

REFLECTIONS

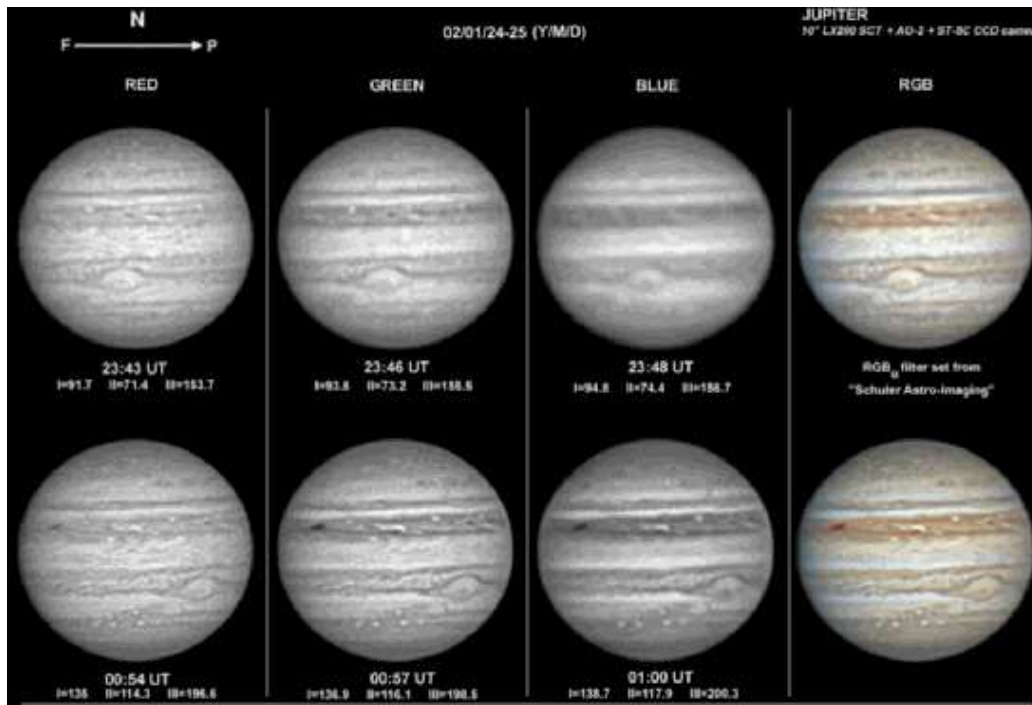
REFRACTIONS

of the University Lowbrow Astronomers

February 2002



The University Lowbrow Astronomers is a club of Astronomy enthusiasts which meets on the third Friday of each month in the University of Michigan's Physics and Astronomy building (Dennison Hall, Room 130 or 807). Meetings begin at 7:30 PM and are open to the public. Public star parties are held twice a month at the University's Peach Mountain Observatory on North Territorial Road (1.1 miles west of Dexter-Pinkney Road; further directions at the end of the newsletter) on Saturdays before and after the new Moon. The party may be canceled if it's cloudy or very cold at sunset. For further information call (313) 480-4514.



Series of CCD images taken on the night of January 24 - 25 by Antonio Cidadao using a 10" LX200 SCT dramatically shows the GRS (Great Red Spot) and the smaller white oval a.k.a. BA moving toward a collision or merge very soon. Look for reports at: spaceweather.com or at Sky & Telescope's web site. Image reprinted with permission.

This Month: Due to prevailing weather conditions thru January & February

February 9th Informal Open House at Peach Mt. Observatory -Check E-mail and / or Voice Mail

February 16th Informal Open House at Peach Mt. Observatory -Check E-mail and / or Voice Mail

We will not be advertising these Open Houses in the Media

February 15th Lowbrow Meeting at 7:30pm in Room 130 of the Dennison Bldg. Speaker: Matthew Walker, "Shedding Some Light on Dark Matter"

Next Month: March 9th Public Open House and Star Party at the Peach Mt. Observatory - Jupiter and Saturn are well placed in the evening sky.

March 15th is the Lowbrow Meeting at 7:30pm in Room 130 of the Dennison Bldg. Speaker: TBA

March 16th Public Open House and Star Party at the Peach Mt. Observatory - Jupiter and Saturn are well placed in the evening sky.

Ramblings of a Beginner By Bob Gruszczynski

After a 30 year absence from the hobby of Astronomy, I was once again reunited with a past love last Christmas. With much agonizing over what to do for Christmas, a brand new, shiny Meade ETX-70 showed up under the tree. After a few clear nights near the Big Day, my wife couldn't wait to open it, but I made us wait. This was mostly because I was busting at the seams myself, knowing that the Venus, Jupiter, and Saturn of my past life (seen then through the standard 50-mm department store refractor), were beckoning. Once the Genie is out of the bottle...

Christmas Day dawned and we unwrapped all the gifts, last but not least, the ETX. After the usual cloudy nights and false starts with the new technology, I got all of my favorites lined up. I was again in awe of the Heavenly Wonders, this time through much better optics and a sturdier tripod. My wife was not so impressed. Having not had the bug from so many years ago, and seeing all of the Hubble and Galileo photos, was a bit skeptical about the views we were seeing. "Those are the rings of Saturn? Are you sure?". Aperture fever was setting in and she didn't even know it. A few days later she proclaimed that we needed a Schmidt-Cassegrain Telescope, preferably 8" or so. So, I explained that those were a bit out of our budget. She can be persistent, and searched for that elusive telescope. She actually found a Celestron G5 at an extremely reasonable price and brought it home.

The G5, however, is not a go-to scope and now forced me to remember how to find my way around the sky. I found the two Terence Dickinson books - The Backyard Astronomer's Guide and, especially, Nightwatch to be extremely invaluable. Also, around that time, we ran into an interesting group of people who gathered on a hill near Dexter twice a month to stare at the sky through all types of interesting devices. We joined the Lowbrows and I learned at an astronomical pace. I learned how to find more and more faint fuzzies. I rekindled an old friendship, and started a few new ones. Of course aperture fever continued to run rampant and our "space cannon" Orion XT-10 Newtonian reflector joined our telescope fold. More fun with faint fuzzies and old astronomical delights.

Time flies when you are having fun and it is now a bit more than a year since that fateful Christmas. I remember a time late last February early in the crisp, clear morning, with my new Schmidt-Cassegrain and a book with a chart that only said "Realm of the Galaxies" in the area that I was preparing to look. Boy, was I excited! Two hours later, frozen to the core, the sun just starting to show some rays, I thought I found something. I actually sketched the star field and later found it to be M100. My first real faint fuzzy in the Virgo Cluster. Of course now that I have the space cannon pointed in that direction, Star Atlas 2000 open, and my telrad finder books, 20 or 30 galaxies float into view as I scan. Kind of like shooting fish in a barrel. I went back to get the G5 out. Six galaxies are visible, now this is a challenge! Wait, what if I try with the ETX? M86 is all I can truly see right now.

I guess the point of my ramblings is that, as a beginning astronomer, it has been overwhelming to jump in with both feet. I'm going to take a lesson from my old friend Mike, and let patience take over. While you'll still see us with the space cannon, you might see me more huddled over the ETX, trying to complete the Messier challenge. Maybe when that's complete...binoculars. I'd like to thank the Lowbrows for making this as much fun as it has been, and special thanks to Mike Radwick, Mark Deprest, John Causland, and Gary Perrine for some valuable lessons during the huge learning curve.



ASTRONOMY AND USED BOOKS

by Harry L. Juday

I did not get started in Astronomy until early 1997, after I was retired from Ford Motor Co. It quickly became apparent to me that I had a huge amount of learning to do if I ever wished to classify myself as a serious amateur astronomer. I immediately subscribed to Astronomy and Sky and Telescope Magazines and Anna and I joined the Ford Amateur Astronomy Club, all of which was educational and beneficial.

However, I soon realized that besides looking thru my telescope, I would have to do some serious reading and studying to learn some of the many things I wanted and needed to know.

Reading the magazines and a visit to Borders Books showed me that there are many books on the subject available, and that most of them are very expensive. I bought a few that seemed to give the most useful information but as I had already started to buy some of the other items I believed I required (extra eyepieces, filters, camera attachments and an off-axis guider for astrophotos, etc.) I was far exceeding my budget and needed to find an economical way to pursue at least part of this wonderful, fascinating, infinite and new (to me) hobby I had embraced.

Enter Used Book Stores. Anna and I have had a long love affair with used book stores. We would make a couple of visits every year to the ones in the Detroit and Ann Arbor areas and would usually come back loaded down with bargain-priced books on many various subjects, so we reasoned that there should be many useful used books on Astronomy available at reasonable prices.

Our next visit to John King's in Detroit proved that we were correct, there were numerous books available, many of which were the same items on the shelves at Borders, but at 1/2 or 1/3 the cost.

All right already, so where are all these wonderful sources of inexpensive used Astronomy books and can they be found in any used book store?

First off, no, you can not expect to find a book treasure in every store. It's like looking for faint objects in the night sky, they are out there and with a little patience and perseverance, you can find much affordable, useful information and occasionally, a real gem. There are also a lot of old and outdated books setting on the shelves, and sometimes, a good copy of an Astronomy literature classic, but those are getting harder to find in just the short time I have been browsing the used book stores for Astronomy books.

If you are not already familiar with them, here is how to find some of the used bookstores that we are familiar with, along with a little commentary.

DETROIT AREA:

1. One of the largest and best used books stores anywhere, is the John King main store on Lafayette and 5th in downtown Detroit. John King is one of the 5 largest book dealers in the United States and his 4 story main store has about 1 million books, categorized by subject and, for the most part, arranged alphabetically by author. Each floor has a knowledgeable

person on duty to help, if required. The store is easy to get to by taking the Howard Street exit from the Southbound John Lodge Freeway (U.S. 10). This exit is just before you make the big curve to go under Cobo Hall. There is secure parking in the book stores' private, fenced lot immediately East of the store, entrance off of Lafayette. The last time we were in this store, they had over 30 feet of books on Astronomy and related subjects (e.g. Space Travel, etc.).

There is also an Antique and Valuable book section to this store. It is located in another building in back of the main store, and mostly contained in a magnificent library that John King has created. This is a very large room, well over a normal room height, lined with floor to ceiling bookshelves and books on three walls with one end wall reserved for a huge antique fireplace that was relocated from some mansion. If you have any interest at all in books, it is worth a trip to John Kings just to see this room.

However, it is not easy to get permission to go there. If you happened to be looking for some antique books on about any subject, and you reviewed the catalogs at the main desk and happened to find a couple of interesting items, and you talk real nice, and they are not too busy, you may get an escorted tour (unescorted tours not allowed) and be allowed to browse thru a particular section or two. It worked for me and was well worth the effort. Not only in seeing one of the finest private libraries I have ever seen, but I did find a couple of good items.

One I treasure is a small pamphlet-like book, printed by the U of M Press in 1932. It is a copy of two letters found in the letters of William Knox (1732 - 1810) by the U of M William L. Clements Library.

The first letter is from William Knox to Sir William Herschel with an overview of his general knowledge of the Universe (pretty standard for that time) and inquiring where exactly Sir William placed, "the Seat of bliss or the place of the Assembly of 10,000 times 10,000 Angels who surround the Seat of the Deity", in the scheme of things.

The second is Herschel's short, but polite reply, written in 1809, correcting a few of Mr. Knox's statements on known Astronomical facts/distances/sizes and stating that "the real extent of the universe is far beyond what we have any conception of. An attempt to assign "a space for the seat of bliss or assembly of angels" does not fall to the lot of the astronomers who keep always within the range of facts that may be ascertained". A real gem.

2. John King has a second store at 22524 Woodward (East side) just South of 9 Mile in Ferndale. Although this store is not as large as the main one, it usually has a high quality selection of all types of books.

3. The Library bookstore is at 169 W. Nine Mile, on the South side. I have not had any luck with Astronomy books there, although they have a fair general selection.

4. The Royal Oak Used Book Store is at 1410 N. Woodward (East side), they have a fair selection of Astronomy books as well as a good general selection of material. There is one more good store on the East side of Woodward between 14 and 16 Mile roads, Phoenix Books. Although not large, they have

good selections of high quality used books including some Astronomy selections.

ANN ARBOR AREA:

There are a number of used book stores in the Ann Arbor area, but I will mention 7 that we frequent, and usually have good luck in. 4 of these are located near the corner of State and Liberty Streets.

1. David's Books is at 622 East Liberty, upstairs over a record shop. They have a fair number of Astronomy books at reasonable prices, however, they are not always the best conditioned books you will find.

2. Books in General is also upstairs at 332 South State St. (South of Liberty, West side). They have high quality books and I have found some good Astronomy items there.

3. Kaleidoscope Books is North of Liberty at 217 State St. on the East side. This store has many items, however it is disorganized and, I find, high priced for the selection and quality of the books available, I often don't bother going in.

4. Dawn Treader Books is on West Liberty about 1 1/2 blocks from State St. on the South side. This is a very good store with a large general selection, although the Astronomy books are mixed within the Science section. For most of the past year they have had overflow piles of Astronomy & other Science item books stacked in front of the shelves for that section. I have managed to find a few good ones, but allow a lot of time as you have to dig thru over a dozen stacks if you want to look thru all of the books. I have seen a couple of old classics, in nice condition and at a fair price in this hodgepodge, but I already have copies of these in my Astronomy library.

5. West Side Books is at 113 West Liberty (first block West on Main St.). They have a good selection of books, however they are a little scant on Astronomy. For those who may also have other interests, they have an excellent Nautical selection and specialize in books about the Arctic and Antarctic (the later two items are stored in a special room and you have to ask to see them).

6. Wooden Spoon Books is at 200 North 4th Ave.

This store has a main owner and several small dealers with their own space. It is a good store with reasonable prices and one can usually find something of interest there.

7. Motte and Bailey is a relatively new used bookstore on the North side of East Ann street, just East of Main. This store specializes in ancient history and has a selection of high quality used books on that subject along with a smaller, but always interesting selection of numerous other subjects, mostly reference and non-fiction.

Last year I found a very interesting small volume "The Search for the Nebulae" by Kenneth Glyn Jones. This book is a brief history of the early discoveries of nebula and star clusters and presents a comprehensive analysis of the several catalogs dealing with these objects until the time of William Herschel. It includes brief descriptions of the major contributions, on this subject, made by Ptolemy, Al-Sufi, Ulugh Begh, Tycho Brahe, Bayer, Galileo, Marius, Boulliah, Hevelius, Kirch, Flamsteed, Halley, Bevis, and several others, both previously known and unknown to me. Although this is a

small book, only 84 pages, I found it fascinating and well worth the purchase price.

Cross Street Bookshop is a very interesting used book store in Ypsilanti. It is located at 523 Cross Street (one way West) just East of the main EMU campus. This is really my kind of used book store. They are piled everywhere. There is usually a small but good selection of Astronomy books available, I have gotten a couple of real unusual and good items there.

As with most small used book store owners that I have found, this one knows pretty well every book he has, if you are searching for a particular item. The best fun is just browsing.

OUT OF STATE:

One of the best chains of used (and new) bookstores I have found is Half Price Books based in Dallas Texas. Although they have no stores in Michigan, they have some in Ohio, Indiana, Iowa, Pa. Wisconsin and a large number in Texas. I have visited their main store in Dallas on two occasions and found a good variety of new half priced astronomy books (overstocks or items that just didn't sell in their original stores). I have found fewer used astro books, but the items I did find were very items and good buys. For further information on this source go to www.halfpricebooks.com.

To the best of my knowledge, this company is not affiliated with half.com, the Internet half priced book co.

So, on these dreary winter days, when you know there will be no viewing and you have run out of astronomical reading, or would just like to curl up with a good book, these are some places to look, and you may find that special astro (or other type) book that you have heard about, or been looking for, at a great price.

Enjoy!

Telescope Topics: Optical Glass

By Tom Ryan

Glass is an amazing substance. It's made from various mixtures of rusty metals or semi-metals, heated and stirred together. A glass may contain oxides of iron, boron, silicon, aluminum, sodium, potassium, calcium, lead (most of the lead in your computer is not in the solder; but in the monitor's glass, protecting you from the x-rays), and rare earths, in over 50,000 combinations. The most amazing thing is that these mixtures are more or less transparent to the light we see.

Glass has lots of problems when it comes to being used as an optical material. Glasses, optical or otherwise, are super-cooled liquids, so defined because they have no long range order on the molecular level, unlike crystals or metals. They are liquids, but are very viscous liquids, and flow easily only at relatively high temperatures. This can be a problem if homogeneity is desired, because glass at those temperatures is corrosive and will dissolve or be contaminated by most things that are used to stir it. Platinum

crucibles are commonly used to make high quality optical glass, but that does not solve every problem.

Striae, bubbles, and inclusions can be seen in glasses that are hard to mix well. Small pieces can be selected from a melt which are free of most of these problems, but larger pieces inevitably fall into different grades, depending on their relative freedom from these defects.

Glass has a property called dispersion, which means that it's index of refraction is different for different wavelengths, and this variation is very non-linear. This is the reason most refractors are doublets, and the non-linearities are the reason most really good refractors are triplets, or use glasses with unusual dispersion curves.

Glass expands a lot with temperature, and different glasses expand by different amounts. This makes mounting lenses a field unto itself, and cementing lenses together impossible above a certain (small) diameter.

The index can change from melt to melt (like the texture of gingersnaps from batch to batch), and can change within the melt itself, since it depends both on the specific composition and on the glass's cooling rate (including nearer or farther from the edge of the crucible). This means that a lens or prism can be designed to perform in a particular way, for the glass that the manufacturer claims to be making, but the glass must actually be measured for index and dispersion when it arrives, and the design adjusted accordingly to accommodate the glass's actual characteristics. This is a "gotcha!" that has brought many designs low, especially if the original design can't adjust to an index change.

This non-uniformity of index is the reason why 155mm is the largest lens that AstroPhysics makes anymore.

Stresses can be locked into the glass as it cools, hardens, cools further, and shrinks. Some optical glasses are subject to staining, either from acids (in your skin oils) or alkalis. Some glasses are very brittle, and hard to work, like the fluorite glass in Takahashi refractors.

All told, it's amazing that good lenses can be made from the stuff at all.

Pirate Treasure

By Tom Ryan

When I was much younger, unencumbered by familiar responsibilities and unheeding of more established men's warnings, I decided to become a pirate. Like most men who have made this decision, I had good reasons for my choice. I was poor, and my prospects while working at a dead-end trade did not seem likely to change that unfortunate fact. Pirates, I knew, often grew very rich while plying their trade. They also traveled a great deal and had terrific adventures, and I was very tired of the small town in which I lived. And finally,

while I knew that pirates often hurt people as a direct result of their employment, I was confident that I, who had never intentionally hurt anyone in my life, could easily circumvent that part of the work.

My only problem in carrying out this plan was the fact that I hadn't the slightest idea of how to become a pirate. The nuts and bolts of it, that is. I had no mentor to teach me piracy, and I found that it didn't come naturally to me. In years past, I suppose a young man would wander down to the docks and hitch a ride with the most disreputable ship he could find that would take him to sea. Or he would show up on Wall Street, and carry messages for Getty or Carnegie until he got the hang of it. But for me, there seemed to be no good place to serve my apprenticeship, so I set aside my ambition, hoping that I would eventually grow strong enough to carry it out myself.

When I actually became a pirate, it surprised me completely, because piracy, as such, had not been my goal at the time. Instead, I had simply wanted an Astromaster, and thought I couldn't afford to pay the asking price for it. Fortunately, I had a friend who both had one and trusted me enough to disassemble (and reassemble) it. I figured that if I took it apart (this is called Reverse Engineering in polite circles), bought the parts, made the circuit board, wired the chips, machined the case, and duplicated the software, then I would have my own personal Astromaster at a fraction of the normal price. And of course I wouldn't hurt anybody, because I wouldn't sell them on the open market (mine, being exact duplicates of the real Astromaster, would have no legitimate market), and the guy who produces the real Astromasters wouldn't have gotten my \$100 anyway, so he wasn't out any coin. And with this reasoning, my nightmare began.

I first made an inventory of the chips. Most of them were available from Radio Shack, but a few were special. The display was not common, but hours of searching through cross reference electronics catalogs finally turned up what I felt might be the same display under another name. It had only one source, and they had a minimum order of \$50.00. Well, maybe I could combine the order with the Radio Shack parts, which they also supplied, and it wouldn't be so bad. The push buttons were easier. Then I set about copying (oops! I mean, Reverse Engineering) the circuit board. I carefully followed the traces, and copied them into my Cad program (both sides of the board). I devoted about three weeks of spare time to that and to figuring out how the board was connected. Meanwhile, I was searching for the microprocessor chip. It was a special version of a Motorola chip that was licensed to Hitachi, and yes, if I wanted to use it, I had to buy six of them (minimum order) for about \$150. Well, hell, I could make six Astromasters with that many chips. I plunged on. I bought three different cases, since I couldn't find an exact match, and paid \$60 for an Eprom burner to decipher the Astromaster's eprom. But I could use the burner for other projects, I told myself. When I downloaded the program from the eprom, it was complete gibberish (even as assembly language, it was gibberish). A careful examination of the traces showed that the data and address

lines were connected in reverse order (that is, a 00110111 was stored as a 11101100). A reverse programming pod was built, and the program was finally deciphered and downloaded. I was prepared to follow the program from the reset vector to the end, but I was not prepared for what I saw in the code. It was a copyright notice. And when I read it, I realized that if I went any further, I would be a pirate indeed. I also knew then that I was not cut out to be a pirate.

I packed up my equipment, put away the hardware, and tallied up my costs, both in cash outlay and in time spent. Piracy didn't make any more economic sense to me that it does for anyone else who tries it. It was exciting, though, and I was lucky, because I did manage to avoid hurting anyone.

THE 100 MESSIER MISSED

An Amateur's List Comparable to the Original

By John A. Barra

Have you ever looked at a non-Messier object for the first time and wondered why Messier did not include it on his list? I did many times. I figured there must be as many of these objects as bright or as remarkable as those numbered by the great astronomer. The list I compiled is the result of my attempt to prove that theory.

Most historians agree that Charles Messier discovered or confirmed only 100 objects. Others added to that list to make 110. Therefore, I tried to find 100 to match his 100. Where there was a dispute as to whether a certain object was actually a Messier object, I chose to resolve the disagreement in favor of inclusion. I want to make it clear that I am not attempting to create any official list. Rather, I am merely having fun to use my amateur skills to test my theory.

PARAMETERS FOR SEARCH

To test my theory as accurately as possible, I used the characteristics of the original 100 as parameters for my search. I included the same number of each type of object. I also made sure that all the objects in each category were as bright as the dimmest object Messier included for that type (*see Table 1*). The only exceptions were where there was only one object per category: supernova remnant, double star, asterism and star cloud.

I did not search for any object lower in the sky than M7 (-34 39) in Scorpius, the Messier object with the lowest declination. For this reason, the list that I compiled differs from some of the more modern lists such as the Caldwell Catalogue. That list includes bright objects in the far southern hemisphere. Messier could not have seen those objects at his viewing latitude. Finally, all the objects I searched for had to be observable in my eight-inch Coulter Odyssey. I was able to view all of the original 100 with that scope at the Peoria Astronomical Society's dark-sky site 12 miles west of Peoria, Illinois.

MY LIST OF THE SECOND 100

My theory proved to be correct. I was able to find another 100 objects as bright and remarkable as Messier's 100 using the same parameters. My list is shown in *Table 2*. Wherever possible I used *The Deep Sky Field Guide to Uranometria 2000.0* by Cragin, Lucyk and Rappaport for statistical informa-

tion. Magnitudes vary greatly from source to source. Therefore I used visual magnitudes rounded off to the nearest one-half.

The first 10 objects I chose were the M101 to M110 included in most Messier lists. These objects were not discovered nor probably confirmed by Messier. However, they are remarkable enough to be included in anybody's list. The remainder, M111 to M200, are listed in order of right ascension.

OPEN CLUSTERS

My list contains 26 open clusters brighter than M26 in Scutum, the dimmest Messier with a magnitude of 8. Many were as spectacular as those in the original list. I must admit that it was difficult to narrow the list. Some people may disagree with my choices on open clusters. There are many others that fit within these parameters. The Double Cluster (M118, NGC869; M119, NGC884) in Perseus is the clear highlight of the open clusters. M46 and M47 in Puppis are almost as close together but not as impressive. I find that the trio of M36, M37 and M38 in Auriga, though further apart, is the most comparable group to the Double Cluster from the original 100. IC4665 (M163) in Ophiucus reminds of M39 in Cygnus in that both are bright and large, but sparse. On the other end of the spectrum, NGC1502 (M122) in Camelopardalis is a very compact cluster, similar to M29 in Cygnus. Each cannot be resolved with binoculars. However, you can follow a three-degree chain of stars from NGC1502 with either your telescope or binoculars. This chain of stars is called Kemble's Cascade.

GLOBULAR CLUSTERS AND GALAXIES

Messier did account for most of the bright globular clusters. All 28 on my list are brighter than M72 in Aquarius, the dimmest of the Messier globulars. However, 22 on the original list were brighter than my brightest of such clusters at magnitude 8. None compared to M13, the Hercules Cluster or any of the other bright Messier globular clusters. In both lists globular clusters were predominate in the Ophiucus-Sagittarius region. There are 12 of these clusters from the original list in these two constellations, while 20 from my list can be found there. In fact, this region could be considered the Realm of Globular Clusters, similar to the Realm of Galaxies in Virgo in the Messier 100.

Of the 32 galaxies that I found with a magnitude of 10 or lower, most compare well with the original list. None, however, were comparable to M31, the Great Andromeda Galaxy. But NGC 253 (M114) in Sculptor does stand out even though it is so low in our sky. This spiral is regarded as a beautiful object from places with a lower latitude. M104, the Sombrero Galaxy in Virgo, and NGC4565 (M145), the Needle Galaxy in Coma Berenices, are two outstanding edge-on galaxies. There are none comparable to them in the original 100.

NEBULAE

When I picked 10 nebulae, I was forced to put both planetary and bright nebulae in the same category. It seems that Messier choose almost all of the bright nebulae observable in amateur telescopes. Six of his ten nebulae are bright nebulae. I found only one such nebula bright enough to see with my telescope. It is NGC2261 (M128), Hubble's Variable Nebula in Monoceros. This nebula changes size and brightness over time. However, Messier did leave out most of the great planetaries,

choosing only four. I added nine, eight which have common names and are regarded as classic deep-sky objects. Included among them are NGC2392 (M132), the Eskimo Nebula in Gemini, NGC6543 (M165) the Cat's Eye Nebula in Draco, and NGC7662 (M199), the Blue Snowball Nebula in Andromeda. I also included my favorite, NGC6826 (M184), the Blinking Planetary in Cygnus. Your eyesight is fooled causing you to alternately see the nebula and its central star.

THE OTHER OBJECTS

The rest of each list consists of single objects in four different categories. I matched supernova remnant M1, the Crab Nebula in Taurus, with M192 (NGC6960, 74, 79, 92, and 95), the Veil Nebula in Cygnus-- the only other such object visible in my telescope. I did have to borrow my friend's nebula filter to see it in its real beauty. Since Messier had a star cloud in his list, M24 known as the Sagittarius Star Cloud, I had to choose one for my list. The Scutum Star Cloud seemed like a natural choice. It is given the number M177 and has no other numbered designation. I literally had thousands of double stars to choose from to correspond with Messier's M40. I picked another virtually unknown F. G. W. Struve 1315 (M134). Both pairs are in Ursa Major, are rather dim, and are easily split. Each star in the two has nearly the same brightness as its companion star. I also had many asterisms to choose from to match M73, the nondescript, four-star asterism in Aquarius. I finally choose CRR399 (M182), Brocchi's Cluster in Vulpecula, better known as the Coathanger. I say finally not because the Coathanger was a hard choice for the next 100. It is one of the most spectacular objects on my list. However, since most books on the subject called it an open cluster, I originally did so too and chose another asterism. The Hipparcos satellite made the decision easy when it recently determined that the Coathanger was indeed an asterism after all.

OTHER COMPARISONS

There are many other comparisons on the two lists, both in terms of names and appearances. For example, Messier had M57, the Ring Nebula in Lyra, while my list includes the similar, but much larger M197 (NGC7293), the Helix Nebula in Aquarius. The original list has the M97, the Owl Nebula in Ursa Major, while I included M116 (NGC457), the Owl Cluster in Cassiopeia. The Wild Duck Cluster (M11) in Scutum is similar in name with M130 (NGC2301) the Great Bird of the Galaxy in Monoceros. This cluster, which has also been described as an airplane, does not look anything like the fan-shaped M11. On the other hand, the open cluster M200 (NGC7789) in Cassiopeia is a very faint version of the Beehive Cluster (M44) in Cancer. As you continue to stare at M200 in binoculars, you can see many stars appear as a swarm. The Coathanger (M182) resembles the Pleiades (M45) in Taurus in that they both can be seen with the naked eye, although their magnitude difference is apparent. Each list includes an open cluster that has a more famous bright nebula associated with it. M16 is an open cluster in Scutum more known for the Eagle Nebula (IC4703) included within it. M127 (NGC2244) is an open cluster in Monoceros more famous by the Rosette Nebula (NGC2237-9,46) that surrounds it. Both open clusters are easy to see. The nebulae are great photographic objects; however, they are difficult to see with amateur telescopes. Messier's list

includes two planetaries named after dumbbells, the Dumbbell (M27) in Vulpecula and the Little Dumbbell (M76) in Perseus, while mine has two planetaries named after planets, the Saturn Nebula in Aquarius (M193, NGC7009) and the Ghost of Jupiter in Hydra (M138, NGC3242). Messier's star cloud M24 has a faint open cluster imbedded within it (NGC6603), while my Scutum Star Cloud M177 also has a faint open cluster within it (NGC6608). Even their NGC numbers are nearly the same.

Finally, I should note that two galaxies in my list team up with two pairs of galaxies from the original 100 to form galactic triangles. M65 and M66 in Leo are joined by M141 (NGC3628). M110, never documented by Messier, of course, teams up with M31 and M32 in Andromeda. Additionally, M105 is joined on my list with nearby M139 (NGC3384) to form the point of another triangle in Leo with M95 and M96.

ANOTHER MARATHON?

The list which I have compiled has proven my theory to be correct, at least to my satisfaction. Meanwhile, it provided a great deal of fun in viewing all these objects--which was probably the real goal of this task. As I mentioned earlier, I do not attempt to make this list into any official list. But I certainly do not object if anyone wants to use it for his pure, viewing pleasure. If anyone might think about trying to make a marathon out of this list of the second 100, the best time would be in mid-March, the normal Messier marathon time. However, I feel compelled to add one last comparison. You will not be able to complete this list in one night either. From latitude forty degrees north, only 96 of the 100 will be viewable in one night. M113 in Cetus, M114 and M115 in Sculptor, and M197 in Aquarius will be blocked out by the Sun.

Table 1: Comparing the Lists

Type	M1- M100		M101- M200	
	Objects	Dimmest	Objects	Dimmest
Open Clusters	26	8	26	8
Globular Clusters	28	9.5	28	9.5
Galaxies	32	10	32	10
Nebulae	10		10	
Bright	6		1	
Planetary	4	10	9	9.5
SNR	1		1	
Star Clouds	1		1	
Asterisms	1	9	1	3.5
Double Stars	1	9.5	1	7.5

The Next Messier 100

Table 2: The Next 100 Messier List

Name	NGC	R.A.	Dec.	Type	Mag.	Size	Constellation	Common Name
M101	5457	14 03.2	+54 21	S Gal	8	26.0' x 26.0'	Ursa Major	
M102	5866	15 06.5	+55 46	S Gal	10	6.6' x 3.2'	Draco	
M103	581	01 33.2	+60 42	OC	7	1/2 6'	Cassiopeia	
M104	4594	12 40.0	-11 37	S Gal	8	7.1' x 4.4'	Virgo	Sombrero Galaxy
M105	3379	10 47.8	+12 35	E Gal	9	1/2 3.9' x 3.9'	Leo	
M106	4258	12 19.0	+47 18	S Gal	8	1/2 20.0' x 8.4'	Canes Venatici	
M107	6171	16 32.5	-13 03	GC	8	10'	Ophiucus	
M108	3556	11 11.5	+55 40	S Gal	10	8.1' x 2.1'	Ursa Major	
M109	3992	11 57.6	+53 23	S Gal	10	7.6' x 4.3'	Ursa Major	
M110	205	00 40.4	+41 41	E Gal	8	19.5' x 12.5'	Andromeda	
M111	129	00 29.9	+60 14	OC	6	1/2 21'	Cassiopeia	
M112	185	00 39.0	+48 20	E Gal	9	14.5' x 12.5'	Cassiopeia	

Name NGC R.A. Dec. Type Mag. Size Constellation Common Name M113 247 00
 47.1 -20 46 S Gal 9 19.0' x 5.5' Cetus
 M114 253 00 47.6 -25 17 S Gal 7 1/2 30.0' x 6.9' Sculptor
 M115 288 00 52.8 -26 35 GC 8 13.8' Sculptor
 M116 457 01 19.1 +58 20 OC 6 1/2 13' Cassiopeia Owl Cluster
 M117 752 01 57.8 +37 41 OC 5 1/2 50' Andromeda
 M118 869 02 19.0 +57 09 OC 5 1/2 29' Perseus Double Cluster
 M119 884 02 22.4 +57 07 OC 6 29' Perseus Double Cluster
 M120 1023 02 40.4 +39 04 S Gal 9 1/2 8.6' x 4.2' Perseus
 M121 IC342 03 46.8 +68 06 S Gal 8 1/2 22.0' x 22.0' Camelopardalis
 M122 1502 04 07.7 +62 20 OC 5 1/2 7' Camelopardalis
 M123 1647 04 46.0 +19 04 OC 6 1/2 45' Taurus
 M124 1981 05 35.2 -04 26 OC 4 1/2 25' Orion
 M125 2169 06 08.4 +13 57 OC 6 6' Orion
 M126 2232 06 26.6 -04 45 OC 4 29' Monoceros
 M127 2244 06 32.4 +04 52 OC 5 23' Monoceros with Rosette Nebula
 M128 2261 06 39.2 +08 44 BN 3.5' x 1.5' Monoceros Hubble's Variable Nebula
 M129 2264 06 41.1 +09 53 OC 4 20' Monoceros Xmas Tree Cluster
 M130 2301 06 51.8 +00 28 OC 6 12' Monoceros Great Bird of Galaxy
 M131 2362 07 18.8 -24 57 OC 4 8' Canis Major
 M132 2392 07 29.2 +20 55 PN 9 >15" Gemini Eskimo Nebula
 M133 2403 07 36.9 +65 36 S Gal 8 1/2 25.5' x 13.0' Camelopardalis
 M134 Sig1315* 09 12.8 +61 41 Double Star 7 1/2 24.9' sep. Ursa Major
 M135 2841 09 22.0 +50 58 S Gal 9 6.8' x 3.3' Ursa Major
 M136 2903 09 32.2 +21 30 S Gal 9 12.0' x 5.6' Leo
 M137 3115 10 05.2 -07 43 S Gal 9 8.1' x 2.8' Sextans
 M138 3242 10 24.8 -18 38 PN 8 >16" Hydra Ghost of Jupiter
 M139 3384 10 48.3 +12 38 S Gal 10 5.5' x 2.9' Leo
 M140 3521 11 05.8 -00 02 S Gal 9 12.5' x 6.5' Leo
 M141 3628 11 20.3 +13 36 S Gal 9 1/2 14.0' x 4.0' Leo
 M142 4449 12 28.2 +44 06 I Gal 9 1/2 5.5' x 4.1' Canes Venatici
 M143 4490 12 30.6 +41 38 S Gal 10 6.4' x 3.3' Canes Venatici
 M144 4494 12 31.4 +25 47 E Gal 10 4.6' x 4.4' Coma Berenices
 M145 4565 12 36.3 +25 59 S Gal 9 1/2 14.0' x 1.8' Coma Berenices Needle Galaxy
 M146 4631 12 42.1 +32 32 S Gal 9 15.5' x 3.3' Canes Venatici
 M147 5005 13 10.9 +37 03 S Gal 10 5.8' x 2.8' Canes Venatici
 M148 5033 13 13.4 +36 36 S Gal 10 10.5' x 5.1' Canes Venatici
 M149 5195 13 30.0 +47 16 I Gal 9 1/2 6.4' x 4.6' Canes Venatici M51 Companion
 M150 5466 14 05.5 +28 32 GC 9 11' Bootes
 M151 5634 14 29.6 -05 59 GC 9 1/2 4.9' Virgo
 M152 5897 15 17.4 -21 01 GC 8 1/2 12.6' Libra
 M153 6144 16 27.3 -26 02 GC 9 9.3' Scorpius
 M154 6210 16 44.5 +23 49 PN 9 >14" Hercules
 M155 6229 16 47.0 +47 32 GC 9 1/2 4.5' Hercules
 M156 6284 17 04.5 -24 46 GC 9 5.6' Ophiucus
 M157 6287 17 05.2 -22 42 GC 9 5.1' Ophiucus
 M158 6293 17 10.2 -26 35 GC 8 7.9' Ophiucus
 M159 6304 17 14.5 -29 28 GC 8 1/2 6.8' Ophiucus
 M160 6316 17 16.6 -28 08 GC 9 4.9' Ophiucus
 M161 6356 17 23.6 -17 49 GC 8 7.2' Ophiucus
 M162 6366 17 27.7 -05 05 GC 9 8.3' Ophiucus
 M163 IC4665 17 46.3 +05 43 OC 4 40.0' Ophiucus
 M164 6440 17 48.9 -20 22 GC 9 5.4' Sagittarius
 M165 6543 17 58.6 +66 38 PN 8 >18" Draco Cat's Eye Nebula
 M166 6522 18 03.6 -30 02 GC 8 1/2 5.6' Sagittarius
 M167 6528 18 04.8 -30 03 GC 9 1/2 3.7' Sagittarius
 M168 6544 18 07.3 -25 00 GC 8 8.9' Sagittarius
 M169 6553 18 09.3 -25 54 GC 8 8.1' Sagittarius

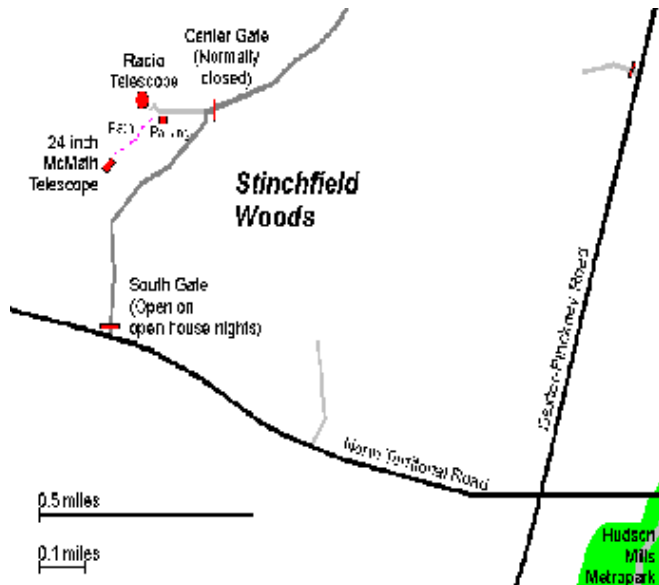
Name NGC R.A. Dec. Type Mag. Size Constellation Common Name M170 6569 18
 13.6 -31 50 GC 8 1/2 5.8' Sagittarius
 M171 6624 18 23.7 -30 22 GC 8 5.9' Sagittarius
 M172 6633 18 27.7 +06 34 OC 4 1/2 27' Ophiucus
 M173 6638 18 30.9 -25 30 GC 9 5' Sagittarius
 M174 6642 18 31.9 -23 29 GC 9 1/2 4.5' Sagittarius
 M175 6652 18 35.8 -32 59 GC 9 3.5' Sagittarius
 M176 IC4756 18 39.0 +05 27 OC 4 1/2 52' Serpens Cauda
 M177 --- 18 46 -06 30 SC 180' Scutum Scutum Star Cloud
 M178 6709 18 51.5 +10 21 OC 6 1/2 13' Aquila
 M179 6712 18 53.1 -08 42 GC 8 7.2' Scutum
 M180 6717 18 55.1 -22 42 GC 9 3.9' Sagittarius
 M181 6760 19 11.2 +01 02 GC 9 6.6' Aquila
 M182 CR399 19 25.4 +20 11 Asterism 3 1/2 60' Vulpecula Coathanger Cluster
 M183 6818 19 44.0 -14 09 PN 9 1/2 >17" Sagittarius Little Gem Nebula
 M184 6826 19 44.8 +50 31 PN 9 >25" Cygnus Blinking Planetary
 M185 6822 19 44.9 -14 48 I Gal 9 19.1' x 14.9' Sagittarius
 Bernard's Galaxy
 M186 6871 20 05.9 +35 47 OC 5 20' Cygnus
 M187 6910 20 23.1 +40 47 OC 7 1/2 7' Cygnus Rocking Horse
 Cluster
 M188 6939 20 31.4 +60 38 OC 8 7' Cepheus
 M189 6934 20 34.2 +07 24 GC 8 1/2 5.9' Delphinus
 M190 6940 20 34.6 +28 18 OC 6 1/2 31' Vulpecula
 M191 6946 20 34.8 +60 09 S Gal 9 13.0' x 13.0' Cepheus
 M192 6960** 20 45.7 +30 43 SNR 70' x 6' Cygnus Veil Nebula
 M193 7009 21 04.2 -11 22 PN 8 1/2 >25" Aquarius Saturn
 Nebula
 M194 7209 22 05.2 +46 30 OC 7 1/2 25' Lacerta
 M195 7217 22 07.9 +31 22 S Gal 10 3.5' x 3.0' Pegasus
 M196 7243 22 15.3 +49 53 OC 6 1/2 21' Lacerta
 M197 7293 22 29.6 -20 48 PN 7 1/2 >769" Aquarius Helix
 Nebula
 M198 7331 22 37.1 +34 25 S Gal 9 1/2 10.5' x 3.7' Pegasus
 M199 7662 23 25.9 +42 33 PN 8 1/2 >12" Andromeda Blue
 Snowball Nebula
 M200 7789 23 57.0 +56 44 OC 6 1/2 15' Cassiopeia
 * Sigma or F. G. W. Struve 1315
 ** Veil Nebula also includes NGC6974, 6979, 6992 and
 6995

Charles Messier would be proud of these additions to his famous list of "non-Comets." An Excel file of these objects is available from Mark Deprest. The above article was written by John A Barra of the Peoria Astronomical Society & reprinted with permission of the author.



Places and Times:

Dennison Hall, also known as The University of Michigan's Physics and Astronomy building, is the site of the monthly meeting of the University Lowbrow Astronomers. It is found in Ann Arbor on Church Street about one block north of South University Avenue. The meeting is held in room 130. Monthly meetings of the Lowbrows are held on the 3rd Friday of each month at 7:30 PM. During the summer months, and when weather permits, a club observing session at Peach Mountain will follow the meeting.



Peach Mountain Observatory is the home of The University of Michigan's 25 meter radio telescope as well as the University's McMath 24 inch telescope which is maintained by the Lowbrows. The observatory is located northwest of Dexter. The entrance is on North Territorial Road, 1.1 miles west of Dexter-Pinckney Road. A small maize-and-blue sign marks the gate. Follow the gravel road one mile to a parking area near the radio telescopes. Walk along the path between the two fenced in areas (about 300 feet) to reach the McMath telescope building.

Public Star Parties:

Public Open House/Star Parties are held on the Saturday before and after each new Moon at the Peach Mountain Observatory. Star Parties are canceled if the sky is cloudy at sunset or the temperature is below 10 degrees F. Call 480-4514 for a recorded message on the afternoon of a scheduled Star Party to check on the status. Many members bring their telescopes and visitors are welcome to do likewise. Peach Mountain is home to millions of hungry mosquitoes - bring insect repellent, and it does get cold at night so dress warmly!

Amateur Telescope Making Group meets monthly, with the location rotating among member's houses. See the calendar on the front cover page for the time and location of next meeting.

Membership:

Membership dues in the University Lowbrow Astronomers are \$20 per year for individuals or families, and \$12 per year for students and seniors (age 55/+). This entitles you to the monthly REFLECTIONS newsletter and the use of the 24" McMath telescope (after some training). Dues can be paid to the club treasurer **Charlie Nielsen** at the monthly meeting or by mail at this address:
6655 Jackson Road #415
Ann Arbor, MI 48103

Magazines:

Members of the University Lowbrow Astronomers can get a discount on these magazine subscriptions:
Sky and Telescope: \$29.95 / year
Astronomy: \$29.00 / year

For more information contact the club Treasurer. Members renewing subscriptions are reminded to send your renewal notice along with your check when applying through the club Treasurer. Make the check payable to "University Lowbrow Astronomers".

Newsletter Contributions:

Members and (non-members) are encouraged to write about any astronomy related topic of interest. Call or E-mail to Newsletter Editors at:

Mark Deprest fbontekoe14774MI@comcast.net
Bernard Friberg (743)761-1875 Bfriberg@aol.com
to discuss length and format. Announcements and articles are due by the first Friday of each month.

Telephone Numbers:

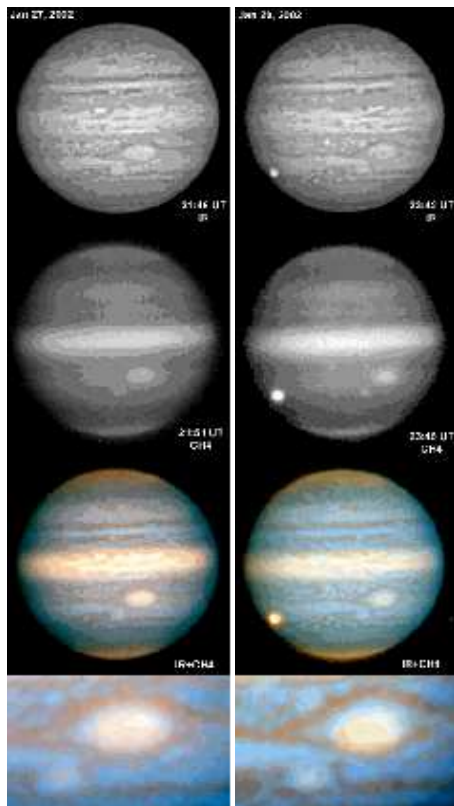
President:	D.C. Moons	
Vice Presidents:	Dave Snyder	(734)747-6537
	Paul Walkowski	(734)662-0145
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Observatory Dir.:	Bernard Friberg	(734)761-1875
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	Bernard Friberg	(734)761-1875
Parking Enforcement	Lorna Simmons	(734)525-5731
Keyholders:	Fred Schebor	(734)426-2363
	Mark Deprest	(734)662-5719

Lowbrow's Home Page:

<http://www.astro.lsa.umich.edu/lowbrows.html>

Dave Snyder, webmaster

<http://www-personal.umich.edu/~dgs/lowbrows/>



Antonio Cidadao took these CCD images on January 27th and 29th respectively. Different wavelengths provide unique details in the progression of the atmospheric disturbances of Jupiter. Note: the bright spot on the lower left limb of Jupiter in the second set is Ganymede beginning its transit. These images were reprinted with the permission of Antonio Cidadao.

**Tom Ryan gives us another
Telescope Topic: Optical Glass**

**Harry Juday Tells how to:
Increase your Astronomical Library**

Bob Gruszczynski Rambles On

Tom Ryan and Pirate Treasure?

**John A. Barra of the Peoria Astronomical Society's:
Messier's Second Hundred**



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Lowbrow's WWW Home Page:
www.astro.lsa.umich.edu/lowbrows.html
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