

HOW ONE PERSISTENT ASTRONOMER BEAT THE



URBAN ASTRONOMY: Observing the Messier Objects from the City

Five years ago, I bought a 70-millimeter refractor, mounted it on the windowsill of my city apartment, and set out to observe the Messier objects. Listed (and in many cases discovered) by 18th-century comet hunter Charles Messier, these 109 star clusters, nebulae, and galaxies are the first deep-sky objects many budding amateur astronomers seek out. Once I figured out how to associate my star charts with the view through my telescope's eyepiece, I finished off the Messier catalog's bright open star clusters in fairly short order. But I had great trouble seeing even the brightest of its galaxies, and most of them proved to be quite invisible. So I sought out darker skies, first in the suburbs and finally in rural New York State, where I completed the project nine months after I had started it.

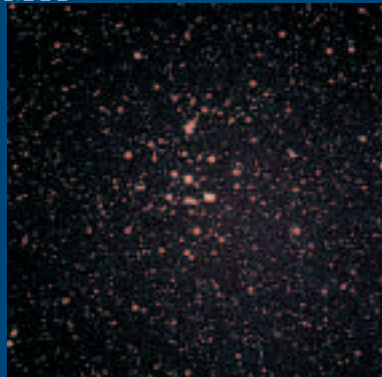
After that, my observing career proceeded apace with the purchase of a 7-inch Dobsonian and a more ambitious observing program: the Herschel 400 (<http://www.astroleague.org/al/obsclubs/herschel/hers400.html>). Completing this program greatly improved my observing skills. For example, viewing the notoriously difficult 9th-magnitude spiral galaxy M74 from a dark site with my little refractor — which had stretched my abilities to the limit the first time around — now seemed like child's play. I began to wonder how many of the Messier objects would yield to my new skills under urban skies.

I was also desperate for a project that I could undertake

close to home on weekday nights. I had observed much of the Herschel 400 from my astronomy club's field on the edge of the Boston suburbs, but that required a 45-minute drive each way.

Finally, I wanted to inspire other citybound beginners attempting to view the Messier objects. There are several fine Messier guidebooks, but typically they describe what the objects look like to experienced observers under dark skies, not what beginners see under urban or suburban skies. So I decided to attempt the entire Messier catalog once more, sticking strictly to the city this time.

M44



CLAYTON W. KESSLER

M45



VINCE AND MAGGIE FARNSWORTH

M42



BILL AND SALLY FLETCHER

LIGHT-POLLUTION BLUES.



BY TONY FLANDERS



Above: Using a 70-millimeter refractor and a 7-inch Dobsonian, Tony Flanders conquered the Messier catalog from this hilltop above what was, until recently, a Cambridge, Massachusetts, garbage dump. Despite a nearby highway and shopping mall, Flanders can see stars approaching 5th magnitude near the zenith. *Sky & Telescope* photographs by Craig Michael Utter. *Below:* Hunting the Messier objects from the city: bad but not hopeless. Among the Messier objects that Flanders found attractive from his hilltop were the Beehive and Pleiades open clusters (M44 and M45), the Orion Nebula (M42), the Little Dumbbell planetary nebula (M76), the large, bright globular cluster M13, and the galaxies M66 in Leo and M82 in Ursa Major.



M76



JAMES MCGAHA / TIM HUNTER

M13



BILL AND SALLY FLETCHER

M66

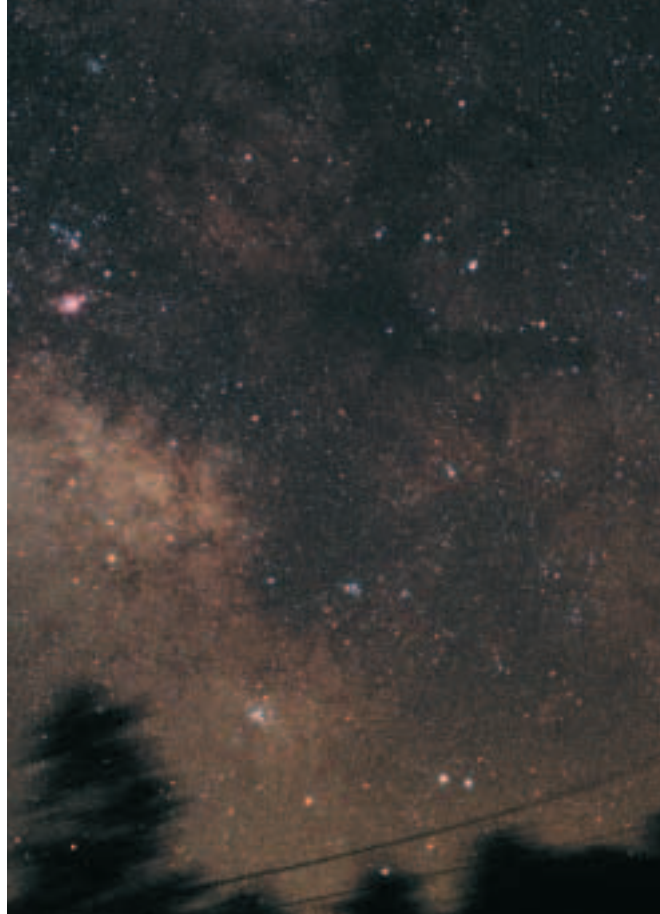


JAMES MCGAHA / TIM HUNTER

M82



AKIRA FUJII



Left: *Sky & Telescope* senior editor Dennis di Cicco took this photograph of the Scorpius Milky Way from his backyard in the Boston suburbs. **Right:** Essentially the same field, as photographed by di Cicco from Breezy Hill, Vermont, during the Stellafane star party. Surprisingly, with effort several deep-sky objects can be observed (if not fully enjoyed) even in the presence of substantial light pollution.

Location, Location, Location

I live in Cambridge, Massachusetts, one of the most densely populated cities in the United States. My backyard, like most in the city, is tiny and blocked from the sky by houses and trees. The sidewalk suffices for observing the Moon and the planets when they are properly placed, but it has too many streetlights for deep-sky astronomy. My refractor balances nicely on my windowsill, but I am not about to try that trick with my Dob!

Fortunately, I live near the best place in Cambridge for soccer, sledding, and stargazing. Danehy Park — one short block from the offices of *Sky & Telescope* — was created by capping the old city dump with the tailings from the latest subway extension. A diminutive hill now overlooks several ball fields and a fragment of the area's former wetlands. The hilltop is about as dark a site as you can find within five miles of downtown Boston, except when the lights are on at one of the ball fields. There are plenty of bright security lights on the buildings nearby, but they all are at or below eye level.

On the best nights I can see stars down to an apparent magnitude of 4.7 from this site with averted vision. The Double Cluster (NGC 869 and NGC 884) and the Beehive Cluster (M44) often are visible to the naked eye, and sometimes the Andromeda Galaxy (M31) is too. I cannot see the Milky Way, but I can deduce its presence when Cygnus is overhead by noting that the sky gets brighter rather than darker toward the zenith. This, I quickly decided, was the place to launch my citybound survey of the Messier catalog.

Aperture Wins

One myth that my survey lays to rest is the claim that large telescope apertures are wasted in the presence of light pollution (February issue, page 123). From Danehy Park I have positively identified 105 out of 109 Messier objects in my 7-inch Dobsonian but only 88 in my 70-mm refractor. Possibly more important, several of the objects that are difficult or lackluster in the refractor are quite impressive in the Dob. For instance, I can barely see the 10th-magnitude planetary nebula M76 through my refractor even under dark skies, but its peanut-like shape shows up easily in the Dob regardless of how bright the sky is. Likewise, the Dob resolves many stars in the globular clusters M5 and M13 even under city skies, while the refractor merely shows them as bright blobs in the city, or bright grainy blobs in the country.

That is not to say that the refractor fails to do justice to any of the Messier objects. Many of the catalog's brightest open clusters show up through light pollution quite well in the little telescope, and the Beehive and the Pleiades (M45) are magnificent. The refractor's view of the great Orion Nebula (M42) also is lovely, but it cannot compare with the stunning image provided by the 7-inch Dob.

Another myth is that deep-sky objects are best viewed at low power. On the contrary, high magnification closely follows aperture as my best weapon against light pollution. I typically use 60× with my refractor and 120× with my Dob while observing the Messier objects. I also find a narrowband or nebula filter very useful on a few nebulae, notably the Lagoon (M8), the Omega (M17), the Trifid (M20), and the Owl (M97).

ALL THE MESSIER STAR CLUSTERS AND PLANETARY NEBULAE ARGUABLY SHOW UP BETTER IN MY DOB UNDER CITY SKIES THAN IN MY REFRACTOR UNDER DARK SKIES.



Total Brightness vs. Surface Brightness

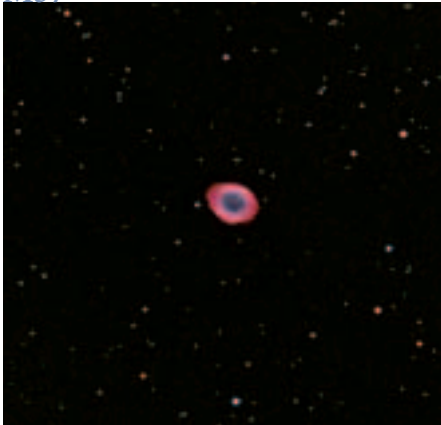
Some of the objects mentioned above — tiny M76 or the individual stars within M5 and M13 — have low *total* brightnesses (that is, numerically large apparent magnitudes) but high *surface* brightnesses, or brightnesses per unit area on the dome of the sky. That makes them relatively immune to light pollution. In fact, *all* the Messier star clusters and planetary nebulae arguably show up better in my Dob under city skies than in my refractor under dark skies.

The reverse is true for low-surface-brightness objects, including most galaxies. Light pollution grievously damages views of these objects, and no amount of aperture can compensate. For the most part, only the cores of galaxies are visible from the city. Even mighty M31 — five times as large as the Moon under dark skies — is reduced in Cambridge to a bright but featureless blob about as large as the Man in the Moon's nose. Most galaxies, M31 included, manifest themselves vastly better through my little refractor under dark skies than through the Dob in the city.

A few galaxies buck the trend, showing a respectable amount of detail even under heavy light pollution. The 8th-magnitude starburst galaxy M82 in Ursa Major is the most obvious example; its cigar-shaped body is quite obvious from Daneyh Park. Ninth-magnitude M66, a moderately inclined spiral in Leo, came as a surprise; my Dob showed not only a clearly elongated core but also a striking knot to the northwest and hints of other detail.

Of the four Messier objects that I failed to see in the Dob, the only one whose invisibility I really regret is M101, the face-on spiral just west of the bend in the Big Dipper's handle. Fourth among all northern galaxies in total brightness, M101 shines at magnitude 7.7 and is one of the most magnificent galaxies to see under dark skies. But M101's huge angular diameter (nearly a half degree) puts it near the bottom of the list in terms of surface brightness, and that, together with its abnormally faint core, must account for my failure. Two of my other failures (M61 in Virgo and M98 in Coma Berenices) are relatively faint in surface brightness *and* total brightness, and I

M57



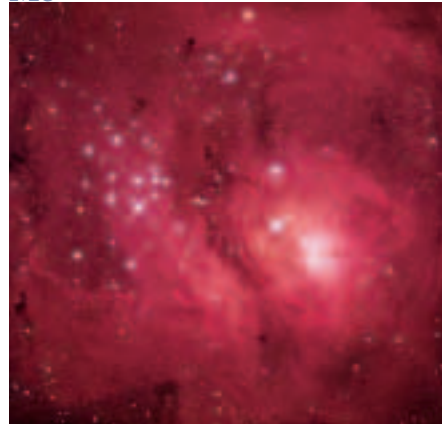
M33



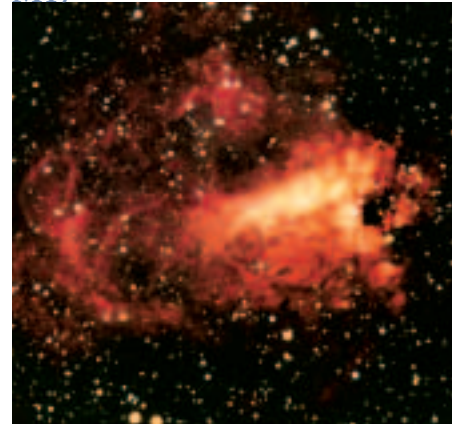
Surface brightness is more important than total brightness when it comes to seeing Messier objects under heavy light pollution. *Far left:* The Ring Nebula (M57) in Lyra glows at a relatively dim magnitude 8.8, but all its light is contained within a circle about 1' across, and it is readily visible in a 7-inch telescope from Daneyh Park. *Left:* The Pinwheel Galaxy (M33), for its part, has a total apparent magnitude of 5.7, making it fully 17 times brighter than the Ring. Yet it is a far more challenging telescopic target for urban observers because its light is spread out over an area roughly 2,000 times greater.

Right: Emission nebulae emit most of their light in narrow slices of the spectrum, and hence views of them can be enhanced by using light-pollution or nebula filters, which favor those slices while blocking much artificial light. Two Messier objects that show up especially well from the city with the help of filters are the Lagoon Nebula (M8) and the Omega (or Swan) Nebula (M17). Bob and Janice Fera of Calabasas, California, obtained these photographs (and those of the Ring Nebula and the Pinwheel Galaxy above) with an 11-inch Schmidt-Cassegrain telescope and hypersensitized film.

M8

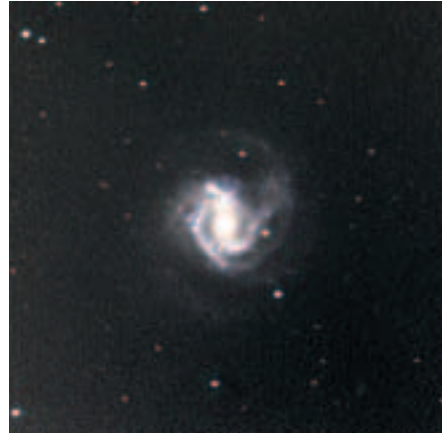


M17



M101

AKIRA FUJII

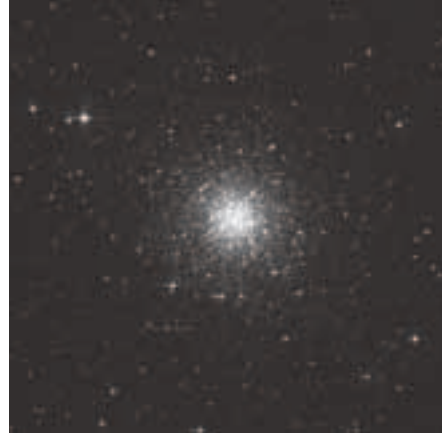
M61

JAMES MCGAHA / TIM HUNTER

Only four Messier objects eluded the author's scrutiny with his citybound 7-inch Dobsonian. Three, not surprisingly, were galaxies (M101 because of its low surface brightness; M61 and M98 because they are relatively dim overall). The fourth, globular cluster M68, may have escaped notice because of its low altitude (though the galaxy M83, in essentially the same part of the sky, was visible, thanks to its bright, compact core).

M98

JAMES MCGAHA / TIM HUNTER

M68

DIGITIZED SKY SURVEY

M83

JAMES MCGAHA / TIM HUNTER

was expecting to have trouble with these two spirals.

My fourth failure, the globular cluster M68 in Hydra, surprised me greatly; it is not inherently hard to see. The problem is its far-southerly declination of -27° ; it barely gets 20° above the Cambridge horizon at its best. I am sure that I could see it easily if I lived in a city just 10° farther south. Conversely, I would guess that many of the southernmost Messier objects might well be invisible from brightly lit cities 5° or 10° farther north.

Making the Best of a Bad Sky

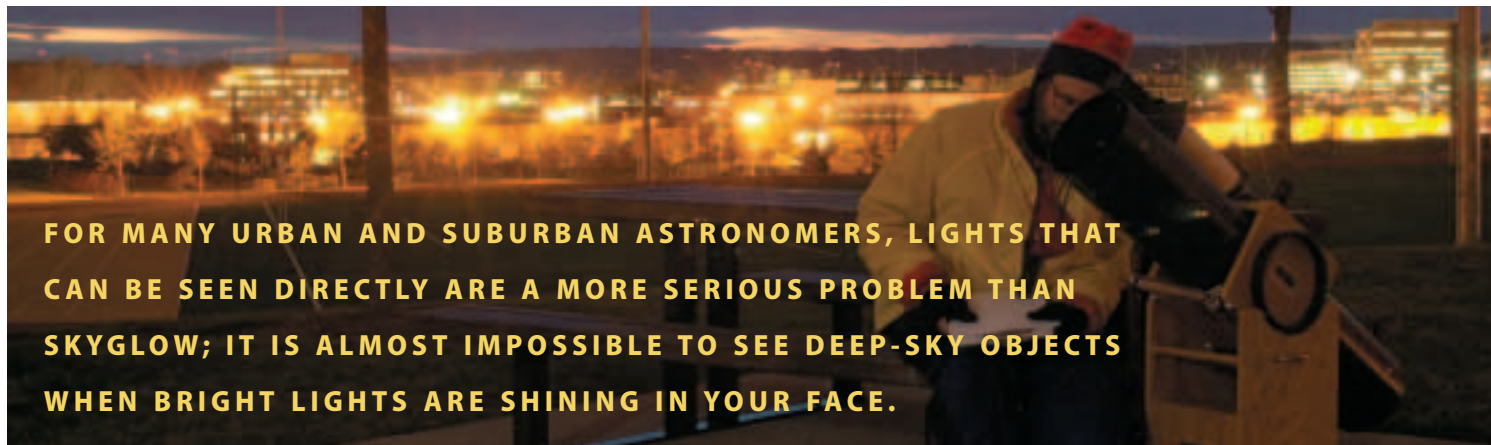
Optimal conditions are essential to observing faint fuzzies from the city; the target must be as high as possible above the horizon on a night of superb transparency. Haze dramatically increases skyglow. Even when haze is minimal, urban skies are

much brighter near the horizon than at the zenith, especially if you are facing downtown, a shopping mall, or a sports stadium with a night game in progress. Fortunately, skyglow decreases significantly after midnight.

Many of the Messier highlights are in the winter skies. It is fortunate that most of these are quite bright and easy to see, because skyglow increases significantly when the leaves fall from the trees in autumn. Fresh snow is a disaster, reflecting even well-shielded, downward-pointing streetlights back up to the sky.

The Moon outshines even the city lights when full, but it is not a limiting factor for urban deep-sky work in its crescent phases.

Relatively small differences in sky brightness can make a huge difference in the visibility of faint fuzzies. In Belmont, just three miles farther than Cambridge from Boston, slightly



FOR MANY URBAN AND SUBURBAN ASTRONOMERS, LIGHTS THAT CAN BE SEEN DIRECTLY ARE A MORE SERIOUS PROBLEM THAN SKYGLOW; IT IS ALMOST IMPOSSIBLE TO SEE DEEP-SKY OBJECTS WHEN BRIGHT LIGHTS ARE SHINING IN YOUR FACE.

Messiers Hit and Missed: Visibility Under Urban Skies

Messier object	7-inch Dob	70-mm refractor	18	2C	2C	37	1A	2B	56	2B	3C	75	2B	2C	94	3C	3C
1	3C	3C	19	3C	3C	38	2B	3C	57	1A	2B	76	2B	no	95	3C	4C
2	1B	2C	20	3C	no	39	2C	2C	58	3C	4C	77	2C	3C	96	2C	3C
3	1B	1C	21	2B	3C	40*	1C	2C	59	3C	no	78	2C	3C	97	3C	3C
4	3B	3C	22	1B	1C	41	1C	1B	60	2C	3C	79	3C	3C	98	no	—
5	1A	1C	23	2B	2B	42	1A	1A	61	no	—	80	1C	1C	99	4C	—
6	1B	1B	24	2B	2B	43	2C	3C	62	1C	2C	81	1B	2B	100	4C	—
7	1B	1B	25	1B	1B	44	1B	1A	63	3B	3C	82	2B	3B	101+	no	—
8	2B	2B	26	3C	no	45	1A	1A	64	2C	3C	83	2B	no	103	2B	2C
9	2C	3C	27	1B	1B	46	1B	2C	65	2C	3C	84	2C	—	104	2B	2B
10	1A	2C	28	1C	2C	47	1C	1B	66	1B	2C	85	2C	4C	105	2C	4C
11	1A	1B	29	2B	2B	48	1B	1C	67	2B	3C	86	2C	—	106	3C	4C
12	2A	3C	30	2B	2C	49	2C	3C	68	no	—	87	2C	no	107	4C	—
13	1A	2B	31	1B	1B	50	1B	1C	69	2B	2B	88	3C	no	108	3C	no
14	3B	3C	32	1B	2B	51	2B	3C	70	2A	3C	89	2C	4C	109	3C	—
15	1B	2C	33	3C	3C	52	2B	2B	71	2B	3C	90	3B	no	110	3C	4C
16	1A	2B	34	2B	2B	53	1B	2C	72	3C	3C	91	4C	—			
17	1B	2B	35	1B	2C	54	2B	2B	73	3C	no	92	1B	1B			
			36	1B	1B	55	3C	3C	74	4C	—	93	1C	1C			

Key: 1 = easily visible
2 = moderately easy
3 = difficult (averted vision required)
4 = very difficult (intermittently visible)

no = not seen
— = not attempted

A = spectacular appearance
B = beautiful or very interesting
C = moderately interesting

*M40 is a double star and was resolved in the 7-inch.

*M102 is a duplicate of M101 and hence is not listed as a separate object.

darker skies allow me to see stars about 0.3 magnitude fainter than (¾ as bright as) those visible from Danehy Park. That may not sound like much of an advantage, but it renders the summer Milky Way faintly yet consistently visible, and objects that are hard to see from Cambridge can be viewed fairly easy in Belmont. Conversely, from my parents' apartment in Manhattan, the limiting visual magnitude is about 0.4 magnitude lower than in Cambridge (meaning that stars have to be about 50 percent brighter to be visible to the naked eye), and the Messier objects are much harder to see. Nevertheless, several people have reported seeing all the Messier objects from Manhattan through 4-inch refractors, which demonstrates how far skill and persistence can go in conquering adverse conditions.

For many urban and suburban astronomers, lights that can be seen directly are a more serious problem than skyglow; it is almost impossible to see deep-sky objects when bright lights are shining in your face. My site is remarkably free of such direct glare, but if yours is not, make every effort to hide from impinging lights or to block them out. Some urban astronomers have gotten good results from strategically placed tarpaulins. Do not stare directly at whatever lights remain visible from your observing site; while less critical than at a pristine site, dark adaptation is important even in the city.

Why Do It?

City dwellers have much to gain by viewing the Messier objects. They are nobody's idea of the 109 *best* objects to view through light pollution, but they are the historic core of deep-sky observing, and they include wonderful representatives of every important category of deep-sky object.

If you can travel to dark, pristine skies, by all means do so; you will never know what a galaxy really looks like until you do. Best of all is our own galaxy, the Milky Way, spread out overhead on a summer night like braids of glistening rope. But traveling to dark skies is rarely practical on weeknights, and why restrict your observing to two nights out of seven?


Then there is the deep satisfaction of experiencing nature with-

in the city. I find the Messier objects all the more precious when they are hard to attain, just as I treasure the sighting of a kestrel or a barred owl more in the city than in the country. It is comforting to know that the city lights cannot steal my old friends from me.

It is also comforting to discover that many other urbanites love to view the heavens. Well-publicized events like planetary conjunctions draw small crowds to Danehy Park, each person independently concluding that it is the best place to view them. On more normal nights, many dog walkers, joggers, and lovers wander by, and quite a few are eager to look through my telescope. That is particularly gratifying when Saturn is in the sky; whenever I give someone his or her first view of the ringed planet I relive my own amazement and joy at that sight.

One evening last July I was working the southern Milky Way from my usual picnic table atop Danehy Park. A few dozen yards away, a group was partying quietly at another table, discussing hip-hop and the relative merits of Cambridge and Boston for a young single woman of color. One self-styled "Cambridge chick" was maintaining stoutly that you meet better men in her town than across the Charles River. Suddenly, she shouted that she had just seen a shooting star. Her companions pooh-poohed her.

The group wandered by on their way out of the park and stopped to take a look through my telescope. I showed them Arcturus, which pleased them mightily. (Seasoned observers may take this for granted, but a zero-magnitude star looks quite impressive through a 7-inch telescope if you have never seen one before.) And then, as I was pointing out Arcturus's location in the sky, a -2 magnitude meteor streaked by right next to it. That shut up the skeptics!

As they were walking away, the young woman remarked to her companions, "There you are! That would never have happened in Boston." I'm not sure that I agree, but I like to hear the night sky being named as one of my city's assets. 

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