

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 the *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

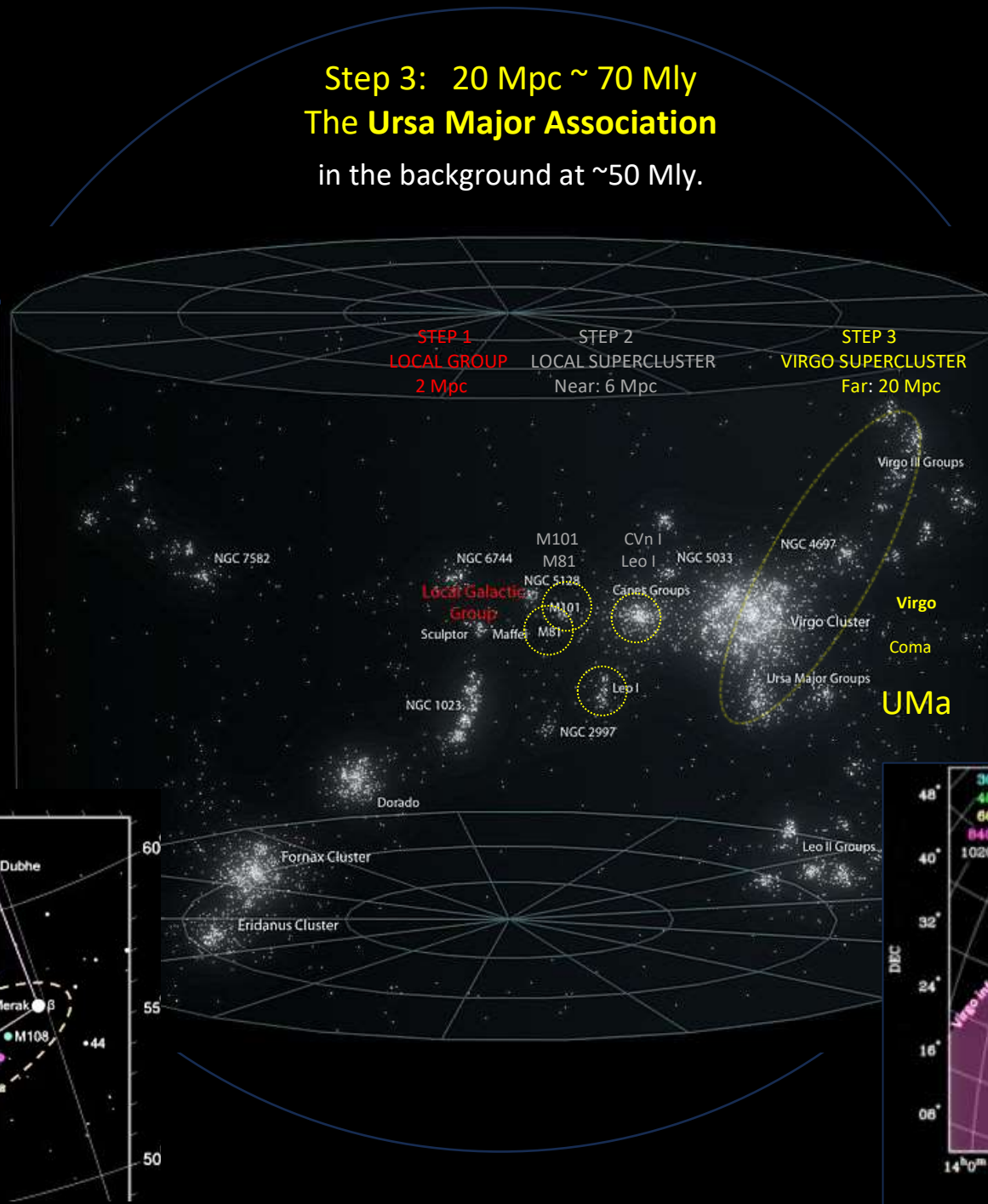
In the far in the background (~15 Mpc) are found remote galaxy groups such as the Coma and Virgo galaxy clusters and the Centaurus Cluster (A3526), plus the M108/109 UMa Group, all gravitationally bound to the Virgo Supercluster.

### UMa-I Cluster

Besides being scattered without an obvious center, the Ursa Major Cluster also lies in a confusing part of the night sky behind the plane of the nearby galaxies in our own Local Supercluster.

There are several galaxy subgroups within the Ursa Major Cluster, many bound to one another and in the early evolutionary process of merging. The figure to the right (lower corner) shows a projected overview of the region with high-probability two-body bound systems connected by a line (FoF: Friend-of-Friends analysis). The structures eventually emerging are all likely bound to one another and therefore together constitute the UMa Association (the 'Ursa Major supergroup').

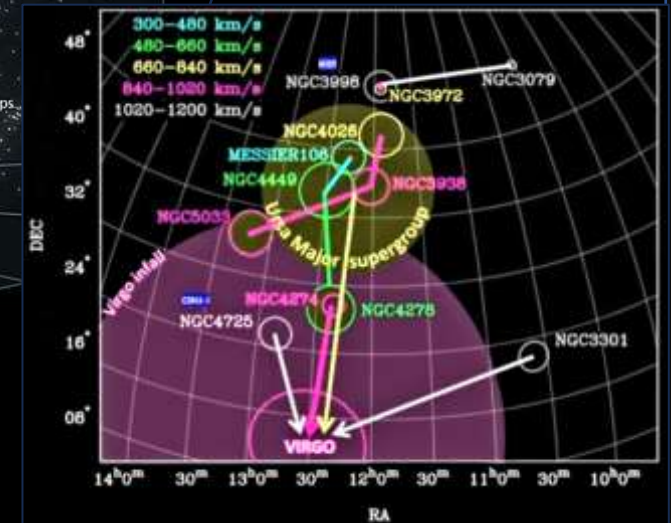
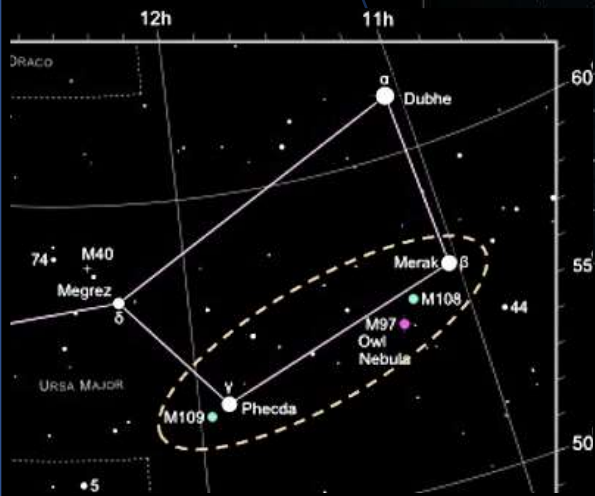
## Step 3: 20 Mpc ~ 70 Mly The Ursa Major Association in the background at ~50 Mly.



The filamentary galaxy group structures in UMa I are:

- in the foreground M106, N4449 and N4278 groups
- at intermediate distance: N4026, N3938 (M109) and N5033 groups
- in the background: N3972. and N3079 groups

The Virgo cluster is likely accreting the Ursa Major supergroup (UMa I) as well as the N4274, N4725 (Coma I) and N3301 groups, all marked with arrows towards the Virgo attractor. The background group plus the N3938 groups are unlikely to be bound to either the UMa supergroup or the Virgo cluster.



## M106

It's early morning (03:30 AM Local), the second day after New Year 2016/17. The sky has cleared up unexpectedly, and I'm out on a DSO hunt in my suburban backyard, -- as usual with my *Vixen FL-80S* mounted on the *Zeiss Ib*. I've observed all the Messiers above 0° DEC with this small refractor by now, apart from **M106 in Canes Venatici**, so that galaxy will be my main prey tonight!

My **star hop** takes off from *Gamma UMa* (Phecda), SW to 5 CVn, which forms a nice kite-shaped asterism with 3 CVn and two slightly fainter (~6<sup>m</sup>) stars. From 5 CVn I first move 2½° SW down to 3 CVn, then 1½° due S, where I see **M106**; -- the galaxy is easily spotted in my **10x56 bino**, as well as in my 10x60 finder scope.

In my 80mm **telescope at 24x** (ATC K-40mm eyepiece), the galaxy is seen with direct vision as a hazy patch of light, gradually brightening towards the center, and obviously elongated in a roughly a S-N direction. I use the 1.8° FOV of this eyepiece to frame my "wide field" drawing. Cranking up the magnification to **38x and 60x** (using my CZJ 25mm and 16mm Orthoscopes), the core shows up as a small, bright bar, with a fragment of an arm extending towards NE and a fainter ditto towards the SW.

For more detail, I now switch to my R2 "electronic eyepiece"... With live video using the R2 ccd/lcd at **110x**, M106 comes alive with a bright, stellar core, a short bar in the direction NNW-SSE plus, one arm extending from each end of the bar: the brightest up N and the fainter one down S; -- All this is embedded in the large but fainter oval glow of the rest of the galaxy. A marvelous sight!



**M106 (NGC 4258)**  
56N 12E Copenhagen  
2017-01-02, 02:30 UT  
Trsp.: 5/7, Seeing 8/10, Calm  
LP: SQN 18.4 (NELM 5.2)

Vixen FL-80S/640 + 1.5x GPC  
ATC K-40mm, **24x @ 1.8°**

## The UMa Association

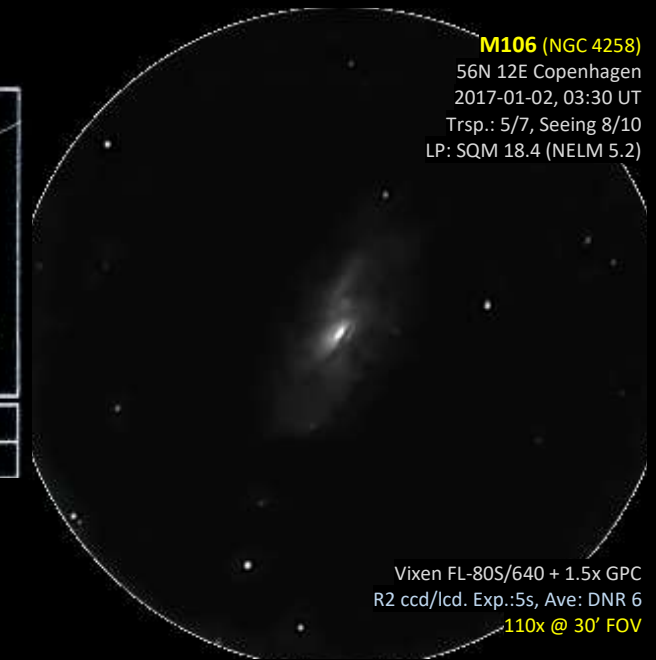
Ursa Major "Supergroup", traditionally labeled the *UMa Galaxy Group* aka Ursa Major I Cluster

The *Ursa Major Galaxy Cluster (UMa-I)* is roughly at the same distance from our Local Cluster as the Virgo cluster. The UMa and Virgo clusters are however rather different in their properties of radius, mass and spread of velocities:

- The *Ursa Major Cluster* is very large (scattered), relatively low mass and with small velocity spread (880 Kpc, 8\*10<sup>13</sup> Msun, 148 km/s). It contains mostly late-type spiral galaxies and has no obvious center;
- The *Virgo Cluster* is large, very massive with high velocity spread (730 Kpc, 1.2\*10<sup>15</sup> Msun, 715 Km/s). It contains a mix of early ellipticals in the core surrounded by late-type spiral galaxies.



**M106 (NGC 4258)**  
56N 12E Copenhagen  
2017-01-02, 03:30 UT  
Trsp.: 5/7, Seeing 8/10  
LP: SQM 18.4 (NELM 5.2)



Vixen FL-80S/640 + 1.5x GPC  
R2 ccd/lcd. Exp.:5s, Ave: DNR 6  
**110x @ 30' FOV**

The M106 galaxy group has the **large SAB spiral M106 (N4258)** at its gravitational center; The spiral is big and bright in my 3" refractor (using R2 ccd/lcd); I can see a luminous stellar core in a highly inclined disc (~20° from edge-on). The disc features two large spiral arms, the bright and broad base of which is easily detected, bending up NW and down SE, giving the disc the look of a warped figure "S".

M106 has an active galactic nucleus (AGN) with a supermassive black hole that is surrounded by an accretion disc, which emits both microwave laser radiation (masers) as well as a pair of jets. The jets in turn heat up the gas in the disc, so that a pair of "extra arms" can be seen arching out above and below the galactic plane (in high resolution photography, alas NOT in my small refractors...).



University  
of California

## M108

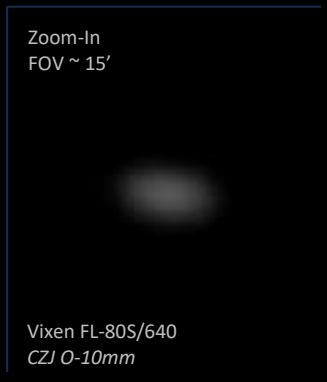
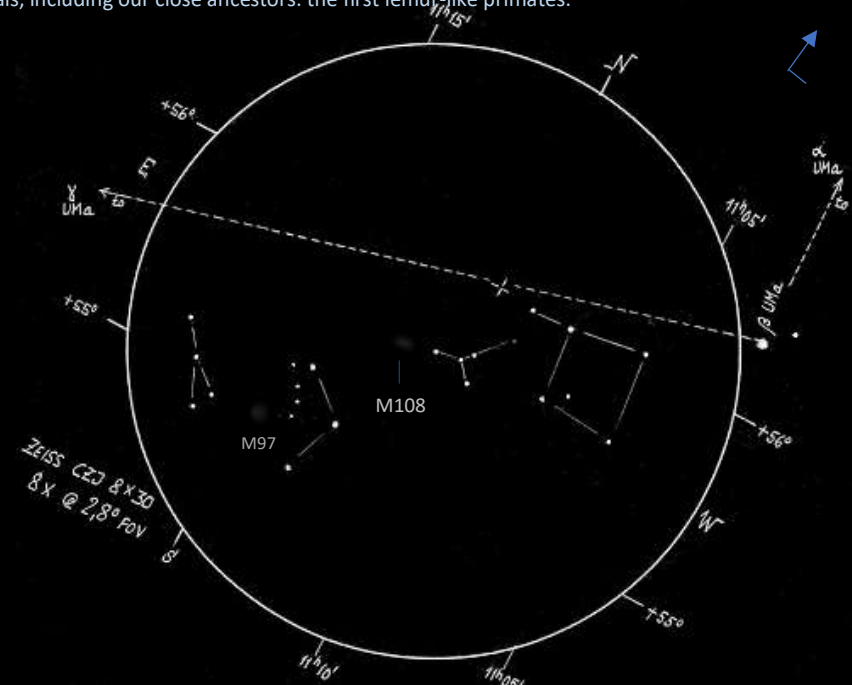
It's May 12., just past midnight (00:45) local time, and there's a 6-day (32%) moon on the border of *Cancer* / *Leo* in the W, which however will be setting in less than an hour. I'm observing from my NELM 5 (Bortle Red/Green) backyard, and I recognize that – given my 56° N location and suburban sky – I am now exiting the season for galaxy observation. Already *the Milky Way* with the Summer Triangle is swinging up on the firmament from the east, pushing *Hercules*, *Ophiuchus* and *Scorpius* ahead of it, with all their wonderful Globular Clusters!

Anyway, my target for tonight is the Messier galaxy in the wake of *Merak* (Beta UMa) : **M108**.



**M108** is a distant galaxy, located in its own small galaxy group, roughly at the same distance (55 MLY) as the large *Virgo Cluster*. The star hop is easy: placing *Merak* ( $\beta$  UMa) in the W "corner" of my widefield EP (K-40, 27x, 1.5°), I get a small "lambda" ( $\lambda$ ) formed asterism in the far E part of the FOV; I now center the position of M108 in the field, but at 27x, I can detect no nebulosity.

I click up the magnification to 44x (O-25, 0.9°), and now I do suspect a faint haze elongated in the N-S direction, just 10' off the tip of a small "tilted lambda" asterism; Increasing the magnification a click further up to 68x (O-16, 0.6°), I can now hold the elongated glow of M108 with averted vision: it is a faint and featureless streak of light, apart from a very slight increase in brightness towards the center. I find it harder to see than the close by *Owl* PN (M97), but it gains in interest, considering that the light which my eye is receiving from the galaxy was emitted at the very start of the *Eocene Epoch* of the Earth's geological history, -- back then, when India began colliding with Asia forming the Himalayas, when a day was 24h long with major global warming (the earth was essentially ice free), and when we saw the evolution of the early mammals, including our close ancestors: the first lemur-like primates. Wow!



**M108** is a barred spiral with loosely wound arms, seen nearly edge on (hence the nickname: the *Surfboard galaxy*). Higher magnification shows mottling by starburst, dust and supernova shells of H1 gas.

## M109

It's a wonderful early December morning (05 AM Local time), and I'm out in my suburban backyard, sweeping up some Messier galaxies, that I have not yet observed with my Vixen FL-80S/640mm refractor. It is a cool, calm and moonless pre-dawn night, with above average transparency and seeing (NELM 5.0), so galaxies are the right prey for this session.

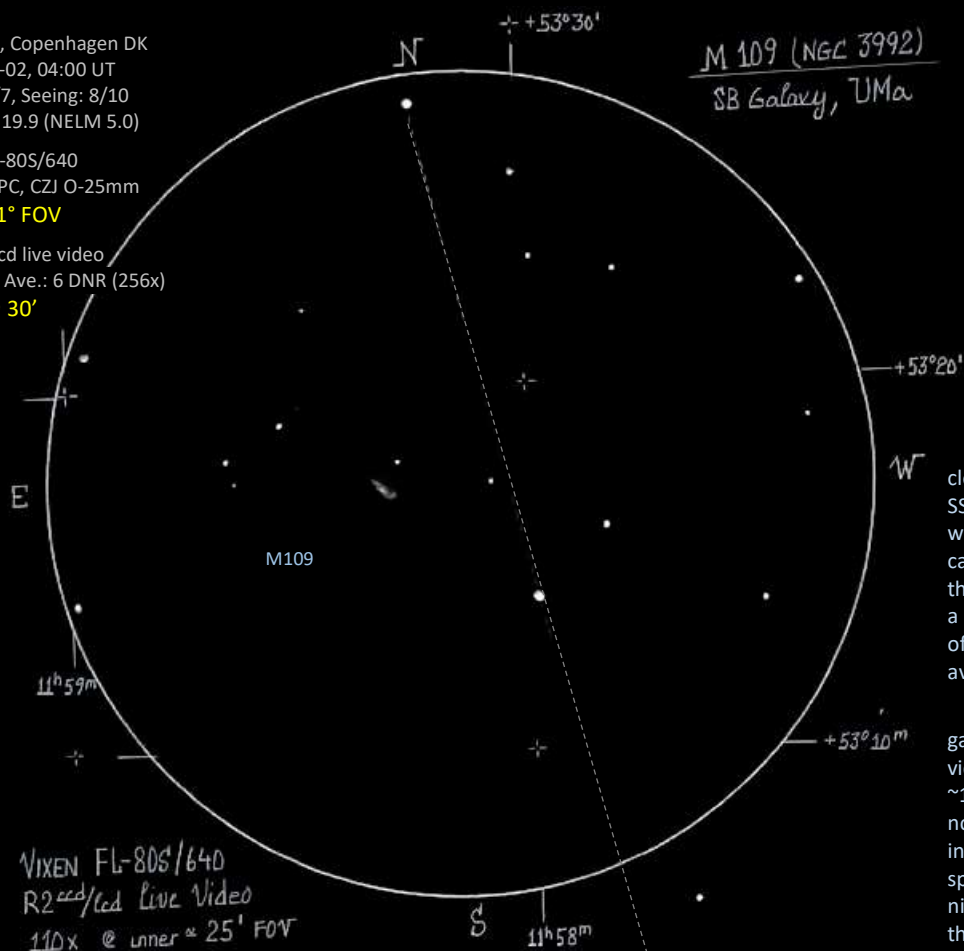
I have just paid the distant galaxy M108 (close to Beta UMa) a visit, and am now turning my small telescope SE to Gamma UMa, to nail **M109**. If M108 (47 MLY away) is a distant galaxy, then M109 is in truth "a galaxy far, far away"! At 81 million light years -- the most distant object in Messier's catalog --, the photons we are receiving today were emitted way back in the Cretaceous Period of Earth geology, when Australia just started to separate from Antarctica, and T. Rex would rule the Earth for the next 15 million years (until the Chicxulub meteor impact in Yucatan, around 65 MY ago, "back in the future").

M109 is easy to locate, continuing the line from Bet UMa (*Merak*) to Gam UMa (*Phecda*) ca 40' SE. When I place Gam UMa in the NE part of the 1.6° FOV of my K-32mm eyepiece (at 30x magnification), I can -- using averted vision -- glimpse M109 in SE part of the field, as a faint, hazy spot. I center M109 in the field, and click up the magnification, first to 38x/1° (O-25mm, for framing my drawing), and then to 60x/0.7° (O-16mm, for details of the galaxy).

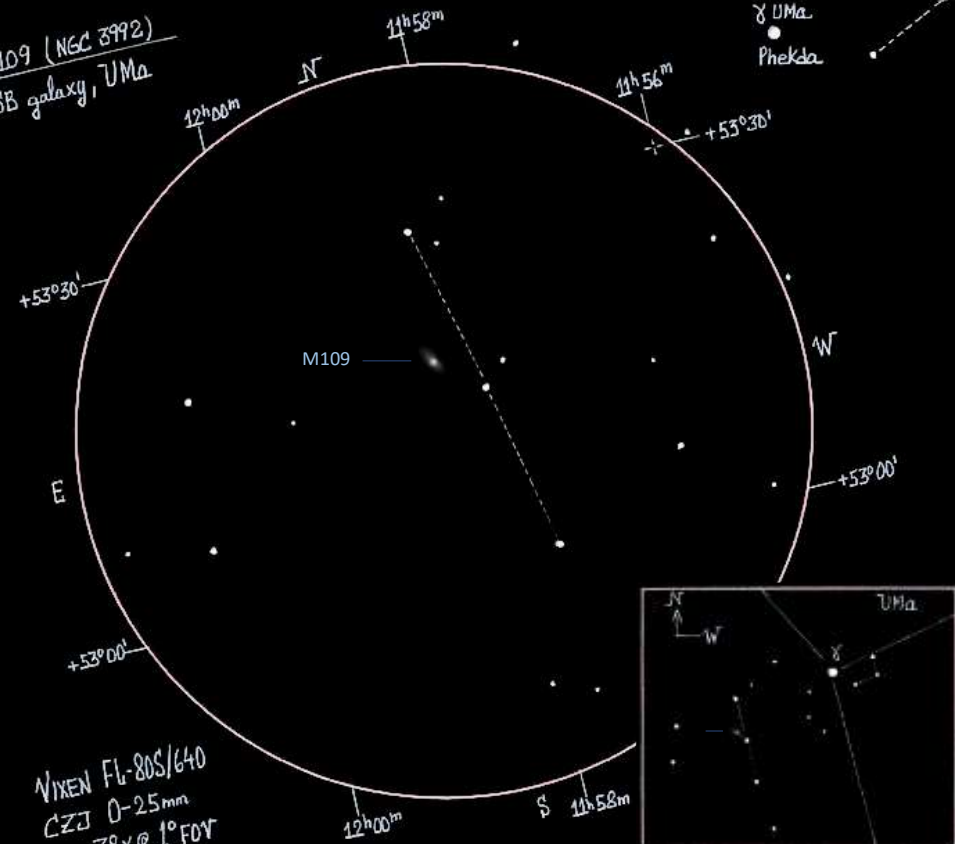
56N 12E, Copenhagen DK  
2016-12-02, 04:00 UT  
Trsp.: 5/7, Seeing: 8/10  
LP: SQN 19.9 (NELM 5.0)

Vixen FL-80S/640  
+ 1.5x GPC, CZJ O-25mm  
**38x @ 1° FOV**

R2 ccd/lcd live video  
Exp.: 5s, Ave.: 6 DNR (256x)  
**110x @ 30'**



M109 (NGC 3992)  
SB galaxy, UMa



Time: FINDER EP/Mag: K-40 / 24x  
IDVPA: 1.7° FOV

**M109** is seen as a faint nebula, clearly elongated in the NNE-SSW direction. It is best studied with averted vision at 30x, but can stand direct vision at 60x. At the high magnification, it shows a brighter core area, the center of which looks stellar with averted vision.

For a close-up view of the galaxy, I finally switch to live video (the R2 ccd/lcd, yielding ~110x in a 30' FOV). The core now shows subtle details including the bar, with hints of a spiral arm bending SE. A very nice, although delicate view, of this "far, far away" galaxy!

Close-Up  
FOV ~ 15'



Zeiss 100/640 APQ  
Photonis 4G NVD



WikiSky