

0: ½ MPC ~ 1.5 Mly, the **Milky Way**, including its two *Magellanic Cloud* irregular spirals and many spheroidal dwarf galaxies and GCs.

Most galaxies as seen in small telescopes from a suburban backyard will show up as just faint patches or stellar points surrounded by tiny halos; What interests me though, is not so much what I'm able to catch of details in the individual objects, but rather the **large-scale location and distribution of the galaxies**, that is: how the groups can be seen "wide field" on the celestial dome, as I zoom out from our *Milky Way*...

Below I've listed the Messier galaxy objects, arranged according to their distance from our own Milky Way galaxy:

1: 2 Mpc - 5 Mly, the **Local Group**, The Milky Way – Andromeda – Triangulum galaxies with their satellites, plus the *Sculptor Group* (N55 at ~10 Mly).

2: 6 Mpc ~ 20 Mly, the **Local Supercluster**, The M81 - CVn – M83 – CenA groups, plus the **Leo Groups** (several Messiers at ~40 Mly).

3: 20 Mpc ~ 70 Mly, the **Virgo Supercluster**, The UMa – Coma -Virgo groups, all in the background at ~50 Mly.

4: 90 Mpc ~ 300 Mly, the **Surrounding voids and supercluster filaments**, for instance the *Taurus Void* and *Perseus-Pisces wall*.

5: And beyond...

5: Galaxies [40]

M NGC LOCAL GROUP (5 Mly) Autumn

M31 N224 S And *Great Andromeda*
M32 N221 E And Dwarf to M31
M110 N205 E And Dwarf to M31
M33 N598 S Tri *Triangulum/Pinwheel*

M NGC LOCAL SUPERCLUSTER (Near~ 15 Mly)

M81 N3031 SA(s)ab UMa *Bode's*
M82 N3034 IO UMa *Cigar*
M94 N4736 (R)SA(r)ab CVn *CrocEye* Canes-I
M64 N4826 (R)SA(rs)ab Com *Black Eye*
M83 N5236 SAB(s)c Hya *S.Pinwheel* Cen-A

M NGC LOCAL SUPERCLUSTER (Far~ 30 Mly) M101-Cloud

M101 N5457 SAB(rs)cd UMa *Pinwheel*
M51 N5194 SAbc CVn, *Whirlpool*
M63 N5055 SAbc CVn *Sunflower*
M66 N3627 SAB(s)b Leo E Triplet
M65 N3623 SAB(rs)a Leo E Triplet
M96 N3368 SAB(rs)ab Leo W Triplet
M95 N3351 SB(r)b Leo W Triplet
M105 N379 E1 Leo W Triplet

M NGC VIRGO SUPERCLUSTER (60-70 Mly) →

- VIRGO-I Core
- UMA-I Association (SUPERGROUP)
- COMA-I Association (SUPERGROUP)

5: Galaxies 40 -- continued]

M NGC VIRGO-I CORE (60 Mly)

M87 N4486 cD pec Virgo A Wall W
M86 N4460 E2 Vir *Markarian* Wall W
M84 N4374 E1 Vir *Markarian* Wall W
M58 N4579 SAB(rs)b Vir Wall E
M59 N4621 E5 Vir Wall E
M60 N4649 E2 Vir Virgo C Wall E
M49 N4472 E2 in Vir Virgo B Outskirts
M61 N4303 SAB(rs)bc Virgo S Outskirts
M85 N4382 SA0+(s)pec Com Outskirts
M88 N4501 SA(rs)b Com Hook N
M91 N4589 SB(rs)b Com Hook N
M89 N4552 E0-1 Vir Hook S
M90 N4569 SAB(rs)ab Vir Hook S
M98 N4192 SAB(s)ab Com Triangle
M99 N4254 SSA(s)c Virgo N Triangle
M100 N4321 SAB(s)bc Com Triangle

M NGC COMA-I Association (60 Mly)

-- N4725,N4565 --<no Messier galaxies>

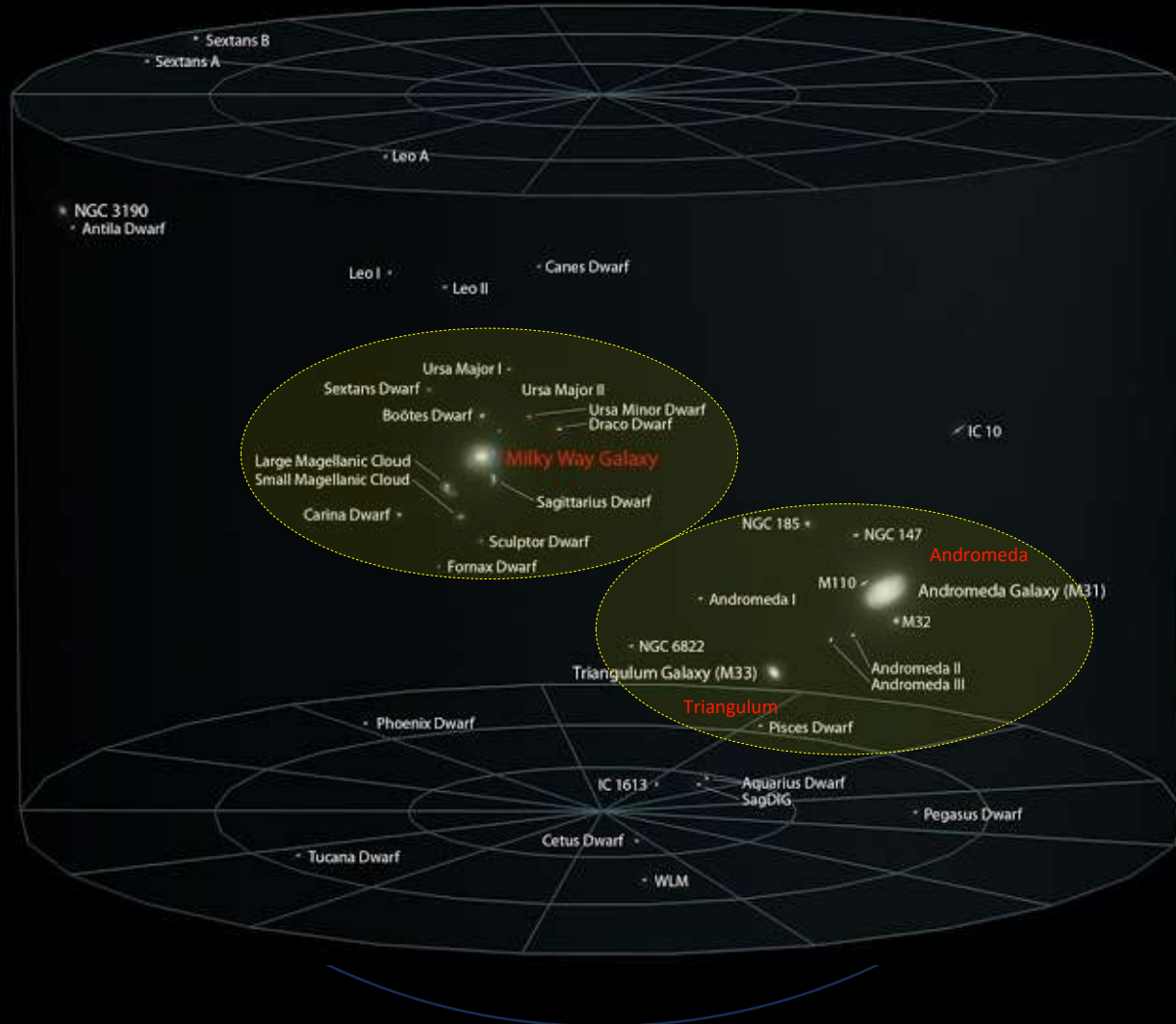
M NGC UMA-I Association (70 Mly)

M106 N4258 SAB(s)bc CVn
M108 N3556 SAB(s)cd UMa
M109 N3992 SB(rs)bc Uma

M74 N628 SA(s)c Psc *Phantom* 30 Mly
M104 N4594 SA(s)a Vir *Sombrero* 30 Mly
M102 N5866 SA0 Draco *Spindle* 50 Mly
M77 N1068 (R)SA(rc)b Cetus 50 Mly

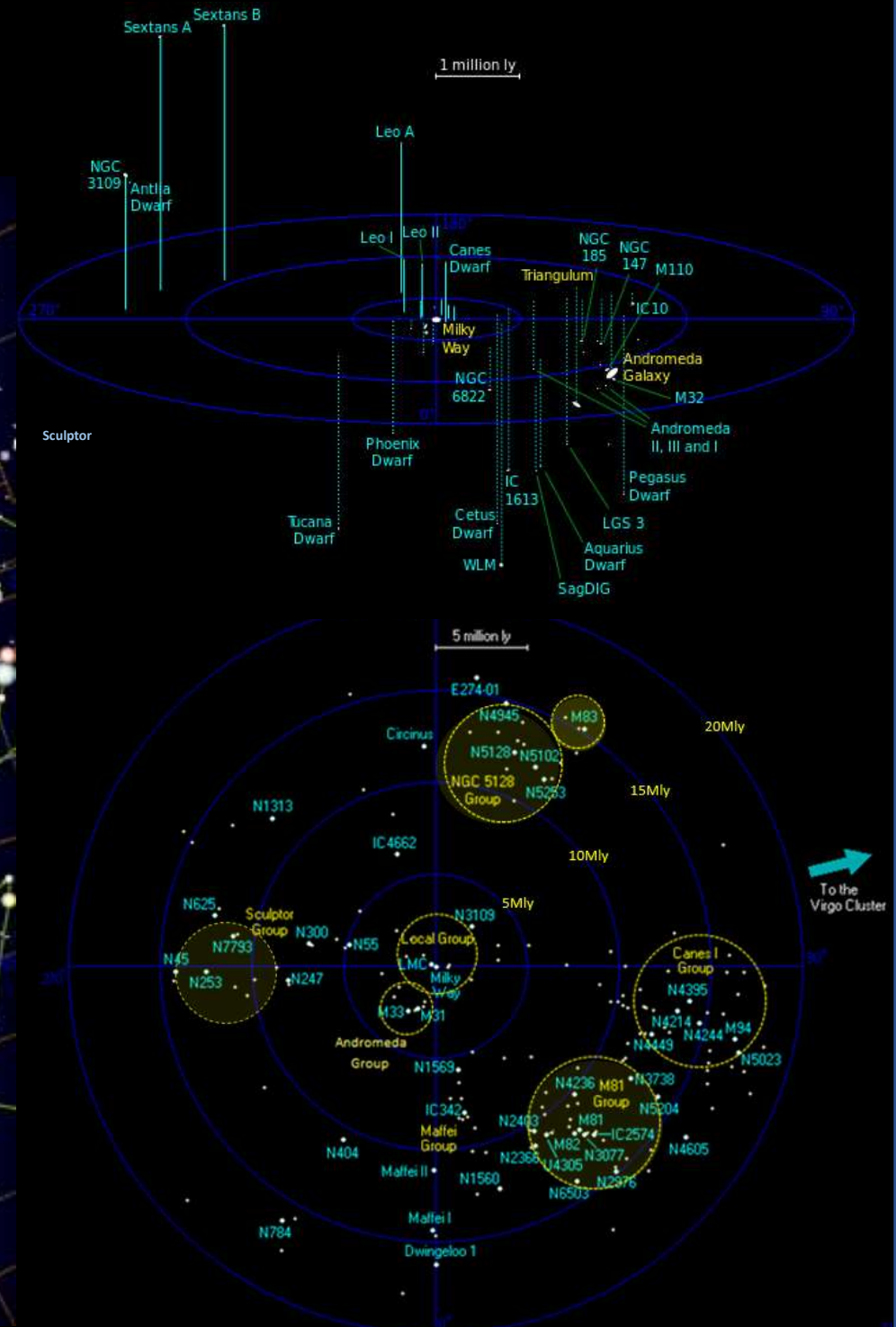
Step 1: 2 Mpc ~ 5 Mly
The **Local Group**

The **Milky Way – Andromeda – Triangulum** galaxies with their satellites, plus, the **Sculptor Group** (N55 at ~10 Mly).



The Local Group

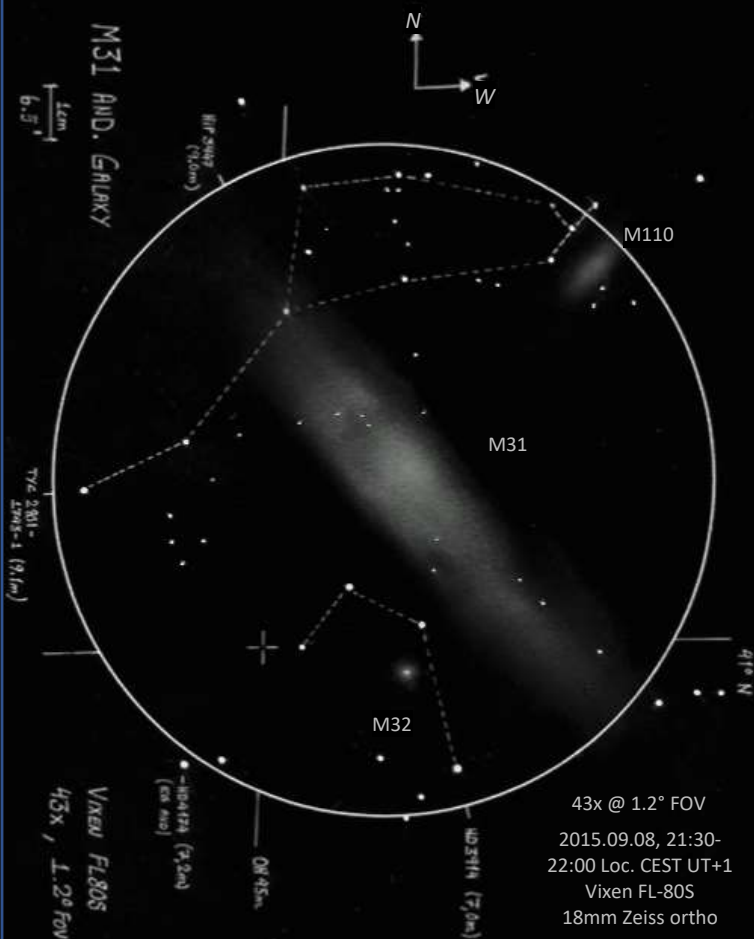
is mostly centered around R.A. 0-1^h on the celestial dome (galactic $\sim 120^\circ$ l), i.e., from *Cassiopeia-Andromeda-Triangulum* to *Pisces-Cetus-Sculptor*. As such, these nearby galaxies are most conveniently studied in **autumn** here from the N. hemisphere



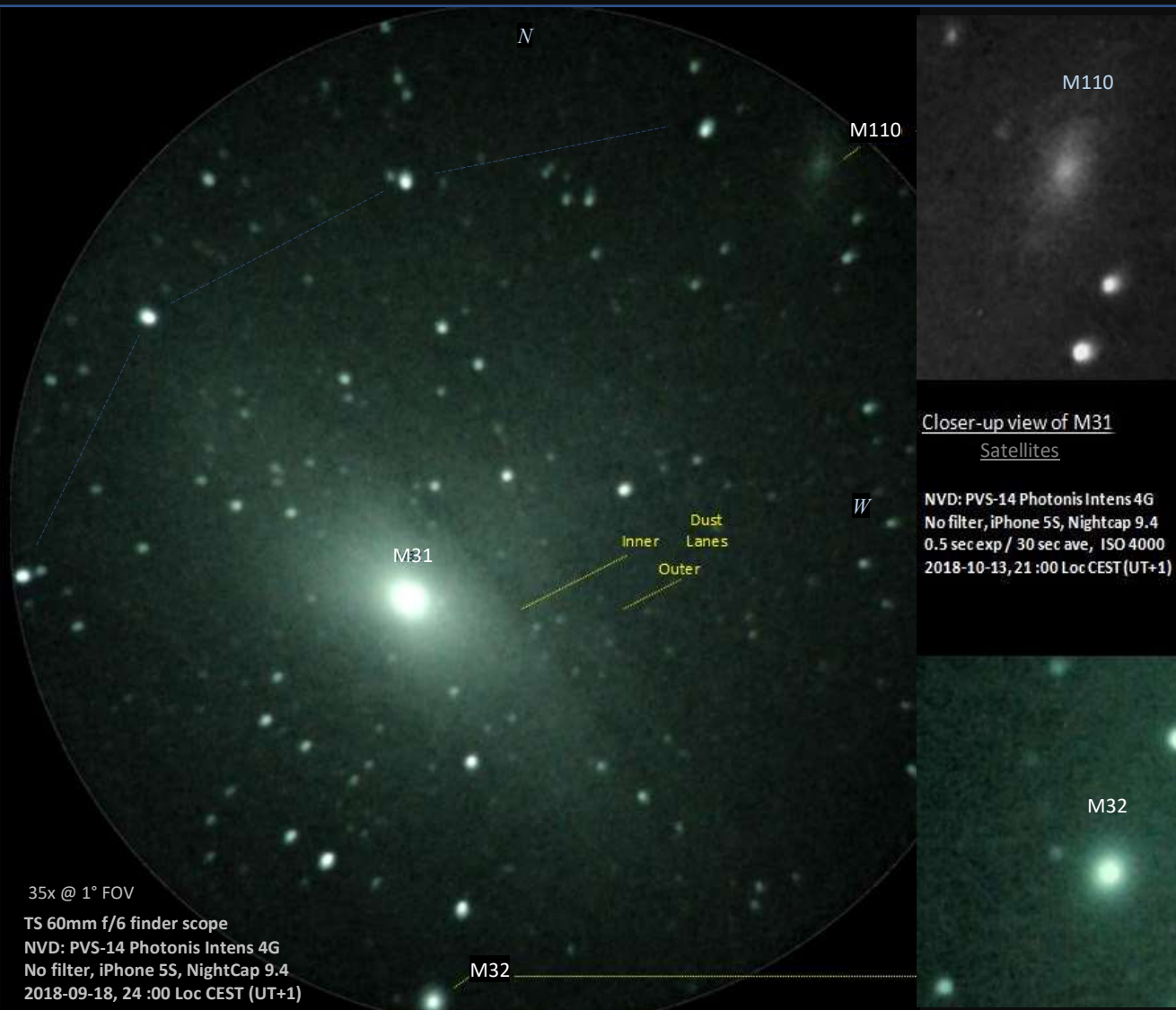
Messier M31 – M32 – M110

Here's a drawing I made back in 2015 (Vixen FL-80S, 18mm ortho, 43x mag.; see: <https://www.cloudynights.com/topic/523941-classic-messier/?p=7085247>). As seen from our own galaxy, M31 is inclined 77° with the nearest edge of the disc upwards towards the NW, and a clockwise rotation of the spiral (as seen "bottom-up") with the trailing arms receding at the NE tip and approaching at the SW end. The core of M31 shows a graduation from a bright circular nucleus, over a surrounding elliptic disc that progressively fades into an elongated faint halo. The galaxy seems brighter and more extended towards the SE, while the NW edge is more sharply delineated due to the dark dust lanes found here.

In my 3" scope the M32 satellite looks like a round "wooly" 8^m star S of the core of M31, while M110 shows up as a fainter but larger and elliptical haze towards the NW. M32 has a central supermassive black hole and is probably the compact core of a disc galaxy that has been torn apart by M31, while M110 is a more typical dwarf elliptical in a further out orbit around M31, though still under influence by the "mothership" as evidenced by recent star forming activity.



43x @ 1.2° FOV
2015.09.08, 21:30-22:00 Loc. CEST UT+1
Vixen FL-80S
18mm Zeiss ortho

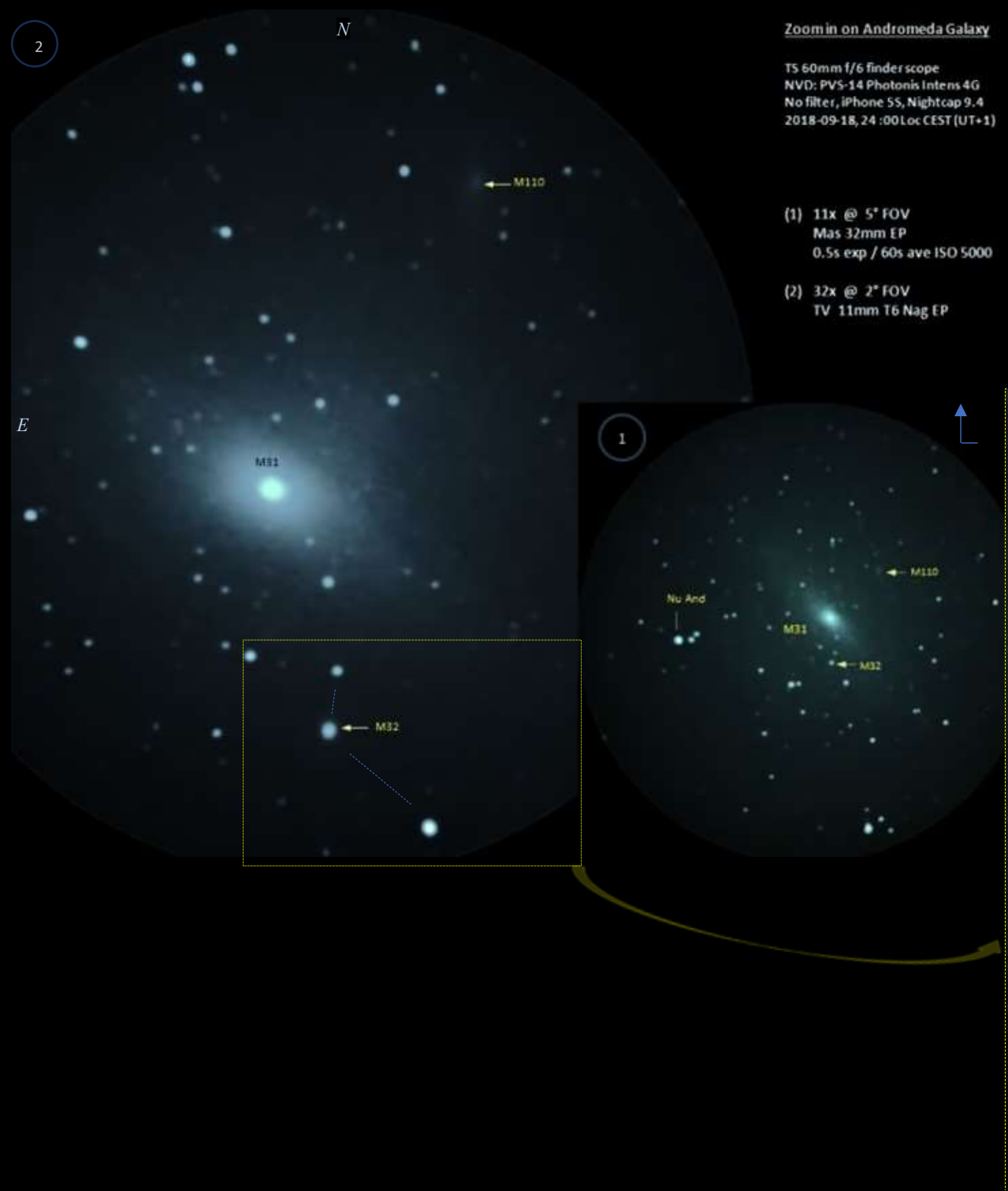


35x @ 1° FOV
TS 60mm f/6 finder scope
NVD: PVS-14 Photonis Intens 4G
No filter, iPhone 5S, NightCap 9.4
2018-09-18, 24 :00 Loc CEST (UT+1)

Closer-up view of M31 Satellites

NVD: PVS-14 Photonis Intens 4G
No filter, iPhone 5S, Nightcap 9.4
0.5 sec exp / 30 sec ave, ISO 4000
2018-10-13, 21 :00 Loc CEST (UT+1)

Now, three year later, I'm out again on a late evening in August (2018-09-18, 24:00 Loc CEST, UT+1) to observe some HII-regions in Perseus with my **Night Vision** monocular; Before calling it a night, I decide to do a fast zoom-in on the Andromeda galaxy, which is now well placed at 64° Alt. in the SE, and closing in on the meridian. Using 11x @ 5° field I can trace the spiral across ~2° of the night sky, and zooming in to 32x @ 2° field I can clearly spot the two closest satellites (M32, M110) as well as the inner dark dust lane in the spiral disc. Finally zooming in to 35x @ 1° field, both inner and outer dust lanes in M31 are now evident, and I can get a better close-up look at the M32 and M110 satellites.



Zoomin on Andromeda Galaxy

TS 60mm f/6 finder scope
 NVD: PVS-14 Photonis Intens 4G
 No filter, iPhone 5S, Nightcap 9.4
 2018-09-18, 24 :00 Loc CEST (UT+1)

(1) 11x @ 5° FOV
 Mas 32mm EP
 0.5s exp / 60s ave ISO 5000

(2) 32x @ 2° FOV
 TV 11mm T6 Nag EP

Just for fun I also pan down to the SW end of the M31 spiral to see if I can spot the NGC 206 star forming region, -- but that turns out to be unexpectedly difficult using NV. However, with some effort, I can identify a couple of other both open and globular star clusters in this area of the galaxy disc (marked C and G on the snapshot below).

All -in-all, the M31 galaxy disc contains at least 188 stellar associations and 403 open clusters surrounded by a halo of 355 gravitationally bound globular clusters (a further 688 have been suspected) plus a family of faint dwarf galaxies (Andromeda I to IX). A lot of objects to track down in this our sibling island universe!

(See: https://ned.ipac.caltech.edu/level5/ANDROMEDA_Atlas/Hodge_contents.html).



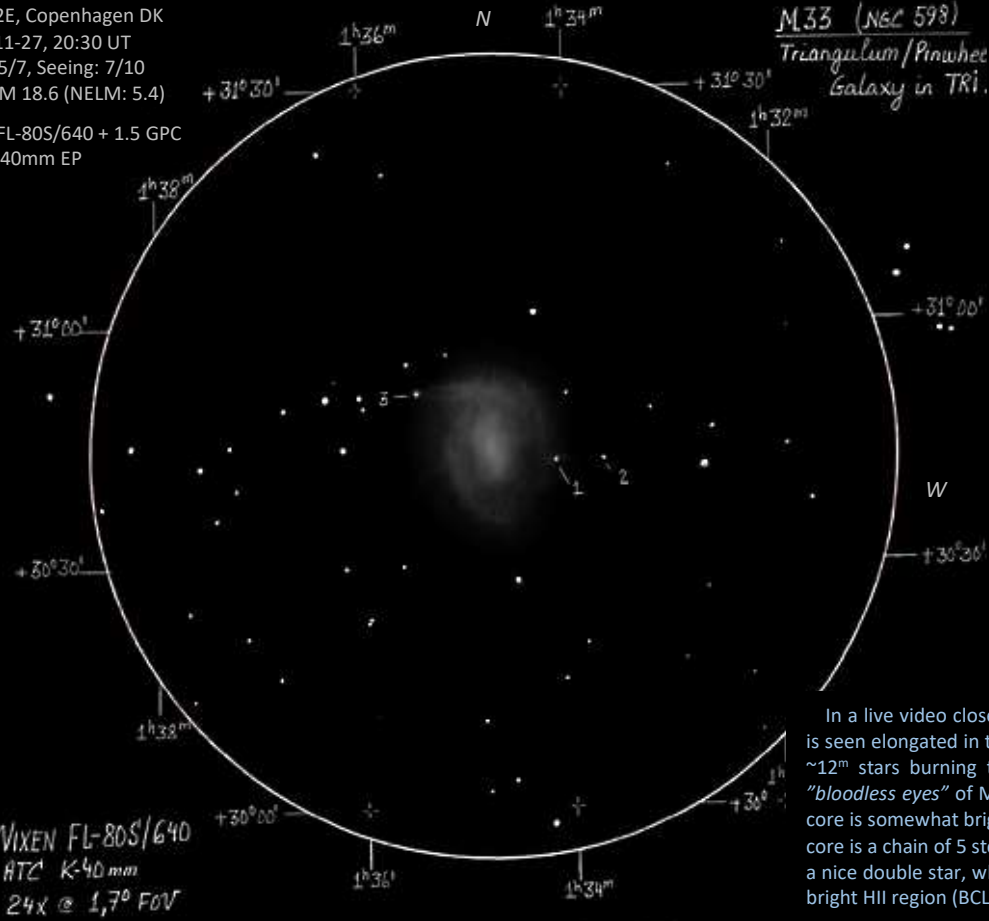
Zoom-In
 ~35° FOV

M33 (NGC 598), the Triangulum (or "Pinwheel") galaxy

It's mid-September (2015), the hour around midnight. A calm night after rain, but still with drifting high clouds, so the transparency is varying, -- from good in the cloud holes to damn lousy when a cloud drifts by... The seeing is steady though, so I give M33 a try with my Zeiss 10x56 bino (FOV 6°). I have mounted the bino using a Manfrotto clamp on a Zeiss dovetail rail that fits my motorized CZJ TM/2V mount. This leaves me with both hands free to draw.

56N 12E, Copenhagen DK
2016-11-27, 20:30 UT
Trsp.: 5/7, Seeing: 7/10
LP: SQM 18.6 (NELM: 5.4)

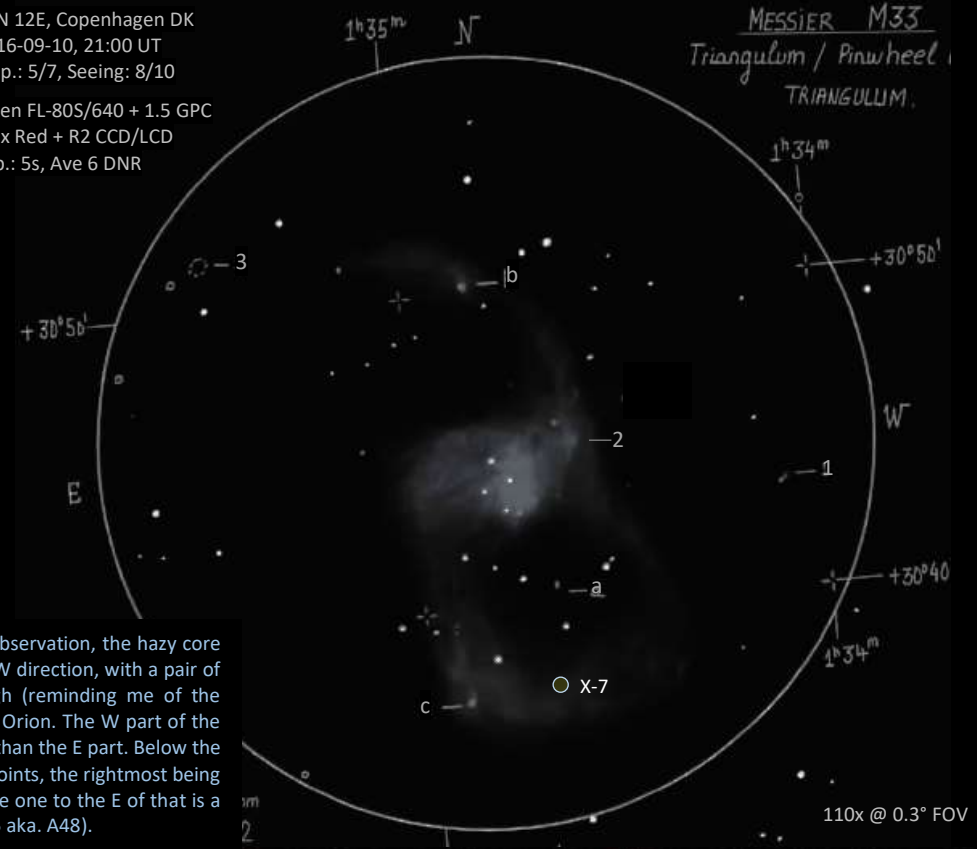
Vixen FL-80S/640 + 1.5 GPC
ATC K-40mm EP



| Galaxy | Size (min) | Area (min ²) | IM Surface Integrated Magnitude | SB Surface Brightness (mag/min ²) |
|--------|------------|--------------------------|---------------------------------|---|
| M33 | 70 x 41 | 2870 | 5.7 | 14.1 |
| M101 | 27 x 26 | 702 | 7.7 | 14.6 |

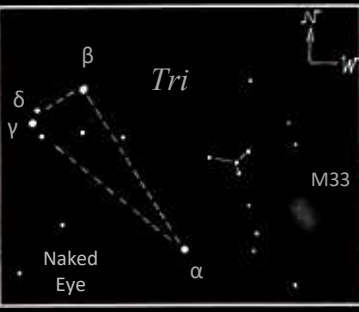
The spiral galaxy M33 has 4 times the area of the elliptic M101. Though the IM of M33 (due to its larger size) sums up to a brighter magnitude, it does appear just as faint and diffuse as M101 (both having a SB below 14). I find these two Messier galaxies about equally challenging to observe.

56N 12E, Copenhagen DK
2016-09-10, 21:00 UT
Trsp.: 5/7, Seeing: 8/10
Vixen FL-80S/640 + 1.5 GPC
0.5x Red + R2 CCD/LCD
Exp.: 5s, Ave 6 DNR



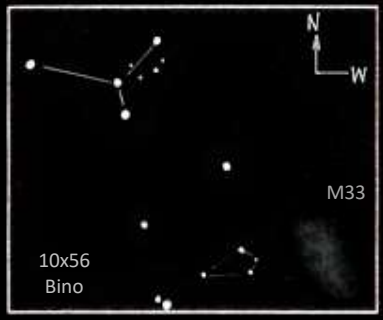
In a live video close-up observation, the hazy core is seen elongated in the E-W direction, with a pair of ~12^m stars burning through (reminding me of the "bloodless eyes" of M78 in Orion). The W part of the core is somewhat brighter than the E part. Below the core is a chain of 5 stellar points, the rightmost being a nice double star, while the one to the E of that is a bright HII region (BCLMP 25 aka. A48).

There are two large but faint spiral arms, one up N bending E, and the other extending S bending W (below the chain of 5 stars), thus forming a mirrored figure "S", indicating the clockwise rotation and trailing arms of the "Pinwheel". Unfortunately, the brightest HII-region in M33 (NGC 604) is just outside my FOV this evening, but several smaller HII regions can be glimpsed as faint hazy spots, including NGC 595 and NGC 592 to the W of the core. All-in-all a nice view, considering this is live video with only a "rolling" 5s exposure time and 6x averaging (i.e., no aligning/stacking or other processing tricks).



- 1 NGC 592
- 2 NGC 595
- 3 NGC 604

56N 12 E, Copenhagen DK
2016-11-27, 20:30 UT
Vixen FL80S-640mm + 1.5 GPC
ATC K-40mm EP, 24x @ 1.7°
Trsp.: 5/7, Seeing: 7/10, LP:
SQM 18.6 (NELM: 5.4^m)



- 1 NGC 592
- 2 NGC 595
- 3 NGC 604 - NOT observed

a BCLMP 25 (A48)
b IC 142
c IC 140
X-7: edge-on eclipsing X-ray binary
[a 16x solar mass black hole
plus a huge type O star

M33 (NGC 598), the Triangulum / "Pinwheel" galaxy

is in orbit around the *Great Andromeda Galaxy* M31. Currently it is at a distance of almost 3 Mly from the MW, -- a little further out than M31 itself - but possibly linked to "the mothership" by a broad stream of HI gas and faint stars (see: <http://iopscience.iop.org/article/10.1088/0004-637X/763/1/4>).

As seen from the MW, M33 is a nearly face on clockwise rotating spiral ca 30% the size of M31. The nucleus of M33 is without a bar or central bulge, but the galaxy features two major trailing spiral arms: the northern arm containing four large HII regions (NGC 604,588,592,595) plus 10 smaller nebulous IC objects, while the southern arm exhibits ~143 large star clouds and OB-associations of young, hot stars (see: <http://astronomy-mall.com/Adventures.In.Deep.Space/M33.HII-Star.Clouds.html>).

Here's a "zoom-in" on M33 using NV (2010-11-02, suburban NELM 5.8, 92% humidity with drifting low cumulus). Night vision is obviously not the best choice with respect to resolution of galaxies (I prefer glass and/or EAA live video), but NV can help to at least identify these objects in high LP conditions:

The brightest HII region in M33 is **NGC 604** at the tip of the N spiral arm, which rivals the *Tarantula Nebula* in our own LMC, as well in size as in star-forming activity; NGC 604 is easily spotted in even small amateur telescopes, as can be seen in my drawings and snapshot here. M33 harbors no central supermassive black hole, but it does in its S spiral arm have an extraordinary massive X-ray eclipsing binary, composed of a stellar black hole + a luminous type O-I blue supergiant (position marked on my drawing: **X-7**). M33 is surrounded by ~54 globular clusters (with 122 more currently suspected); C39 is the brightest GC in M33, but still very faint at ~16^m as seen here from our MW.

M33 Triangulum Galaxy

TS 60/360mm Finder
PVS-7/Photonis 4G NV



2018-11-02 20:00 Loc CEST (UT+1)
Temp 8°C, Hum 92%, Dew-Pt: 6°C
Scattered *Cumulus Humilis*
Transp. 1-5/7, Seeing 6/10
LP: SQM 19.5 ~ NELM 5.8^m

