

Messier Marathon 2022






Plan To Succeed



Tom Heisey
Solar System Ambassador
Feb 17, 2022

Image attribution as marked

southplainsastronomy.org/events/2022-star-party-calendar/

Date	Location	Start Time	Moon Phase	Moon % Lit	Moon Rise Set Time
Feb 5	Ransom Canyon	7:00 pm		25%	set 11:17 pm
Feb 19	Tech Terrace	7:00 pm		90%	rise 9:48 pm
Feb 26	Member's Party	7:15 pm		21%	set 2:18 pm rise 4:27 am
MARCH					
Mar 5	Ransom Canyon	7:15 pm		11%	set 10:02 pm
Mar 13	Daylight Savings				
Mar 26	Tech Terrace	8:32 pm		34%	set 2:16 pm

The 2022 Star party schedule is up on the web site at
<https://southplainsastronomy.org/events/2022-star-party-calendar/>

Messier than what?

- Charles Messier
 - 1730-1817
 - 10th of 12 children
 - Member Royal Society
- Legacy
 - Lunar crater Messier
 - Asteroid 7359 Messier



By Ansiaux (1729—1786) Wikipedia

By Ansiaux (1729—1786) (??) - Stoyan R. et al. Atlas of the Messier Objects: Highlights of the Deep Sky. — Cambridge: Cambridge University Press, 2008. — P. 15., Public Domain,
<https://commons.wikimedia.org/w/index.php?curid=1386610>
https://en.wikipedia.org/wiki/Charles_Messier

Astronomer Charles Messier

- 1744 Great Six-tailed Comet - spurred Messier's interest in astronomy
- Honors
 - 1751 - Employed by Astronomer of the French Navy
 - 1753 - transit of Mercury (1st recorded observation)
 - 1764 - Fellow of the Royal Society
 - 1769 - Member of Royal Swedish Academy of Science
 - 1770 - member of French Academy of Science
- 1760-1785 - Discovered 13 comets

https://en.wikipedia.org/wiki/Charles_Messier

A Brief History of Telescopes

- 14-15th Century - developed eyeglasses
- 17th Century
 - 1609 Galileo's telescope with **convex lenses**
 - 1611 Kepler develops **concave eyepieces**
 - 1673 Hevelius **longer f/l** reduces aberration
 - 1675 Huygens
 - **Air-spaced convex lenses**
 - **Aerial telescopes** - objective on a pole or tower
 - 1668 Newton - 2" **spherical Newtonian**

<http://www.antiquetelescopes.org/history.html>

<http://www.antiquetelescopes.org/history.html>

in order to understand Messier's catalog, we've to go look at the technology of the telescopes in his era. Many of the objects don't resemble comets in today's telescopes, but the mirrors and lenses of the 17th and 18th did not have the clarity and resolution of even a department store telescope.

Convex lens eyepieces - very narrow FOV

Concave lens eyepieces - wider FOV, could project solar images

Longer focal length - reduces chromatic aberration

Air spaced convex lenses - reduced chromatic aberration

Aerial telescopes - longer focal length without massive tubes

Newtonian - compact reflector, but still using spherical mirrors

A Brief History of Telescopes

- 18th Century

- 1729 - Hall - **Achromatic lens pairs**
- 1730 - Short - **Parabolic reflector** (speculum)
- 1757 - Dolland - **Achromat triplet**
- 1789 - Herschel - 40' telescope 4' mirror

<http://www.antiquetelescopes.org/history.html>

<http://www.antiquetelescopes.org/history.html>

Achromatic lens pairs - less chromatic aberration and improved image resolution

Parabolic reflector - better image quality with light beams focusing to a point

Achromat triplet - improved image quality and again reduced chromatic aberration.

18th Century Large Reflectors



astronomy.com

- Speculum Mirrors

- Mixture of copper/tin
- Spherical grind
- Prone to tarnish, needs polishing 2x year
- Poor reflectivity

- For 200 years, was the only mirror in telescopes

- The drawbacks fueled the development of refractors

www.antiquetelescopes.org

<https://www.astronomy.com/magazine/2019/08/great-telescopes-of-the--past>

https://en.wikipedia.org/wiki/Speculum_metal

White copper/tin mixtures had been used for household mirrors for approximately 2000 years in China.

In Europe, speculum of variable metals were used by the wealthy only. (Rare metals)

Speculum metal was very hard to cast and shape, plus it tarnished easily.

- This meant the telescope mirrors had to be removed, polished, and reshaped twice a year, meaning some mirrors would eventually be unusable in a few years.

- Rapid nighttime cooling caused stress and misshaped the mirrors, causing poor images.

The mixtures affected the colors reflected

- 68% copper, 32% tin more yellow

- 55% copper, 45% tin more blue, but resisted tarnishing

18th Century Large Refractors



Marly Tower, Paris Observatory
wikipedia.org

- 2-3 lens achromat
- Very long focal length
 - reduces aberration
- Aerial telescopes
 - No tube
 - No light pollution
- Tube scopes
 - Long tubes prone to sagging

https://en.wikipedia.org/wiki/Paris_Observatory#/media/File:Paris_Observatory_XVIII_century.png

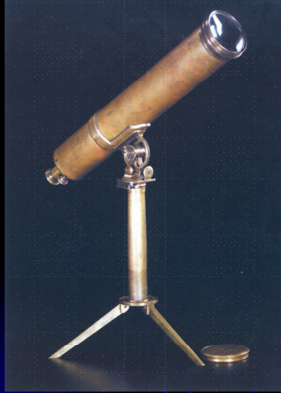
Lens technology of the time was primitive and lead to poor image quality and large amounts of chromatic aberration.

Long tubes caused engineering problems and needed large domes and heavy support structures

Aerial telescopes like the one pictured worked without a tube, with the lens in open air.

There was no light pollution like we have today - lights were contained inside houses and extinguished at night.

18th Century Small Scopes



Ramsden 2.5" Reflector



Ramsden 2.75" refractor



Ramsden 4.5" Reflector
~40" focal length

www.antiquetelescopes.org

<http://www.antiquetelescopes.org/ramsden.jpg>

<http://www.antiquetelescopes.org/Miltitz.jpg>

http://www.antiquetelescopes.org/Jramsden_t.jpg

Messier's Telescopes

Telescopes Messier listed and stated he used in 1765-69, published in the *Connaissance des Temps*

- Reflectors

- 6 feet FL, Mag. 110x
- 30 feet FL, 6 inch aperture, Mag. 104x
- 4.5 foot FL, Mag. 60x
- 1 foot FL, 3-inch aperture Mag. 44x
- 19 foot FL, Mag. 76x

- Refractors

- 25 foot FL, Mag. 138x
- 10.5 foot FL, Mag. 120x
- 3.25 foot FL, Mag. 120x
- 23 foot FL, Mag. 102x
- 30 foot FL, Mag. 117x
- Mag. 64x

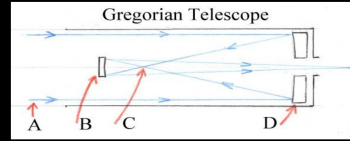
<https://www.messier.seds.org/xtra/history/m-scopes.html>

<https://www.messier.seds.org/xtra/history/m-scopes.html>

- Messier's telescopes (1765-69) as published in the *Connaissance des Temps* for 1807
- FL means "Focal Length", "Mag." Magnification, unfortunately he normally doesn't give the aperture
- Fixed magnification, so interchangeable eyepieces were not used

Messier's Favorite Telescopes

- The book Messier Album,



- Messier's favorite was Gregorian reflector

- 7.5' objective, 32' focal length, mag 104x
 - Effective as today's 3.5" refractor

- Hotel de Cluny Newtonian reflector

- 8" objective
 - Effective as today's 2.5" refractor

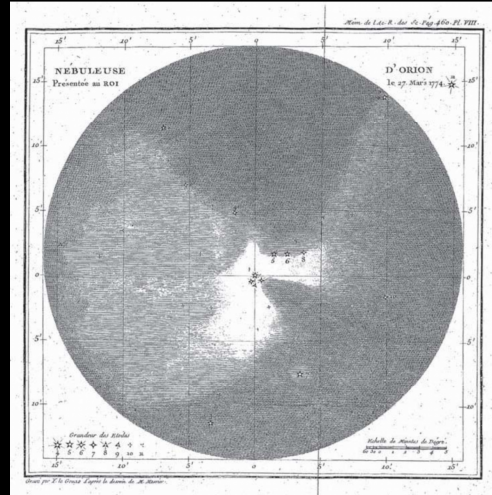
- Later in life, 3.5" achromat refractors

- Focal length about 3.5', magnification 120x
 - They were accessible after the Hotel closed.

- 8" speculum mirror is roughly equivalent to a 4" refractor
- In his contribution to Sky & Telescope which is reprinted in Mallas' and Kreimer's Messier Album, Owen Gingerich points out that Messier's favorite instrument was a 32-foot FL, 7.5-inch aperture Gregorian reflector with mag. 104x, not listed above. Bailly has computed that the effective aperture of this instrument was equivalent to a 3.5-inch refractor.
- Even worse was the situation for the old Newtonian reflector he came over from Delisle, which was an 8-inch but as effective as a 2.5-inch refractor only, so it was little used, although it seems this was the "original" instrument at Hotel de Cluny, Messier's observatory.
- Later he preferred to use several 3.5-inch (90 mm) achromatic refractors, which were usually about 3.5 feet long and magnifying 120 times. He selected to use these scopes because they were the best accessible instruments for him.

Messier Catalog

- Objects that could be confused with comets
- Objects include
 - 40 Galaxies
 - 29 globular clusters
 - 27 open clusters
 - 4 planetary nebulae
 - 6 diffuse nebulae
 - 1 supernova remnant
 - 1 asterism
 - 1 double star
 - 1 Milky Way patch



The Orion Nebula as drawn by Messier
Wikipedia.org

https://en.wikipedia.org/wiki/Charles_Messier

<https://starlust.org/messier-catalog/>

Messier Catalog

- Versions published:

- 1774, 45 objects
- 1783, 68 objects
- 1784, 103 objects

- Messier discovered 17 of the objects

- Objects between north pole & -36°
 - Visible from Paris



- Musee de Cluny

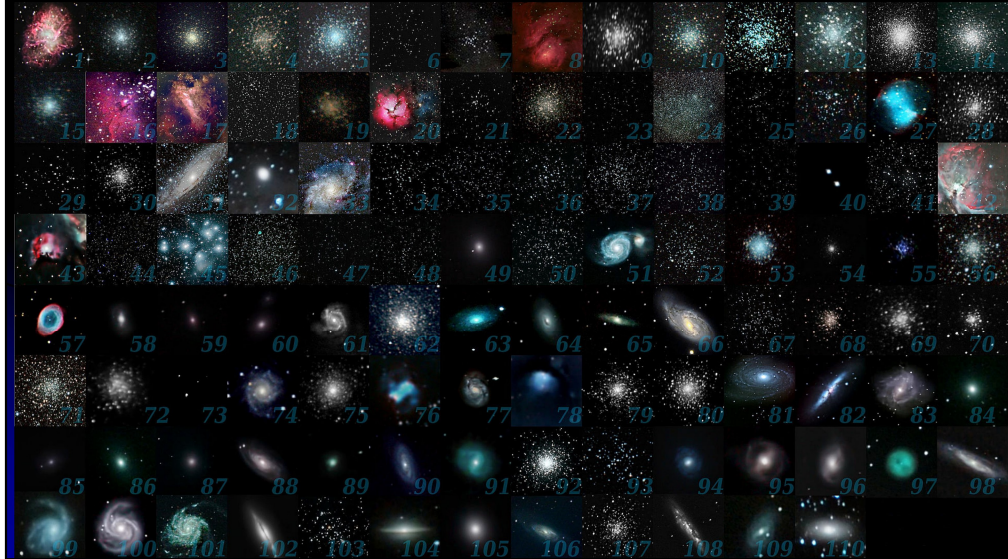
<http://astro.ago.uni-lj.si/mirror/www.seds.org/messier/xtra/history/m-cat.html>

<https://www.messier.seds.org/Messier.html>

Musee de Cluny was the primary observatory for Messier, where he observed from the tower.

1789 French Revolution, the building was seized by the government for a variety of uses. That coincides with the end of Messier's major observations noted today.

Messier Objects



https://en.wikipedia.org/wiki/Messier_object#Messier_objects

[https://commons.wikimedia.org/wiki/File:All_messier_objects_\(numbered\).jpg](https://commons.wikimedia.org/wiki/File:All_messier_objects_(numbered).jpg)

Astronomical League

- Messier Observing Program
 - Manual Telescopes
 - Level 1 = 70 objects
 - Level 2 = 110 objects
 - 6" scope recommended
 - Log book required
- Messier Marathon informal certificate:



Messier
Observing
Program



www.astroleague.org/content/downloadable-certificates

Messier Observing Program

<https://www.astroleague.org/al/obsclubs/messier/mess.html>

www.astroleague.org/content/downloadable-certificates

Messier Observation Logs

- Required Entries:
 - Date & Time (UT/local)
 - Latitude & Longitude
 - Seeing & Transparency
 - Telescope Aperture
 - Power used
 - Description of object
- Examined/verified by club officers
- No Go-To or setting circles allowed
- Messier Marathons discouraged



<https://www.astroleague.org/al/obsclubs/messier/mess.html>

No Go-To scopes - Program is meant to familiarize the observer with the sky, so go-to scopes, setting circles, and even cell-phone apps are disallowed. Printed Telrad maps are allowed. Only finder scopes, Telrad-type finders, and red dot finders are allowed.

Marathons are discouraged because you don't have time to truly observe and record the impressions of the objects.

Messier Marathon Advice

- Telescope dark skies
 - Most objects are visible in 50mm binos
 - 3" and sharp eyes can see all
 - 6-8" scopes make it easier
 - Wider f/ratio helps
 - f/4-f/7 recommended
- Light pollution makes the task difficult
- Have a plan!
 - Use a log
- Low Horizon is a must
- Process
 - Star Hop to object
 - Observe
 - Log the observation
 - Wash, Rinse, Repeat

Most of this is from experience, but the SEDS site helped bring up some points I forgot:

<https://www.messier.seds.org/xtra/marathon/mm-tips.html>

Have Fun While Learning!

- Comfort & Fun

- Dress warmly
- Comfortable chair
- Table for charts
- Power Bank
- Thermos w/hot drink

- Fun!

- Manage expectations
- Don't stress out
- Pair up if needed

- Equipment Tips:

- Binos for searching!
- Telrads 4 star hopping
- Printed maps
- Mobile atlas
 - SkySafari
 - Google Sky Map
 - Stellarium
- Red headlamp/light
- Laser to share find

<http://www.messier.seds.org/m-goodie.html>

<https://www.messier.seds.org/xtra/marathon/mm-tips.html>

You'll be outside for a long time, so be prepared. Dress warmly, especially head and feet, which can be overlooked. Hunter's or shooter's gloves or mittens can be warm the hands while you still access your telescope. They also make gloves with hand-warmer pockets, electrically heated gloves, vests, and socks. Felt-lined boots are great for cold nights. They also make rechargeable hand-warmers in a variety of sizes and styles starting at \$10-\$15. (If you can't find them locally, Amazon has them.

Best tip is not stress out if you don't catch all of them. Above all, this is a learning program, a social gathering, and meant to be fun!!!

Binoculars will be a big help in finding, verifying, and seeing objects. While the marathon is meant to be a telescopic adventure, binos make star hopping easier thanks to their very wide view. Sometimes, you'll only find your way if you scout it out with the binos and then hop with your scope.

Types of Marathons

- Traditional
 - Manual scope (tracking OK)
 - Visual only
 - Printed maps only
 - Group work OK
- Pairs
 - Traditional marathon
 - 2 per scope
 - Alternate Objects
- Go-To Marathon
 - Go To Scope allowed
 - no challenge
 - Longer looks at objects
 - Assist traditional
- Half Marathon
 - Traditional to midnight
 - Try for maximum objects
- Camera
 - Insane difficulty

The marathon has some tradition since it began in the 70's and the traditional one is star hopping with a telescope. However, clubs recognize several other types.

The Go-To Marathon has no challenge, but it gives you much more time to enjoy the objects. You can also use your view to show the traditional marathoners what an object looks like and even help with star hopping.

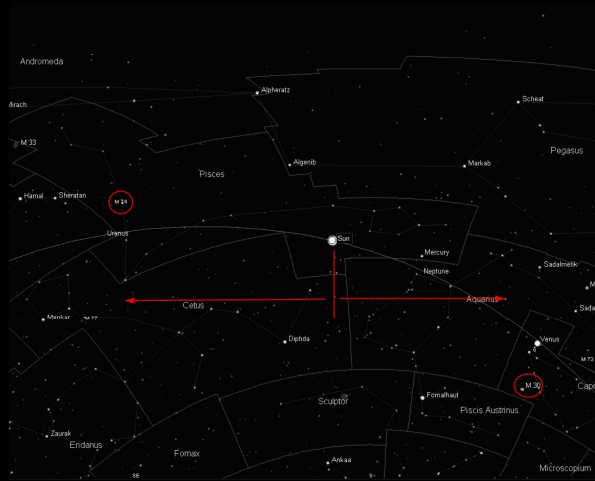
Pairs can be a fun experience where two people switch off between running the scope and paperwork. This can really help in the late night as you have a partner to help with star hopping and keeping things on track.

The Half Marathon can be run until midnight or the morning break. You try for the maximum number of objects within that time frame.

The Camera Marathon is a bit insane because you simply don't have the time needed to accumulate enough pixels for the dim objects, even with a computerized scope. I tried it once and failed with a cooled DSLR. (Better cameras with higher ISOs would help.)

Why Spring?

- Messier catalog has a gap in spring
- 2022 Dates
 - March 5
 - April 2

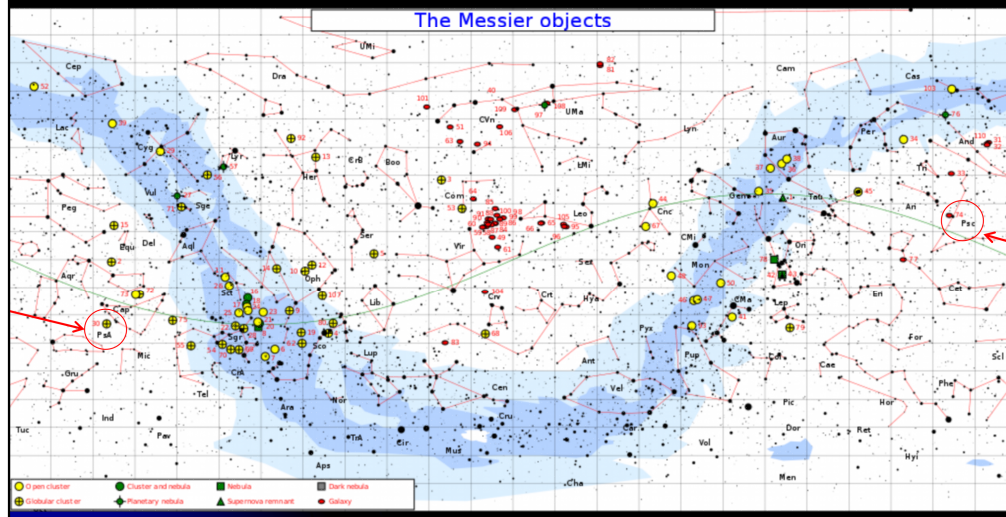


<https://www.messier.seds.org/xtra/marathon/mm-dates.html>

<https://www.peterboroughastronomy.com/LearningCentre/Messier%20Marathon%202019/G.%20The%20Messier%20Gap%20-2.jpg>

The Messier objects are not distributed evenly and in spring, there is just enough space that the sun can set and rise with M30 and M74/77 just above the horizon. This break occurs in March or April every year and the best weekends are at the new moons in these months.

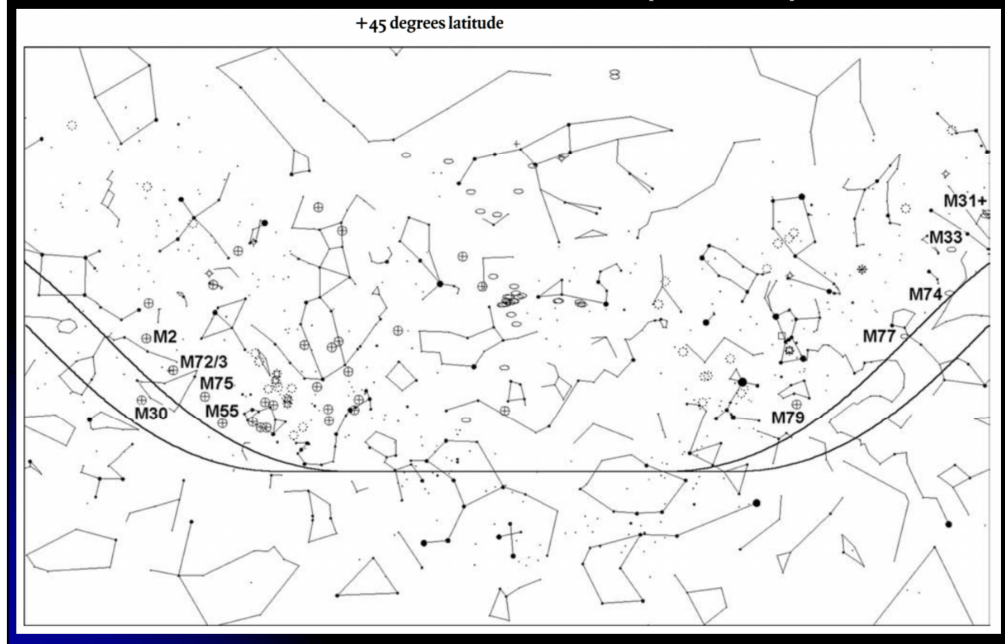
Messier Object Atlas



<https://en.wikipedia.org/wiki/File:MessierStarChart.svg>

Most Messier maps will show this same layout, centered on the Virgo cluster of galaxies and the edges split the M30 to M74/77 gap. There is another gap in Autumn that is not quite as wide and some objects won't be visible. The Virgo cluster really complicates the fall marathon, since it is lower to the ground and closer to the sun. See <https://www.scopereviews.com/fallmm.html> for more info

Northern Rush (NYC)

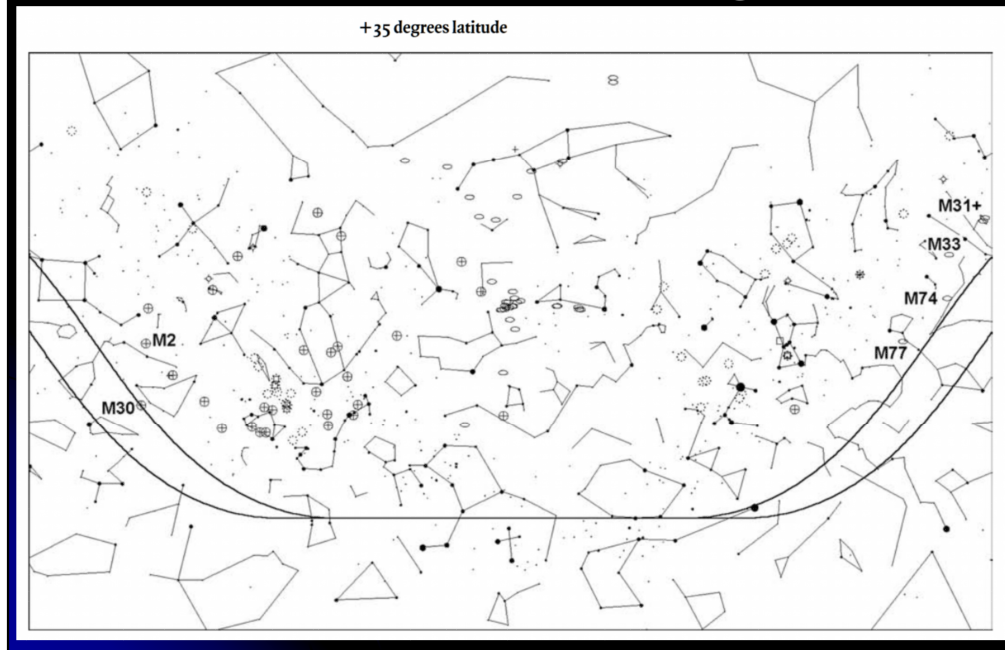


From The Observing Guide To The Messier Marathon, A Handbook and Atlas
by Don Machholz

<https://www.cambridge.org/us/academic/subjects/physics/amateur-and-popular-astronomy/observing-guide-messier-marathon-handbook-and-atlas?format=HB&isbn=9780521803861>

Don Machholz's book is a fantastic guide if you want to know everything about the marathon. This map is a great example. The bottom line on either side is nightfall. The upper line is twilight. In the northern US, the hardest objects are stuck low to the horizon in twilight and early night. This means they hug the horizon, so scattered clouds and small light domes might hide them.

Southern Advantage



From The Observing Guide To The Messier Marathon, A Handbook and Atlas
by Don Machholz

<https://www.cambridge.org/us/academic/subjects/physics/amateur-and-popular-astronomy/observing-guide-messier-marathon-handbook-and-atlas?format=HB&isbn=9780521803861>

In the south, we have more time to find the objects and can wait for nightfall for most of the objects. Lubbock is at about 33 degrees, so it's a little higher for us than this map shows.

The hardest objects to Marathon

Object	Type	Mag.	Altitude at 8 pm in Mid-March from Toronto
M74	Galaxy	9.2	13 deg.
M77	Galaxy	8.8	14 deg.
M79	Globular Cluster	8.0	16 deg.
M31	Galaxy	3.4	21 deg.
M32	Galaxy	8.2	21 deg.
M110	Galaxy	8.0	21 deg.
M33	Galaxy	5.7	22 deg.

Critical Evening Objects

Object	Type	Mag.	Altitude at 4:30 am in Mid-March from Toronto
M15	Globular Cluster	6.4	13 deg.
M2	Globular Cluster	6.5	3 deg.
M75	Globular Cluster	8.6	3 deg.
M72	Glob. Cluster	9.4	2 deg.
M73	Open Cluster	9.0	1 deg.
M55	Globular Cluster	7.0	0 deg.
M30	Globular Cluster	7.5	-13 deg.

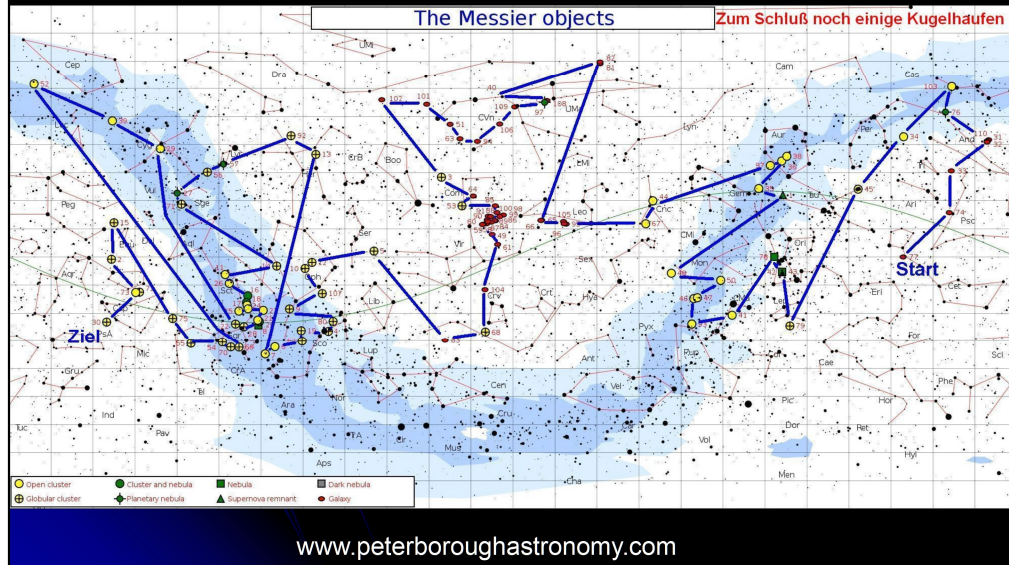
Critical Morning Objects

www.peterboroughastronomy.com/messier.php

<https://www.peterboroughastronomy.com/messier.php>

The heights listed are for Toronto, so we'll be 10-15 degrees higher, but it still shows that there will be a number of objects you'll need to capture quickly as they set in evening and rise at dawn.

Messier Marathon Map



<https://www.peterboroughastronomy.com/messier.php>

Morning and evening horizons roughly follow the Milky Way diagonals during the marathon. In the evening, the horizon is roughly parallel with M013 to M79 line. At dusk, the line is from M52 to M55. This means that most marathon sequences will agree pretty closely in the early evening and early morning objects. However, as you can imagine, the star hopping in the rest of the night can be up to interpretation. I've seen some sequences where they hop from Leo to Virgo Cluster, then take the loop through the northern constellations. However, I recommend sticking to whatever plan you pick so you get all of the objects in a night. Make a checklist or log book for the objects to be sure.

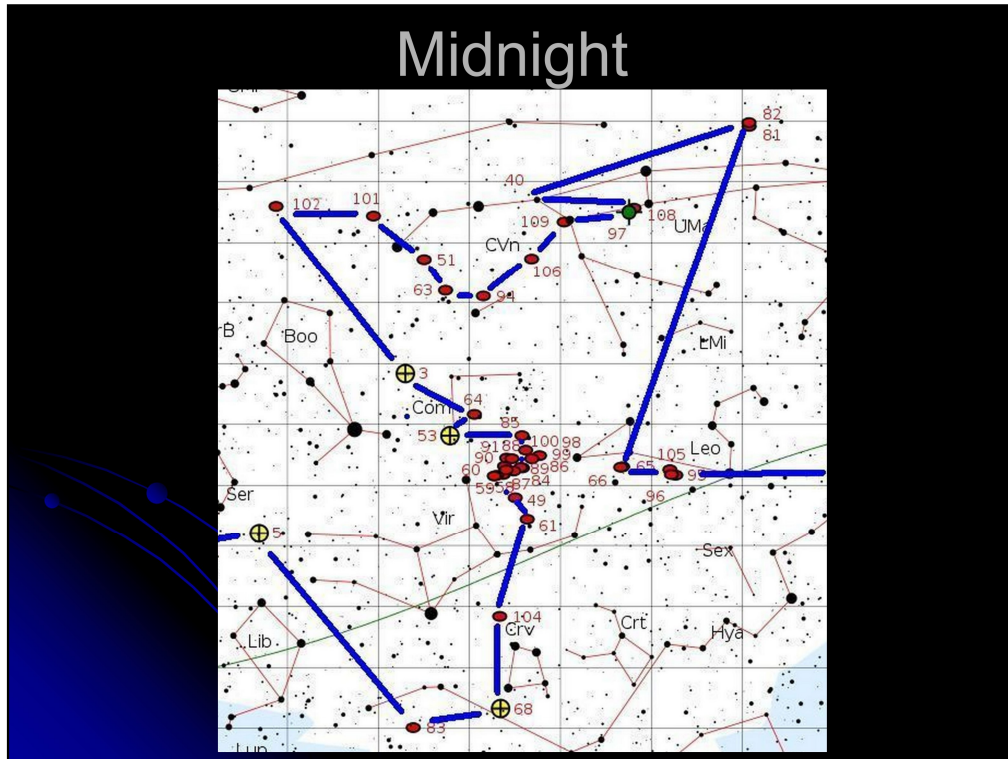
Evening

A star chart for the evening sky, showing various constellations and a path of stars. The chart is overlaid on a grid. The word "Evening" is written in large white letters at the top. The chart includes constellations such as Cam, Cas, Lyn, Aur, Per, And, Tri, Ari, Psc, Ori, Eri, For, Cet, Pyx, Cnc, Cmi, Mon, CMa, and Leo. A path of stars is marked with blue lines and numbers, starting from a red dot labeled "Start" in the lower right. The path includes stars numbered 103, 76, 34, 110, 31, 32, 33, 74, 77, 45, 38, 36, 37, 35, 44, 67, 48, 50, 46, 47, 41, 42, 43, 78, 79, and 59. The path ends at a green triangle in the center of the chart.

<https://www.peterboroughastronomy.com/messier.php>

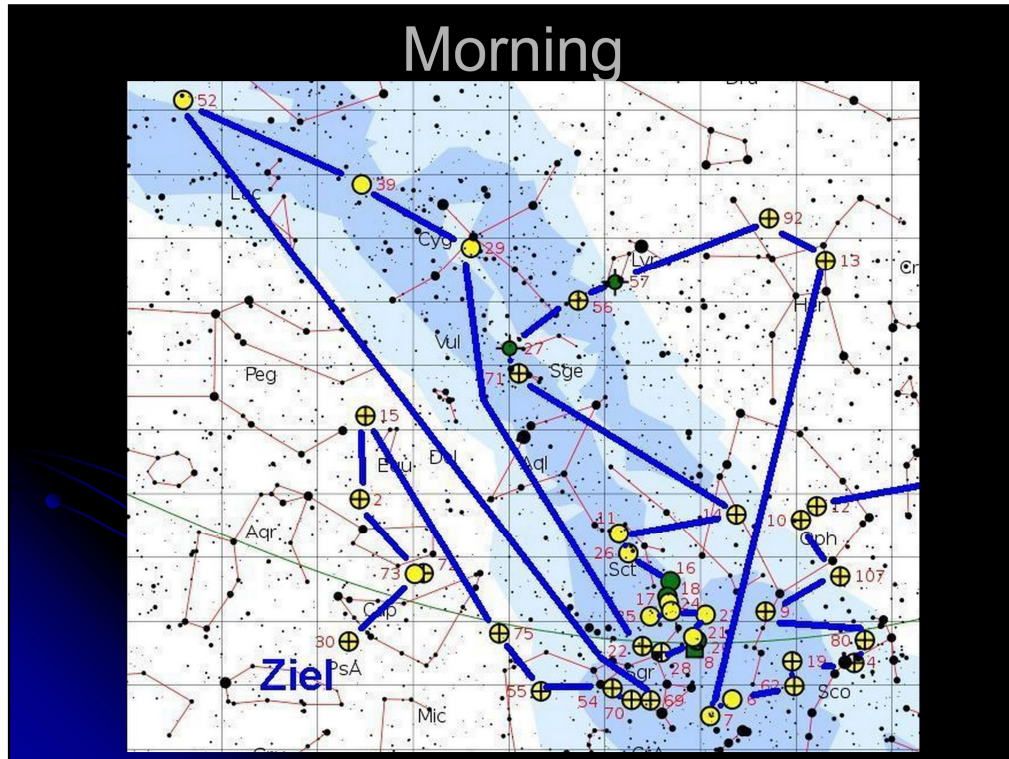
Remember that M77-74-33-31-32-101 are all fairly low to the horizon and need to be found first. You should have plenty of time for the M013-M79 line after that.

Midnight



<https://www.peterboroughastronomy.com/messier.php>

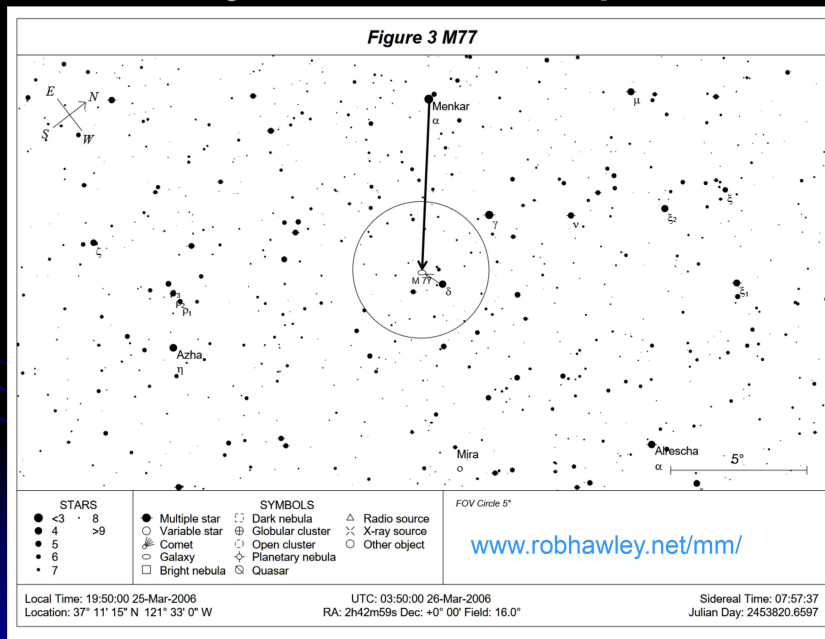
This stretch includes some very difficult targets in the Virgo Cluster. I think they chose this path because it's easier to hop from M53 into the Virgo cluster than it is to go from Leo into the cluster from the west.



<https://www.peterboroughastronomy.com/messier.php>

The morning requires some sizeable jumps, but many of the objects are fairly bright and easy to find, which is good for a tired marathoner. This is often a mad race to hop to the last of these objects!

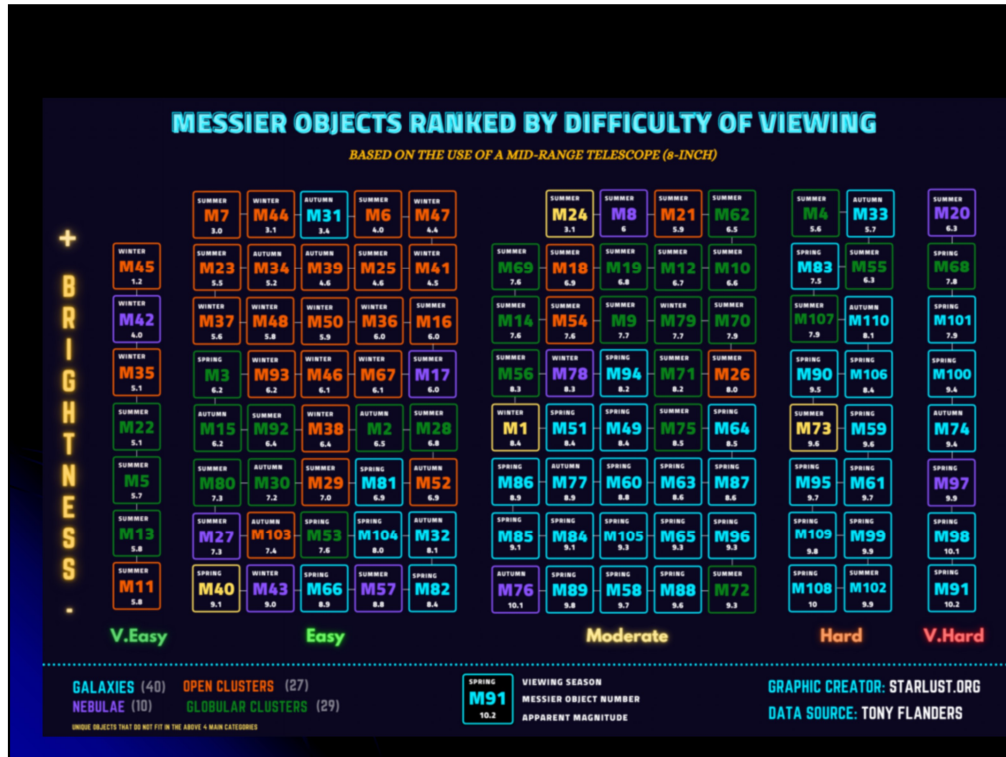
My Favorite Map



For a long time, I used charts similar to
http://astro-tom.com/messier/messier_finder_charts/messier_maps.htm.

However, that set lacked details for star hopping. Rob Hawley solved that by making the charts even more user-friendly and even included simulated eyepiece views for some of the galaxies! I highly recommend printing his maps:

www.robhawley.net/mm/



<https://starlust.org/messier-catalog/>

I found this an interesting and useful way to classify the objects for viewing. Brightness goes up the left and difficulty goes up on the bottom.

M11 is the dimmest very easy object.

M45 is the brightest very easy object

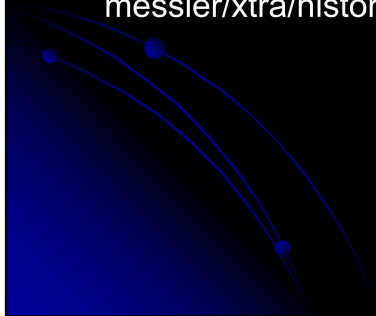
M91 s both dim and very difficult

M20 is bright but very difficult.

For comparison, naked eye objects for me include 45, 6, 7, 31, and M24.

Charles Messier Links

- <https://www.messier.seds.org/xtra/history/biograph.html>
- <https://www.messier.seds.org/xtra/history/timeline.html>
- Messier's Log Book translated:
[astro.ago.uni-lj.si/mirror/www.seds.org/
messier/xtra/history/m-cat.html](http://astro.ago.uni-lj.si/mirror/www.seds.org/messier/xtra/history/m-cat.html)



Marathon Guides

- www.peterboroughastronomy.com/messier.php
(source of many marathon images I used)
- www.robhawley.net/mm/
- www.messier.seds.org/xtra/marathon/mm-tips.html
- www.messier.seds.org/xtra/marathon/marathon.html
- lovethenightsky.com/messier-marathon-planning/
- astro-tom.com/messier/messier_files/files_and_links.htm

Hopping Messier Maps (PDF)

- www.robhawley.net/mm/SHG-MM-charts-v6.pdf
 - www.robhawley.net/mm/SHG-MM-text-v6a.pdf
- www.grayfoximages.com/Pages/NightSky/MessierMarathonACT.pdf (Tulsa)
- www.peterboroughastronomy.com/messier.php
- www.astro-tom.com/messier/messier_finder_charts/messier_maps.htm

<http://astrotulsa.com/pub/Messier/>

http://astrotulsa.com/CMS_Files/MessierTelradFinderCharts.pdf

http://astrotulsa.com/CMS_Files/MessierMarathonOrderTelradCharts.pdf

Messier Marathon Logbooks

- www.peterboroughastronomy.com/messier.php
(Logbook that goes with the maps)
- astronomyhouston.org/sites/default/files/MM%26Tx45Log_0.pdf
- astunit.com/tonkinsastro/messier/messmara.pdf

Special Recommendation

- Don Machholz is a comet hunter and one of the founders of the Messier Marathon.
- His book is often listed as THE reference for the marathon and I agree!
- The Observing Guide To The Messier Marathon, A Handbook and Atlas by Don Machholz

Messier Observing Program

- www.astroleague.org/al/obsclubs/messier/mess.html
- www.messier.seds.org/Messier.html
- The Ultimate Messier Object Log:
 - www.physics.hmc.edu/faculty/esin/a101/messier.pdf
 - astro-tom.com/messier/tumol/tumol.htm
(obsolete? computerized logbook)
- www.physics.hmc.edu/faculty/esin/a101/messier.pdf
(91 page Messier Log)

astrowolf.at/wp-content/uploads/2015/10/Objektkatalog_Messier.pdf (The ultimate Messier Object Log 91 pages!)

<http://astro-tom.com/messier/tumol/tumol.htm>