



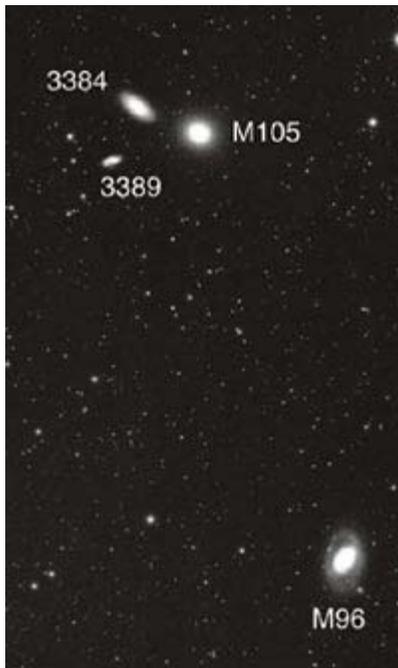
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A Galaxy-Hop in Leo

A rich field of galaxies lies waiting in Leo.

By Alan M. MacRobert



How many observers know what a rich field of galaxies and double stars awaits exploration just north of M95, M96, and M105? Compare this red-light Palomar Observatory Sky Survey print, 2.8° tall, with the chart on the following page. Click on the image to see a larger field of view.

Springtime (in the Northern Hemisphere) is galaxy time for deep-sky observers, for three reasons. On spring evenings the Milky Way lies right down on the horizon, keeping its own telescopic distractions out of sight. Second, the absence of the Milky Way allows us a wide, clear view into inter-galactic space with little or no interstellar dust in the way. And smack in the middle of this open view is the Virgo Cluster of galaxies — the core of the much larger Local Supercluster of galaxies, which is splashed across more than a dozen surrounding constellations (and includes, on its outskirts, our own Milky Way).

Tonight's telescopic guided tour begins at the star Denebola, Beta (β) Leonis, the tail tip of Leo just a few degrees from Virgo. Leo can be found high in the south on our naked-eye constellation map of April. As early as the beginning of March, it is already well up in the east by midevening.

Most galaxies are notoriously dim. Their surface brightnesses, naturally enough, are similar to that of the Milky Way band crossing our sky. Of course their enormous distances make them appear small; the ones on tonight's list range from about 30 to 60 million light-years away. But surface brightness, the light per square arcsecond of sky (*Sky & Telescope*: January, page 118), is unaffected by distance and is not greatly affected by whether you're using a telescope or the naked eye. So if the light pollution in your sky hides the Milky Way, expect it to hide most parts of other galaxies too.

Luckily, most galaxies contain a much brighter nucleus or central region. We can't see the bright core of the Milky Way because it's hidden behind

interstellar dust. So at least the central parts of many galaxies can be seen through even very mediocre skies.

I used a 6-inch reflector at 70x to scout out the tour here. The naked-eye limiting magnitude was a typical suburban 4.8. In a sky like this the Milky Way is just visible if you know where to look for it (when it's up), but it shows little or no detail and attracts no attention. If your skies are better than this, you'll have an easier time than I did.

Star Chart Basics and An Initial Hop

Before starting out, make sure you have a good feel for the use of the map. The black circles are 1° in diameter, the width of the view filling a typical 40x or 50x eyepiece. If you use higher power to help penetrate light pollution, as I did, be prepared to see a proportionally smaller area of the map at any one time.

North is up on the map. Nudge your telescope slightly toward

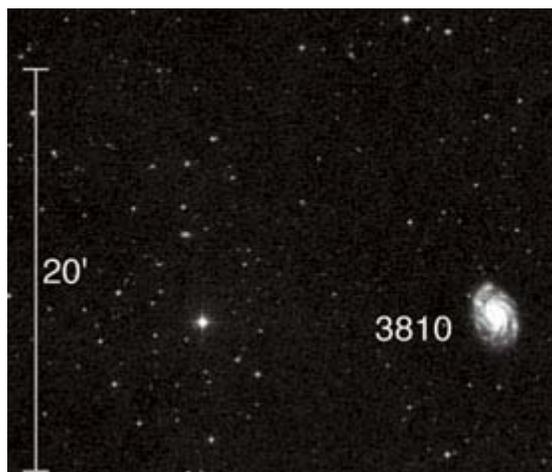
Polaris and note which side of the view new stars enter from, then turn the map around so its north side matches this direction. Lastly, make sure your telescope gives a correct image rather than a mirror image; the light going through the telescope should be reflected an even number of times (zero counts as an even number). This usually means removing a right-angle star diagonal at the eyepiece. You need a correct image if you want to easily compare what you see to a map.

1. Denebola. Our jumping-off point is the second-brightest star in Leo, magnitude 2.1. It hangs just a few degrees over Virgo's head. In my 6-inch, Denebola appears a definite pale blue-white — slightly surprising considering that its spectral type is A3 and its color index is +0.1. This is only the tiniest bit to the blue side of the spectral type and color index often considered to be pure white (A5 and +0.2.). Denebola is a beautiful diamond, the first and last really bright object on our night's itinerary. It is 22 times as luminous as the Sun and 40 light-years away.

2. h2583. Carefully star-hop to this 9th-magnitude double star 1.7° southwest from Denebola, matching star patterns on the map to what you see in the eyepiece each step of the way. Pay special attention to triangles of stars, particularly their exact shapes. Triangles are the basic steppingstones for star-hopping.

If you've got the map correctly oriented to north, you'll have no problem making your way to this little double. It is named with a lowercase "h" for its number in the 19th-century double-star catalog of John Herschel, son of William Herschel, who was capital H. In the 6-inch it's an attractive little pair of identical white points, wide and easily separated, like distant animal eyes in the dark. Not all the pretty double stars for small telescopes are the bright ones listed in observing guides!

From NGC 3810 to a Pair of Faint Glows



NGC 3810 displays knotty, pinwheel arms in this enlargement from a [Palomar Observatory Sky Survey \(POSS\)](#) blue plate. Only its brighter nuclear region was visible in a 6-inch reflector under mediocre skies. In a dark sky, how small a telescope will show the surrounding disk?



A galaxy tour for spring evenings, starting from 2nd-magnitude Denebola, the tail star of Leo. Stars are plotted to magnitude 11.0 and galaxies to about 12.9. The black circles are 1° in diameter, about the size of the view you see in an ordinary 45-power eyepiece. The circles highlight the points of interest described in the text. Click on the image to see the complete chart. (It's a large file and may take some time to load.) *Sky & Telescope* illustration.

3. NGC 3810. Our first galaxy is a tough one. It's listed in the *Deep Sky Field Guide to Uranometria 2000.0* as having a total visual magnitude of 10.8 but a rather dim average surface brightness, 13.1 magnitudes per square arcminute. Low surface brightness is bad news in a light-polluted sky, so I didn't have much hope for it.

Star-hop southward through faint fields, working with the map from triangle to triangle, until you're looking at exactly the right spot. I saw nothing here at first. But with more time a faint, ethereal little patch glimmered in and out of view. Eventually I was able to hold it in view for a couple of seconds at a time. Success! Don't forget to breathe steadily; your eye needs oxygen. What I was seeing was only the galaxy's small nucleus, less than 1' wide, not the disk of spiral arms prominent in the photograph above.

4. 88 Leonis. Work nearly 4° northwest until you hit this double star. Its components are magnitudes 6.4 and 8.4, off-white and orange-brown, 16 arcseconds apart with the faint

one to the north-northwest. The bright star is an F7 dwarf about $2\frac{1}{2}$ times as luminous as the Sun; the faint one is $2\frac{1}{2}$ times dimmer than the Sun.

5. NGC 3686, 3684, and 3681. Farther northwest is the 6th-magnitude, orange-yellow star 81 Leonis. Spaced in a row less than a degree northeast of it are three galaxies. NGC 3686 wasn't very difficult — a large, diffuse glow with hardly any central brightening. But I could see nothing of the other two. Oddly, however, all three are listed as about the same visual magnitude (11.3), size (2' by 3'), and low surface brightness (13.2 magnitudes per square arcminute).

6. NGC 3655 (magnitude 11.7, surface brightness 11.8) was a challenge, barely detectable in the 6-inch. How hard to imagine that each of these dim little glows we're finding is an island universe containing hundreds of billions of suns and, most surely, many billions of planets!

7. NGC 3626 (mag. 11.0, s.b. 12.5) was the easiest galaxy on the itinerary so far. It was visible at first glance — or at least its rather small, condensed nucleus was.

8. NGC 3607 and 3608 (mags. 9.9 and 10.8, s.b. 12.9 and 12.6, respectively). Here was an unexpectedly lovely pair of glows. Both were easy to spot at first look. The one on the south, NGC 3607, is larger, more condensed (concentrated toward the middle), and has a brighter nucleus. There's a sprinkling of faint stars around and among the pair, adding to the beauty of the field. I saw no sign of nearby NGC 3599, magnitude 11.9.

A Beautiful Trio of Galaxies

9. M65, M66, and NGC 3628. Work south to Theta (θ) Leonis, a 3.3-magnitude cold-white dazzle. Check in on the faint little double star a half degree due south of Theta, labeled Double A on the map. Continue on south-southeast and you'll hit our first Messier objects of the night.

What a beautiful scene this is, after the faint galaxies we've been logging up to now! Someone who starts the night by pointing straight at M65 and M66 might be impressed only by their dimness, but since we have pushed our vision to the limit on fainter galaxies, these look big and bright by comparison. Both appear elongated, the first galaxies of the evening to show much real shape in the 6-inch. M66 has a brighter nucleus, shows signs of mottled detail, and seems more sharply bordered on its southwestern side. There is a nice sprinkling of stars around it.

M65 is in a blanker area. It appears larger and more elongated than M66 and is edged most sharply on the east. This indicates that the eastern side of the galaxy is closer to us; dark dust lanes are blocking the glow from parts behind, as confirmed on photographs. These two galaxies are a nice study in similarities and differences.

M65 and M66 are magnitudes 9.3 and 8.9, respectively, 9' by 2' and 8' by 4' in size, and have the same average surface brightness, 12.5 magnitudes per square arcminute. Both are type Sb, similar to the Milky Way, though M66 is the dustier and clumpier of the two.

There's more to this field. North-northeast by 0.6° is NGC 3628, an enormously elongated east-west pencil 14' by 4' in size, an Sb galaxy oriented edge on. Its total magnitude is 9.8, but it has such a low surface brightness (13.7) that it was not easy in the 6-inch. I thought I glimpsed signs of its two thin, unequal bands of light sandwiching a dark dust lane. It's halfway between two 10th-magnitude stars to the north and south.

More Challenging Galaxies

10. NGC 3593 (mag. 10.9, s.b. 13.4) was visible almost at first sight, but even so, we're back now to faint little smudges of galaxies. This

one appeared quite small, though with a lot of looking I thought I caught hints of a much larger glow around it. It's in a nice star field.

11. NGC 3705 (mag. 11.1, s.b. 13.3). To pick up this galaxy you need to make a side excursion south past Iota (ι) Leonis. (Iota is a bright, slightly greenish white binary, magnitudes 4.0 and 6.7, with a current separation of only 1.6" in position angle 121°; try your highest power.) The galaxy, however, is worth the trip. In the 6-inch it was easy at first sight, small and round with hints of elongation, in a nice, starry field. It is the brightest in a group of much fainter galaxies that may be visible with large apertures under good skies.

12. NGC 3489 is back on our main line. With a magnitude of 10.3 and a favorable surface brightness of 12.2, it was plain as day at first glance — a glow with a very sharp stellar nucleus, and, I thought, signs of east-west elongation.

13. Struve 1496 (Σ 1496) is a nice double star, moderately wide with very unequal components, magnitudes 8 and 10, 20" apart. The faint star is in position angle 352°, almost due north of the primary. Their colors seemed white and gray-brown.

14. h2547 is a fainter double, a pair of nearly equal 11th-magnitude stars 27" apart in position angle 65°. They are both *G* stars, possibly dwarfs like the Sun.

15. NGC 3412 (mag. 10.5, s.b. 12.4) was also seen at first glance. The faint galaxies seem to be getting easier now! This one appeared quite small and condensed with a bright nuclear area; a nice little grayish glow.

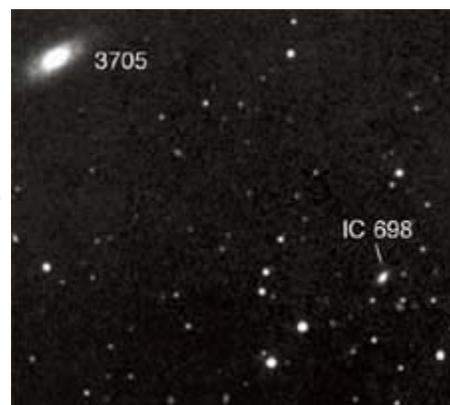
16. NGC 3377 and 3367 (mags. 10.4 and 11.5, s.b. 12.8 and 12.9). NGC 3377 was also visible at first glance; it displayed a bright, very stellar nucleus in a larger surrounding glow.

I didn't see NGC 3367 at first. But with a lot of effort I finally picked it up, after breathing deeply and shielding all extraneous light from around the eyepiece. It was a large, diffuse glow with little or no central condensation.

On to M96 and M95



One of a pair of Messier galaxies in Leo; M96 is 0.8° away from M95 (below). M95 is a barred spiral; M96 is plain. Like M65, M66, and M105, both M96 and M95 are thought to be



NGC 3705 is the brightest galaxy in a field that includes NGC 3692 and, for very large telescopes under dark skies, a cluster of more than a dozen much more distant galaxies known as the IC 698 group. [Martin C. Germano](#) of Thousand Oaks, California, used an 8-inch f/5 Newtonian reflector with a coma corrector for this 70-minute exposure on hypered Kodak Technical Pan 2415 film. Click on the image for a wider field.

17. Four double stars. Just south of NGC 3367 is a field of wide doubles. Barely 16° to the galaxy's south is a 44"-wide pair, magnitudes 8.9 and 10.0; the fainter star is due west. I've labeled it Double B on the map. Can you see any orange color in the brighter star?

A half degree southeast, Double C is 36" wide with the 10.7-magnitude component southwest of the 9th-magnitude primary.

Σ 1472 in the same field is brighter, magnitudes 8.1 and 8.8, about 40" wide with a *K0* primary. The stars looked pale yellow-orange and greenish gray. Its secondary star and that of Double C point nearly toward each other.

Σ 1477 is closer, with a separation of 18", and nearly equal; both stars are 9th magnitude. They're aligned almost east-

roughly 30 million light-years away. Kim Zussman used a 14-inch f/8 Cassegrain telescope for a 2-hour exposure of M96 on Tech Pan 2415 film.

west (position angle 275°). This is the prettiest pair of the four, and it forms a nice little triangle with two field stars.

18. M105 and NGC 3384 (mags. 9.3 and 9.9, s.b. 12.1 and 12.8). The surprises keep coming! This is another beautiful pair of glows in the same field, a follow-on to M65-M66 and NGC 3607-08. M105 is larger and has a bigger glowing core. NGC 3384 has a bright nucleus too but is somewhat smaller overall. I couldn't say I definitely saw NGC 3389 (mag. 11.9, s.b. 12.9), located very close by.

There's a nice little row of four 10th-magnitude stars running north-south just east of this pair or trio. I didn't want to leave this spot — a special deep-sky find worth returning to on future nights.

19. M96 (mag. 9.2, s.b. 12.9). We end the show with two bangs. The Sa-type spiral M96 was found easily, all by itself in a relatively starless field. It's large, appeared slightly elongated northwest-southeast, and has a bright center. I thought it looked a little more sharply bordered on the northeast side.



This view of M95 was also obtained by Kim Zussman who used an 11-inch f/10 Schmidt-Cassegrain for a 2½-hour exposure on Tech Pan 2415 film.

20. M95 (mag. 9.7, s.b. 13.5), a barred spiral of type SBb, appeared less bright than M96. It was nearly as large but with a dimmer center. Again, it was somewhat elongated northwest-southeast.

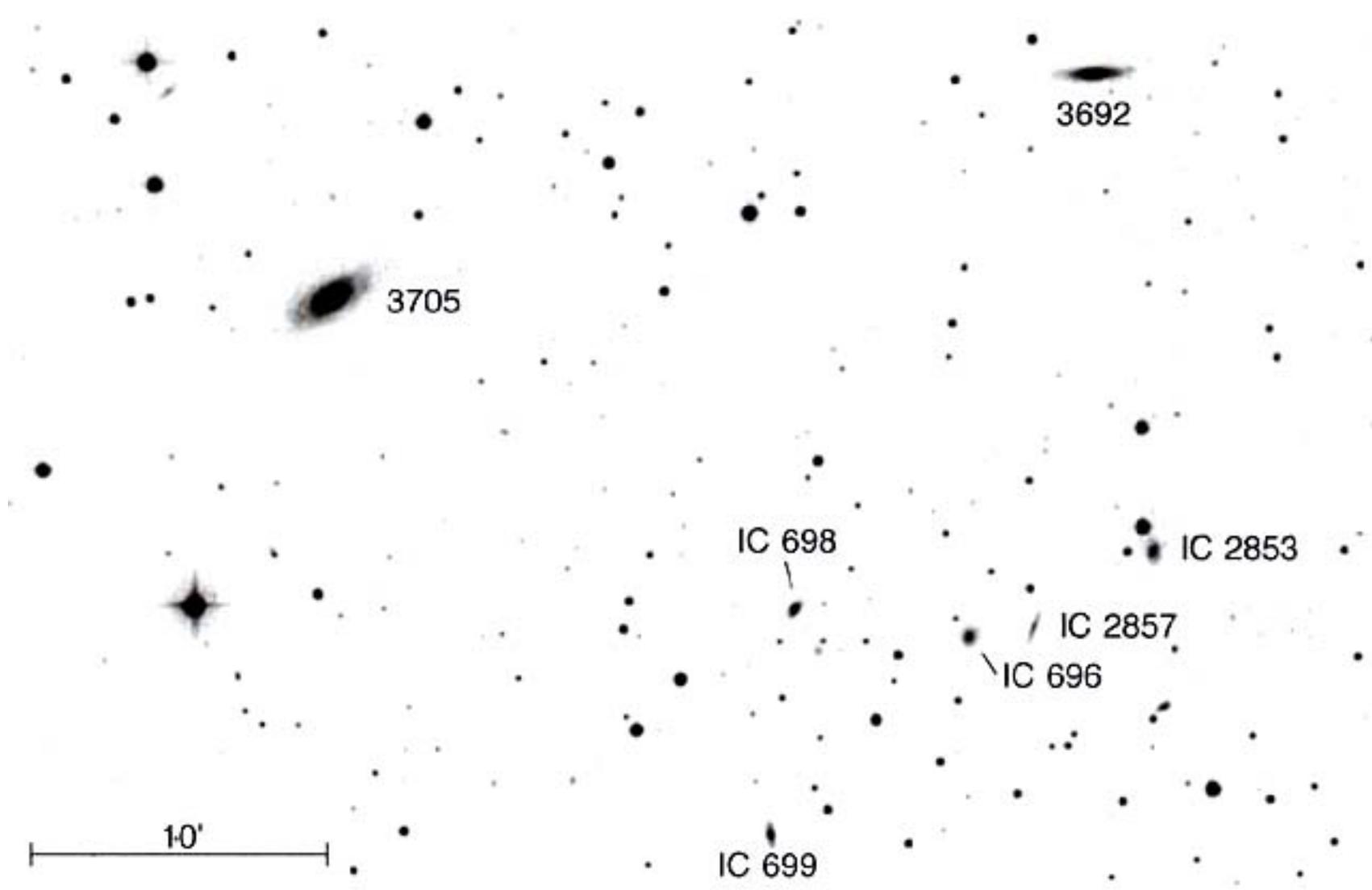
We've worked westward all the way from the Lion's tail tip to his midriff, flea-like. By now, if you've taken the tour at a leisurely pace and stayed out late, Leo is already carrying his deep-sky cargo down toward the west. Time to turn in, with visions of galaxy glows in hidden depths over the rooftops to bring to our dreams.

Fourteen other star-hop projects like this one are collected in Alan MacRobert's book, [Star-Hopping for Backyard Astronomers](#).

Alan MacRobert is a senior editor at Sky & Telescope magazine who likes chasing faint galactic fuzzies with telescopes large and small.

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● 52 Leonis

● 3377

● 3367

● Double B

● 3412

● Double C

● $\Sigma 1472$

● $\Sigma 1477$

3384

● M105

3389

● M96

● M95

30'

