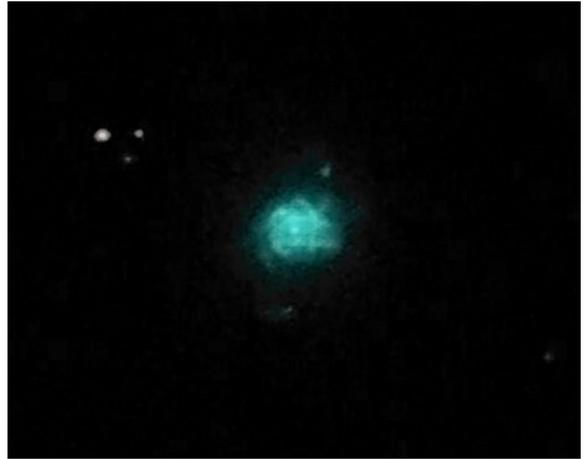
~ *Clubhouse Committee Chairs* ~
~ *Steve Clougherty, John Reed and Dave Prowten* ~

Observer's Challenge** . . .

July, 2022

NGC 6210 Planetary Nebula in Ursa Hercules
Magnitude 8.8
Size 20" X 13"

A majority of the non-Messier deep sky objects featured in the Observer's Challenge were discovered by the German-English astronomer William Herschel during surveys conducted in the latter part of the 18th century and early years of the 19th. One of Herschel's more notable "misses" was this month's Challenge, the bright planetary nebula NGC 6210 in Hercules. Perhaps its relatively small size (a mere 20 X 13 arc-seconds and almost stellar-looking when viewed with low magnification) was to blame. But Herschel was able to detect the non-stellar appearance of Uranus when he discovered the planet in 1781, and its disc is just 4 arc-seconds across. Whatever the reason, NGC 6210 remained undetected until stumbled upon by the German-born Russian astronomer Wilhelm Struve while searching for double stars in 1825.



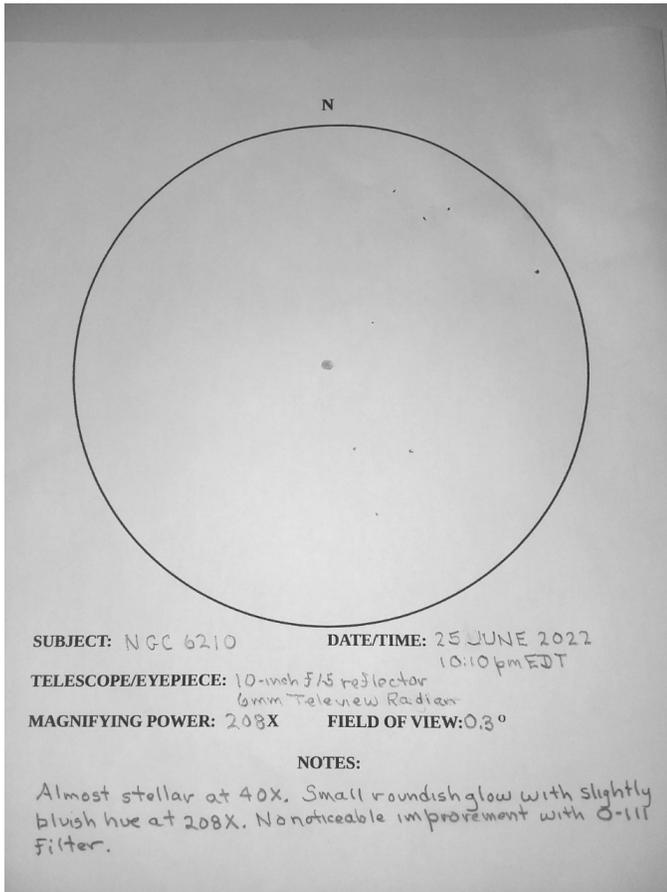
Canon 80D, 1200mm f/8 lens, ISO 800, 180 x 30sec = 90min total exposure, 200% scale, North up. Image by Doug Paul.

NGC 6210, nick-named the "Turtle Nebula" for its appearance in astroimages and visually through large-aperture scopes, is situated south of the "Keystone" of Hercules at 2000.0 coordinates RA 16h 44m 29.5s and Dec +23° 47' 59.5". It's about 4 degrees northeast of the 3rd magnitude star beta (β) Herculis, a good starting point for star-hoppers working with a low-power eyepiece (refer to Finder Chart B). You'll know you've hit the mark when you arrive at a thin triangle 18 arc-minutes long and comprised of two 7th magnitude stars and a slightly out-of-focus 9th magnitude object (NGC 6210).

Even the smallest of astronomical telescopes will pick up NGC 6210. I first saw it on the evening of May 27, 1978, using a 3-inch f/10 reflector. In my logbook, I wrote, "At 30X, this object is still nearly star-like. At 60X, it seems more diffuse, and at 120X is definitely nebulous." I saw no indication of color.

Recently, I returned to NGC 6210 with a 10-inch f/5 reflector. Again, low power (this time, 40X) revealed little more than a near-stellar image. A switch to higher magnification (208X) brought out a slightly bluish hue, but there was no sign of the outer extensions that form the "Turtle's" head and appendages. I also failed to pick out the 13th magnitude central star. Darker skies (mine had a limiting magnitude of 5) and/or more aperture would have done the trick.

After giving NGC 6210 its due respect, turn your gaze to the 7th magnitude triangle member that lies 18 arc-minutes south and slightly west. This is the tight double star Struve 2094 (Σ 2094). Its magnitude 7.5 and 7.9 component stars are just 1.1 arc-seconds apart, so I recommend using a scope with minimum aperture of 4 inches and a magnifying power of at least 200X on an evening when the seeing conditions are as steady as possible. An 11.7-magnitude third component lies 25 arc-seconds northwest of the main pair.



10-inch f/5 reflector at 208X. North is up in this 0.3 degree field. Sketch by Glenn Chaple. [Click this link for an enlarged view.](#)



Chart A - theskylive.com

NGC 6210 is about 6500 light years away. The bright central portion is roughly one-half light year in diameter, while the "Turtle" spans 1.6 light years.

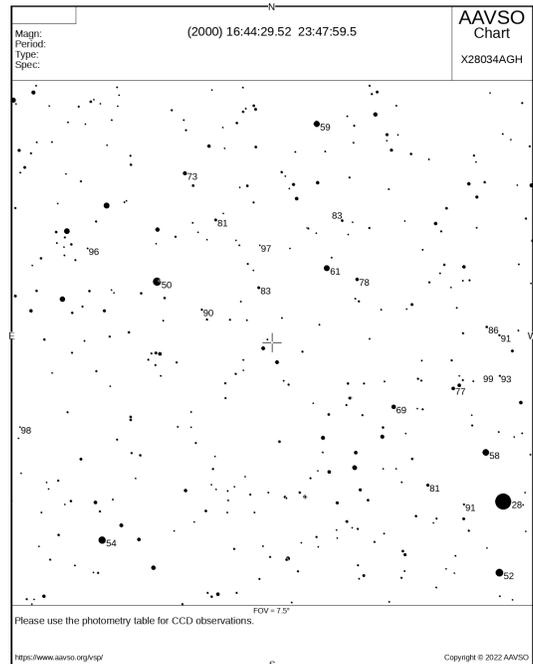


Chart B - Chart created using the AAVSO's Variable Star Plotter (VSP). The location of NGC 6210 is marked with a crosshair. Numbers are stellar magnitudes, decimals omitted. The 2.8 magnitude star is beta (β) Herculis. Stars plotted to 10th magnitude. North is up in this 4 X 4 degree field. The star just below and slightly right of NGC 6210 is Struve 2094.

**The purpose of the Observer's Challenge is to encourage the pursuit of visual observing. It is open to everyone who is interested. If you'd like to contribute notes, drawings, or photographs, we'll be happy to include them in our monthly summary. Submit your observing notes, sketches, and/or images to Roger Ivester (rogerivester@me.com). To find out more about the Observer's Challenge or access past reports, log on to <https://rogerivester.com/category/observers-challenge-reports-complete/>.

~ Submitted by Glenn Chaple ~

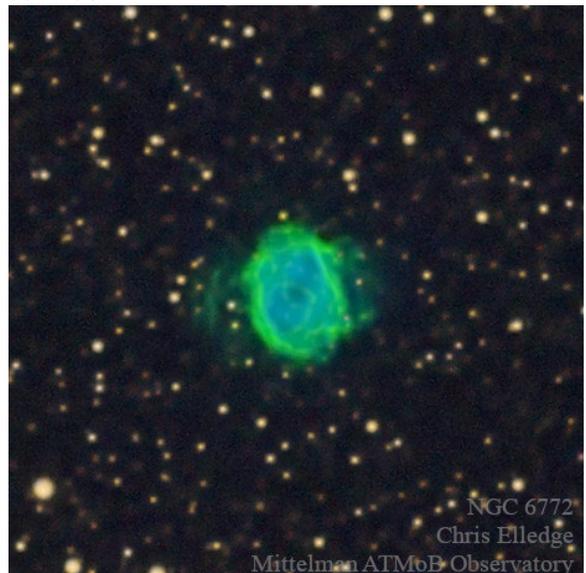
Observer's Challenge** ...

August, 2022

NGC 6772 Planetary Nebula in Aquila

Magnitude 12.7

Size 70" x 56"



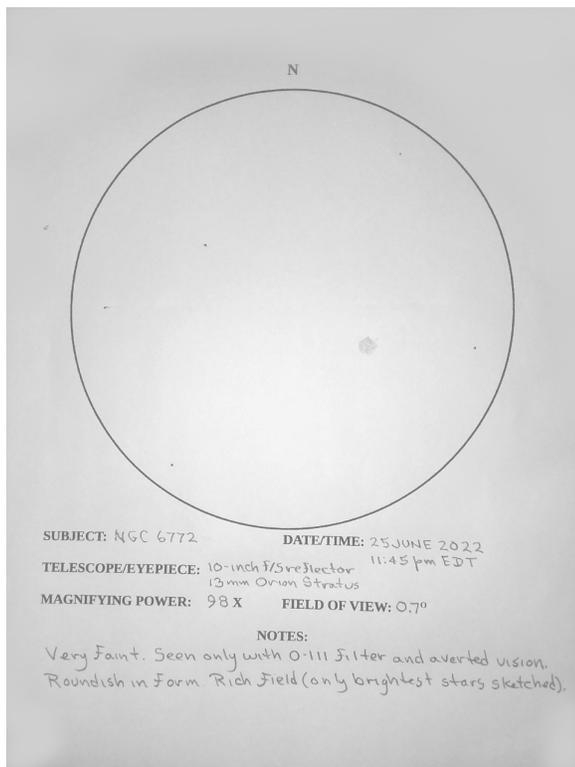
NGC 6772. SHO pallet, 12 x 300 second, SII, H-alpha, OIII. Imaged by Mittelman-ATMoB Observatory. Processed by Chris Elledge.

The July Observer's Challenge featured the bright planetary nebula NGC 6210 in Hercules. This month we visit another planetary nebula - one that, to put it bluntly, isn't so bright. NGC 6772 is about the same size as M57, the Ring Nebula (70" X 56" to 86" by 62"), but is 4 magnitudes fainter (12.7 to 8.8). To see it visually you'll need a dark sky, reasonably large aperture scope, and (highly recommended) a nebula filter.

NGC 6772 is located in the southwest corner of Aquila at 2000.0 coordinates RA 19h 14m 36.4s, Dec -2° 42' 25.0". Star-hoppers can find their way here by beginning 3 degrees southwest at 3rd magnitude lambda (λ) Aquilae (see Finder Chart B).

William Herschel may have overlooked NGC 6210, but his capable eye spotted NGC 6772 on the night of July 21, 1784. He described it as "very faint, round, nearly of equal light throughout, about 1' in diameter, In the midst of numberless stars of the Milky Way,"

This planetary nebula proved to be a challenge when I tackled it on the night of June 25, 2022, with a 10-inch f/5 reflector. A limiting naked eye magnitude of 5 didn't help. I was unable to see anything with an unfiltered view. Placing an O-III filter into a 13mm eyepiece brought out an extremely elusive roundish glow that I could only detect with averted vision. As Herschel had noted 238 years earlier, "it was immersed in a field littered with faint stars".



10-inch f/5 reflector at 98X. North is up in this 0.7 degree field. Sketch by Glenn Chaple. [Click this link for an enlarged view.](#)

Sources ascribe a distance of 4000-4200 light years to this planetary. Its true diameter may be in the order of 1.5 light years.

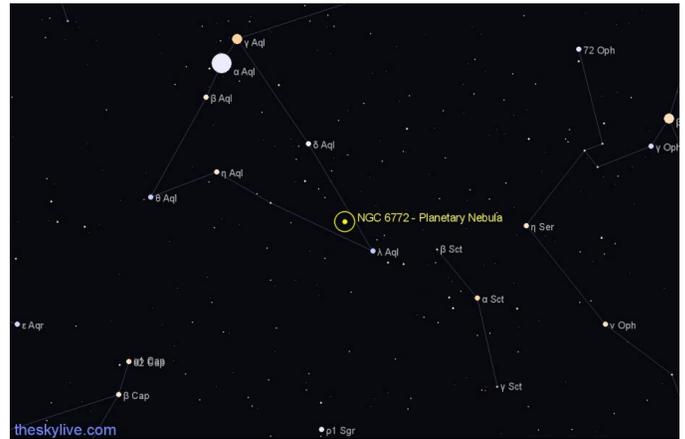


Chart A: theskydrive.com

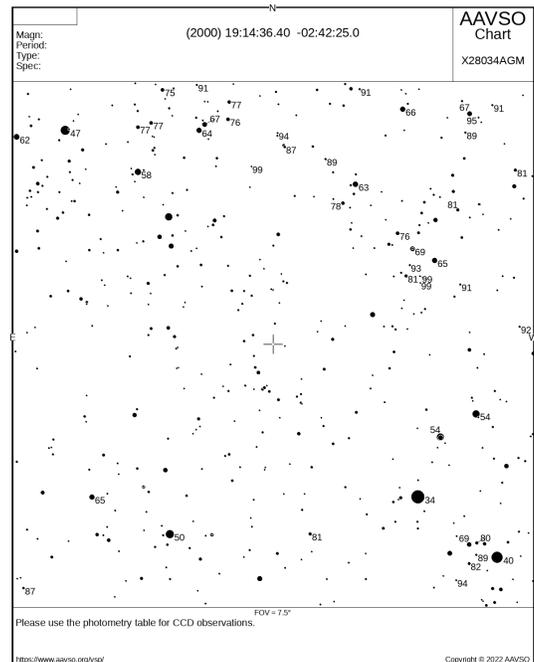


Chart B: Chart created using the AAVSO's Variable Star Plotter (VSP). The location of NGC 6772 is marked with a crosshair. Numbers are stellar magnitudes, decimals omitted. The 3.4 magnitude star is lambda (λ) Aquilae. Stars plotted to 10th magnitude. North is up in this 3.5 X 3.5 degree field.

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~ Submitted by Glenn Chaple ~

Editor: * Photos by Al Takeda unless otherwise noted.

September Star Fields DEADLINE
Sunday, August 21st

Email articles to Al Takeda at
newsletter@atmob.org

Articles from members are always welcome.

Amateur Telescope Makers of Boston, Inc.
c/o Chris Elledge, Membership Secretary
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MEETINGS: Zoom On-Line Meetings until further notice. Meetings held the second Thursday of each month (September to July) at 8:00 PM. For meeting details go to www.atmob.org and check your email on the ATMOB-ANNOUNCE list.

CLUBHOUSE: Latitude 42° 36.5' N Longitude 71° 29.8' W

The Tom Britton Clubhouse is currently closed. It is the white farmhouse on the grounds of MIT's Haystack Observatory in Westford, MA. Take Rt. 3 North from Rt. 128 or Rt. 495 to Exit 33 and proceed West on Rt. 40 for five miles. Turn right at the MIT Lincoln Lab, Haystack Observatory at the Groton town line. Proceed to the farmhouse on left side of the road. Clubhouse phone #: (978) 692-8708.

Heads Up For the Month . . .

To calculate Eastern Daylight Time EDT subtract 4 from UT.

Jul 6 First Quarter Moon (Moonset at midnight)
Jul 13 Full Moon
Jul 18 Jupiter 2 degrees North of the Moon
Jul 20 Last Quarter Moon (Moonrise at midnight)
Jul 21 Mars 1 degree North of the Moon
Jul 28 New Moon
Aug 5 First Quarter Moon (Moonset at midnight)
Aug 11 Full Moon
Aug 12 Perseid meteors peak
Aug 19 Last Quarter Moon (Moonrise at midnight)
Aug 27 New Moon, Mercury at greatest eastern (evening) elongation