

# Retour d'expérience sur 3 ans d'observation via tous les tubes "EAA" du marché

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# Qui suis-je ?

-52 ans

1<sup>er</sup> télescope

-46 ans

1<sup>er</sup> Ordinateur

-20 ans

1<sup>er</sup> Club astro

-4 ans

1<sup>er</sup> EAA

Aujourd'hui

6<sup>eme</sup> EAA

4 Fédérations

10 clubs

5 CA

2 Associations

Conférencier

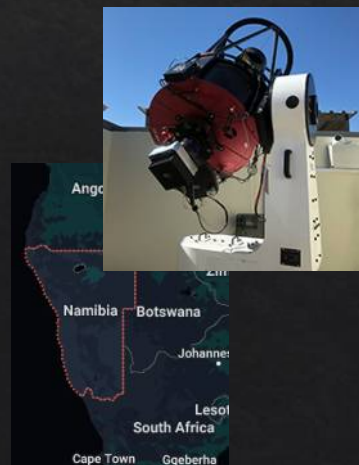
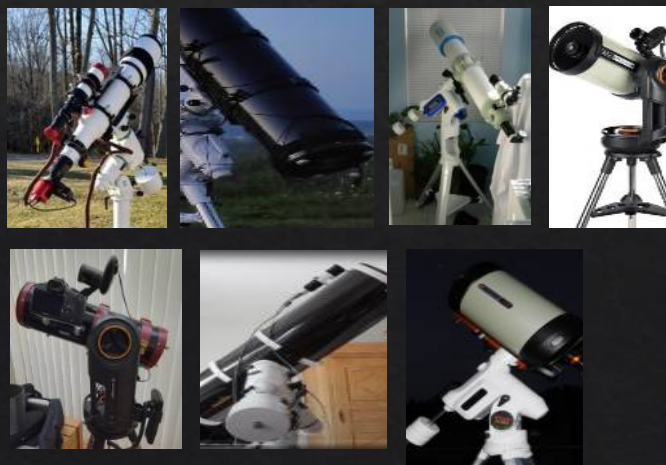
Animateur

Observateur

Science / Projets

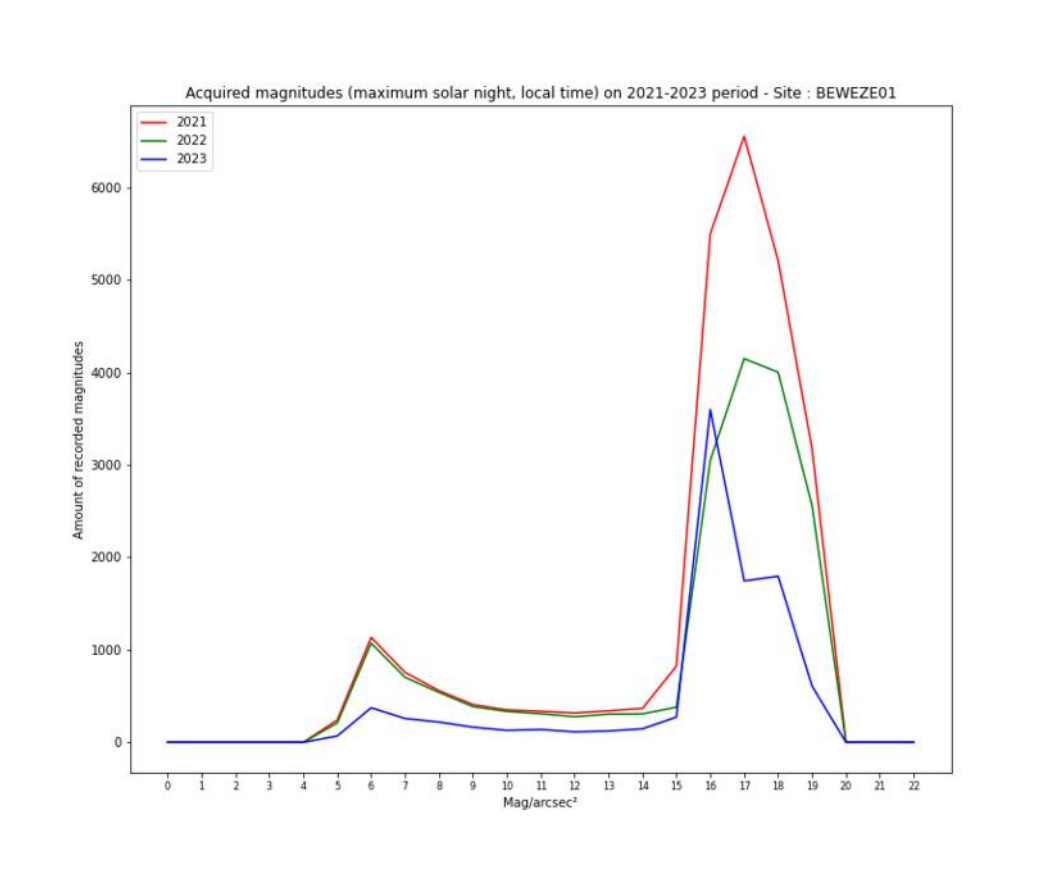
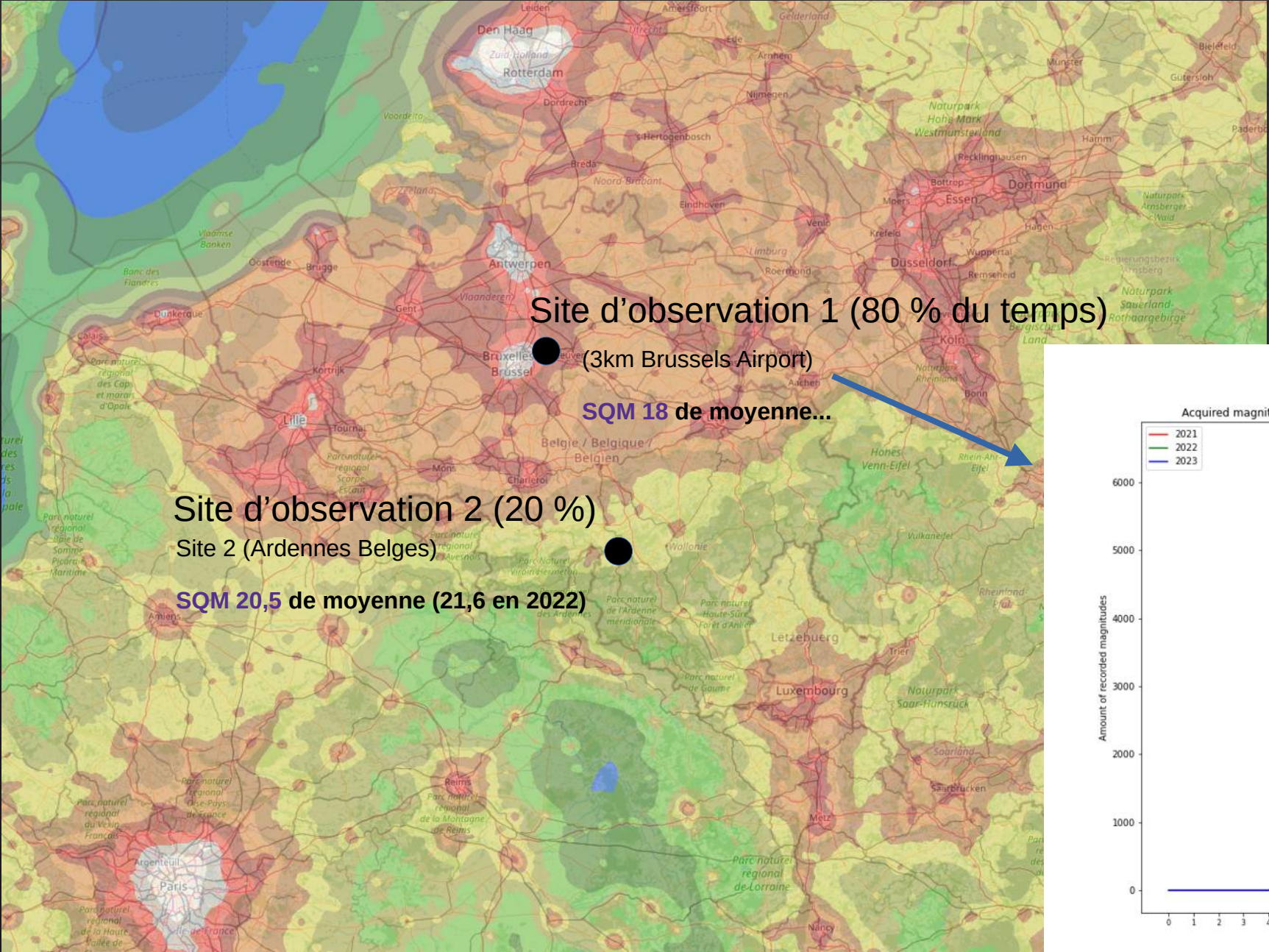
Cours

24h/jour = **un problème....**





# Association pour la Sauvegarde du Ciel et de l' Environnement Nocturnes



*Le **bon** télescope, c'est .....*

*Celui qu'on **utilise**....*

*Et **pas** celui qu'on **vous** dit d'acheter !*



# Sommaire

- Caractéristiques communes
- Interrogation et marché
- Avantages / inconvénients par modèle utilisé
- Ce qu'on le lit pas souvent
- Conclusion

*"Electronically Assisted Astronomy (EAA) is the use of an analog or digital image capturing device in place of an eyepiece at the telescope."*

*Lu sur Cloudynights - 2019*

*Un outil qui ouvre l'astronomie à tous, sans restrictions au niveau de la personne, de son âge ou de ses capacités...*

*Ma définition...*

***Le triomphe de l'astropantoufle sans observatoire !***

*Ma réalité...*



# VA : Une évolution somme toute logique...



**ETX ("Everybody's Telescope")**  
- Goto (Meade)



**StarSense Tech (Celestron)**  
- Sky Field Recog + GoTo



**Smartphone computing capacity**



**StarSense Tech**  
- GoTo « manuel » ou AR

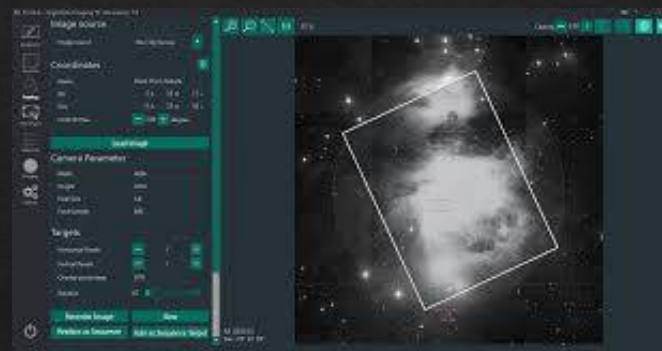
**ETX-LS (2009)**  
- Sky Field Recog + GoTo



**AutoAlign, Capture, CCD, APN**



**AutoAlign + Stack + Sky recog + Control**

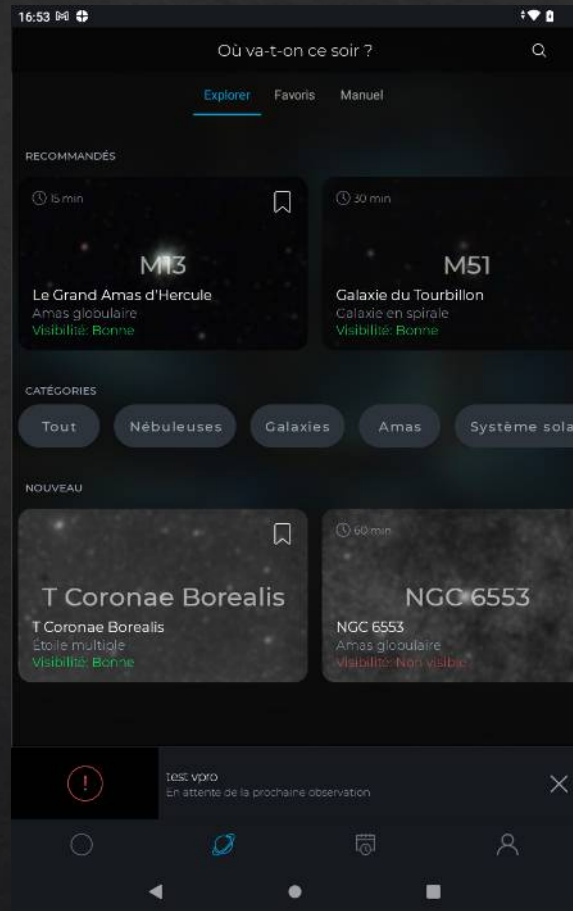


**All-in-One software**  
- Find, follow, capture

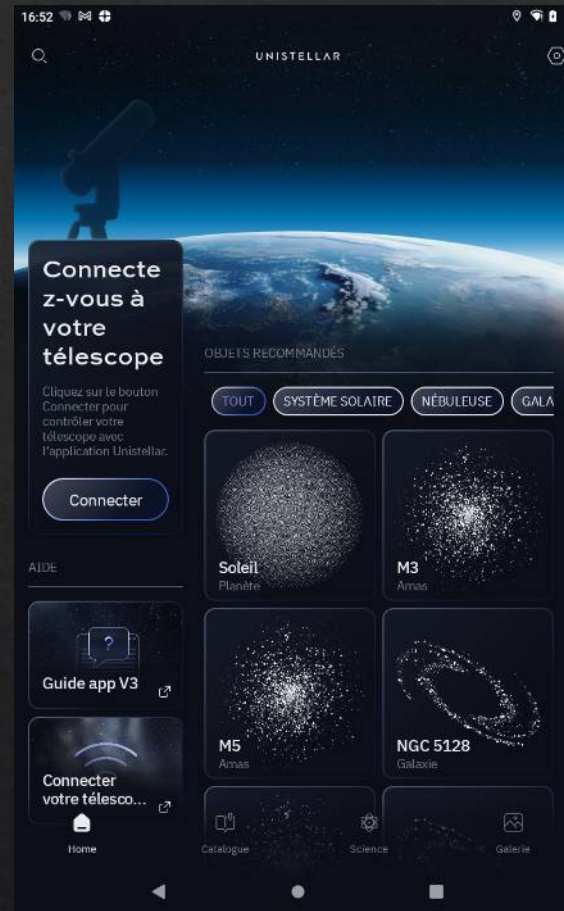


**Vaonis Stellina (2016)**  
- « All in one » concept

# « Remote control »



Vaonis



Unistellar



ZWO



## En 8 ans... Les tubes « automatiques » :

### Montures :

- Mise en station automatique
- Catalogue (visuel) des objets
- Altazimutal
  - légèreté, simplicité, suivi faible
  - ok pour pose courte (max 30 sec)
- F et F/D faibles
  - champ large
  - luminosité et but précis...



- Intégration, légèreté
- Solidité, Fiabilité
- Autonomie
- Stabilité logicielle
- Suivi logiciel
- Mise au point
- Calibration (Miroir)

### Captures :

- Dérotation
- Flat, dark, offset
- Traitement automatique « optimisé »
  - Mosaïque
- Pré-optimisation
- Accès aux images



- Contrôle à distance
- Accès aux paramètres de capture ?
- Optimisations possibles
- Traitement, scripts et automatisation
- Limites de traitement : « Pub » et réalités

## « Sky Recognition », « Plate solving » et « Mise en station automatique »

« **Blind plate solvers** » : Astrometry.net

1 image, pas de localisation, pas de données additionnelles  
puissance de calcul, (très) large catalogue, - **rapide**

« **Local plate-solvers** » :

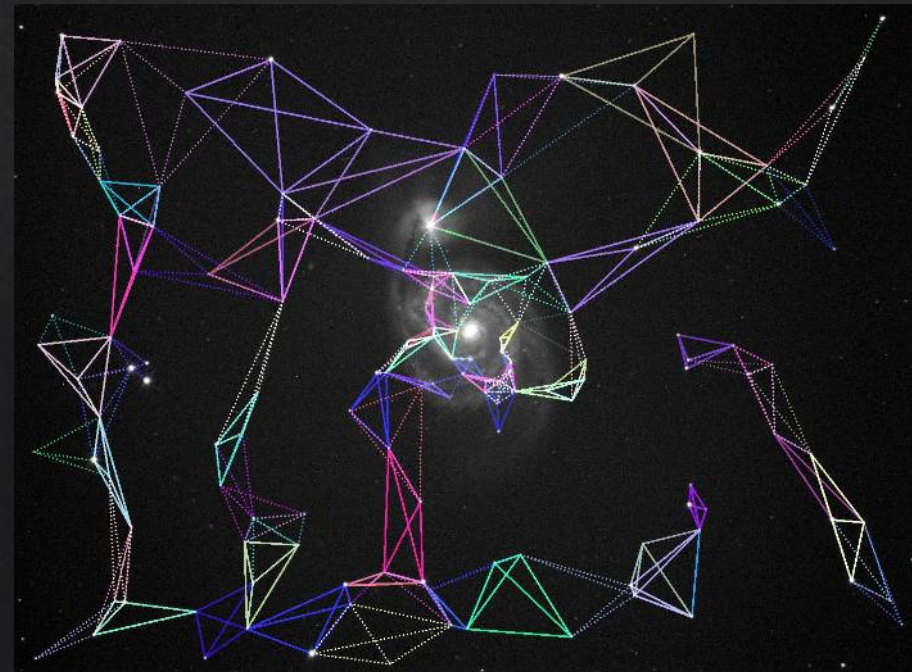
1 à n « captures », données : date, localisation, champ  
moins gourmand, catalogue réduit, + **rapide**

Capturer => isoler étoiles => comparer au catalogue  
=> calcul vision et position => mise en station

*Il suffit d'un morceau visible de ciel avec des étoiles !*

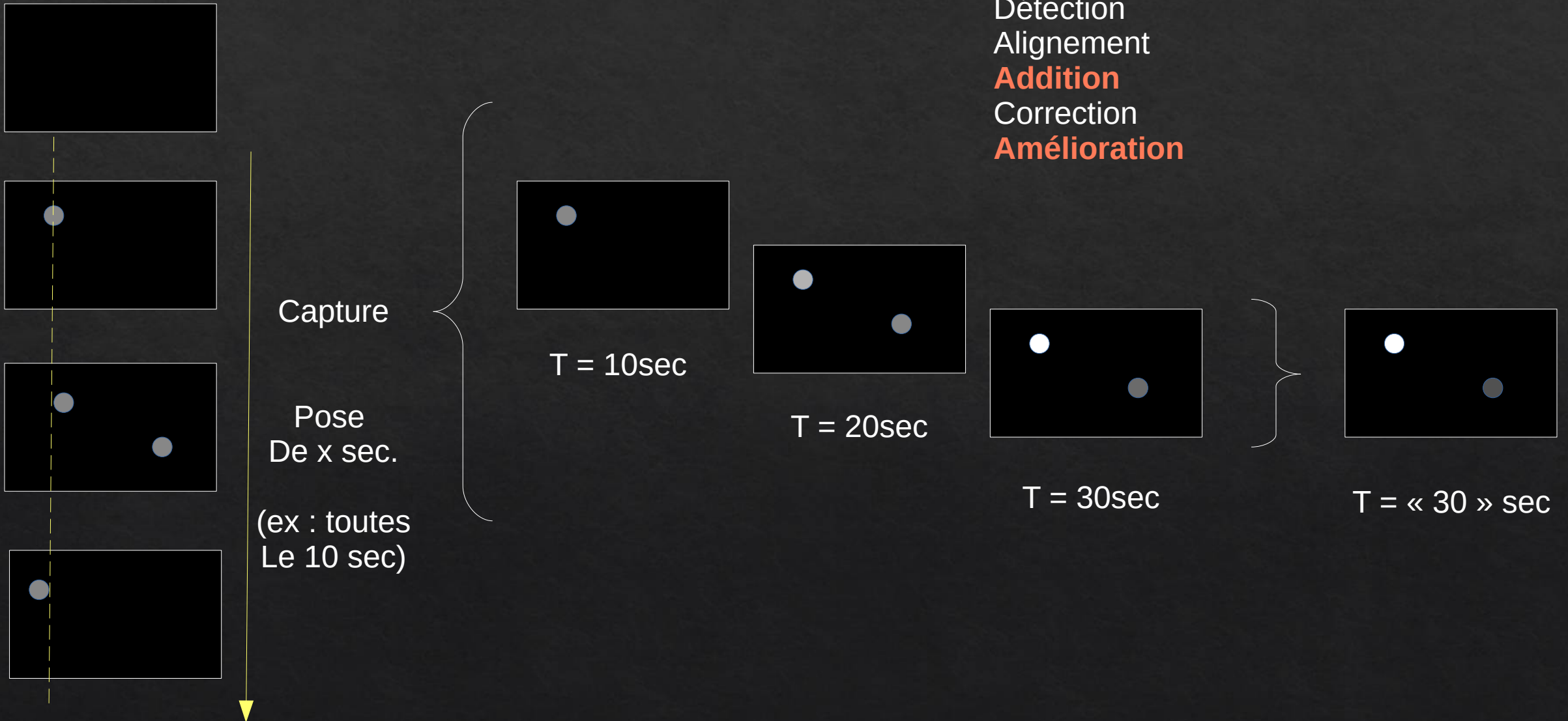
*Guidage initial manuel sur Soleil et Lune...*

**=> De 1 à 5 minutes, sans intervention humaine...**





# « Live Stacking » ou « Empilage dynamique »



# « Live Stacking on M42 »



t=1min



t=2min



t=3min

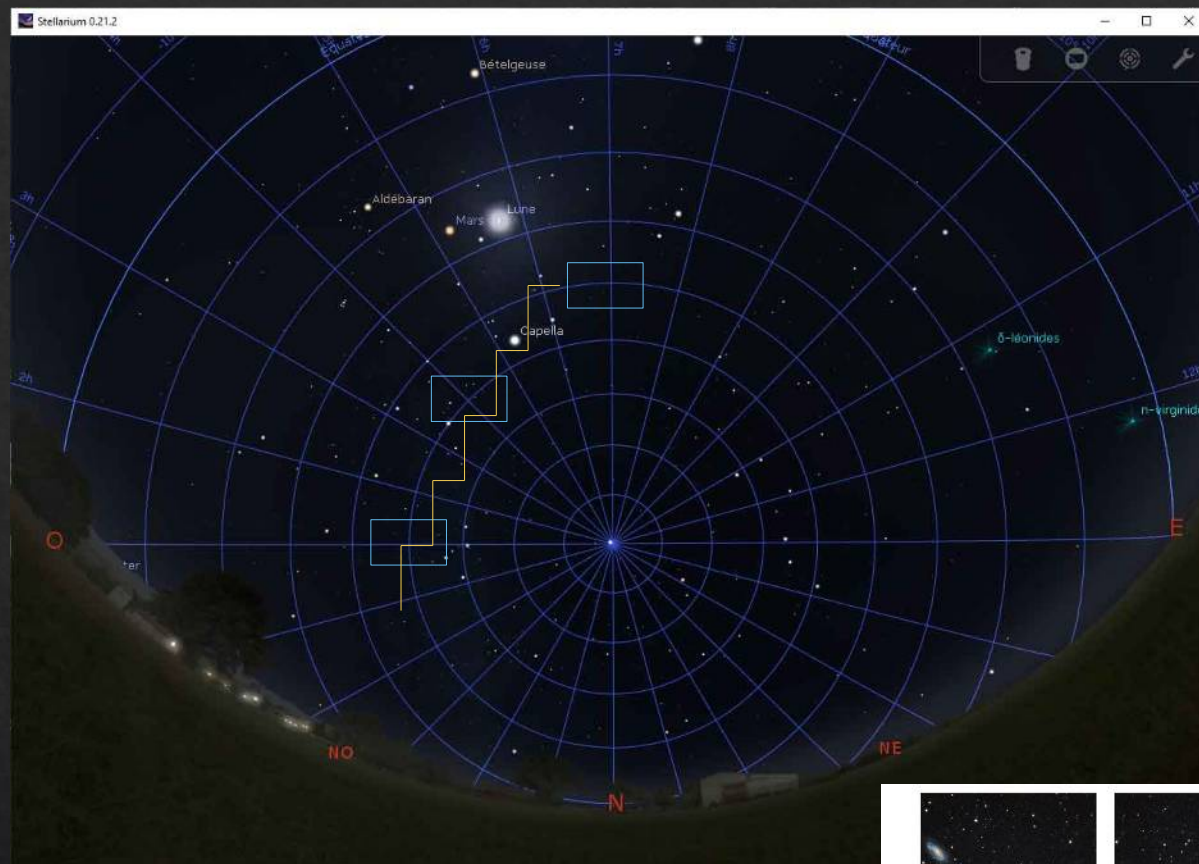




« *Altazimutal* » = « suivre un objet », mais pas « suivre un objet dans sa rotation apparente »



Rotation du ciel, 4h, SeeStar



« Le » problème...



Usage typiquement belge...



*Si on dispose de 1/2 h et  
d'un bout de ciel dégagé :  
go !*



Usage typiquement belge...

*Invisible à l'oeil nu,  
à cause de la PL locale...*



C/2023 A3  
SeeStar (JPEG smartphone)



C/2023 A3  
Vespera (Mosaic mode, JPEG smartphone)

# *Mon interrogation :*

*Est-ce que les EAA peuvent me suffire  
dans toutes mes activités astro ?*

## **Observation « publique »**

- Découverte
- Initiation
- Cours (Solaire / Nuit)

## **Observation « météo ok »**

- Météo ok rare
- PL élevée
- Légèreté
- Evenement astro  
(Nova, comète, etc...)
- Astrophoto plaisir...
- Voyage

## **Observation « régulière »**

- Petits corps
- Impact lunaires
- Variables
- Visuel / Radio
- Champ large



Le marché... Evolue rapidement (+1 tous les 6 mois... ) !

## Vaonis

Vespera I,II,Pro



D=50, F=200/250  
2 (f4), 8 (f5), 12 (f5) Mpix

Mosaic  
CovalENS

~~Hestia~~



~~Zoom 25x~~

## Unistellar

Odyssey, Pro



D=85, F=320  
3,4 Mpix  
4,1 Mpix

Evscope 1, 2



D=112, F=450  
4 Mpix

Equinox 1,2



D=112, F=450  
F/D 4  
1.2 Mpix  
4 Mpix

## ZWO

SeeStar 50



D=50, F=250, F/D 5  
2 Mpix

ASI AIR



AZ/GTI | AM3/5 |

## Celestron



D=152, F=335  
F/D 2,2  
6 Mpix (IMX178)

Dwarf II, III

Dwarf Lab



D=24/35, F=100/150, F/D 4  
2 (8) Mpix (2x2)  
2 (8) Mpix (2x2)

Le prix ne fait pas tout....



~ 6000 eur (MM)

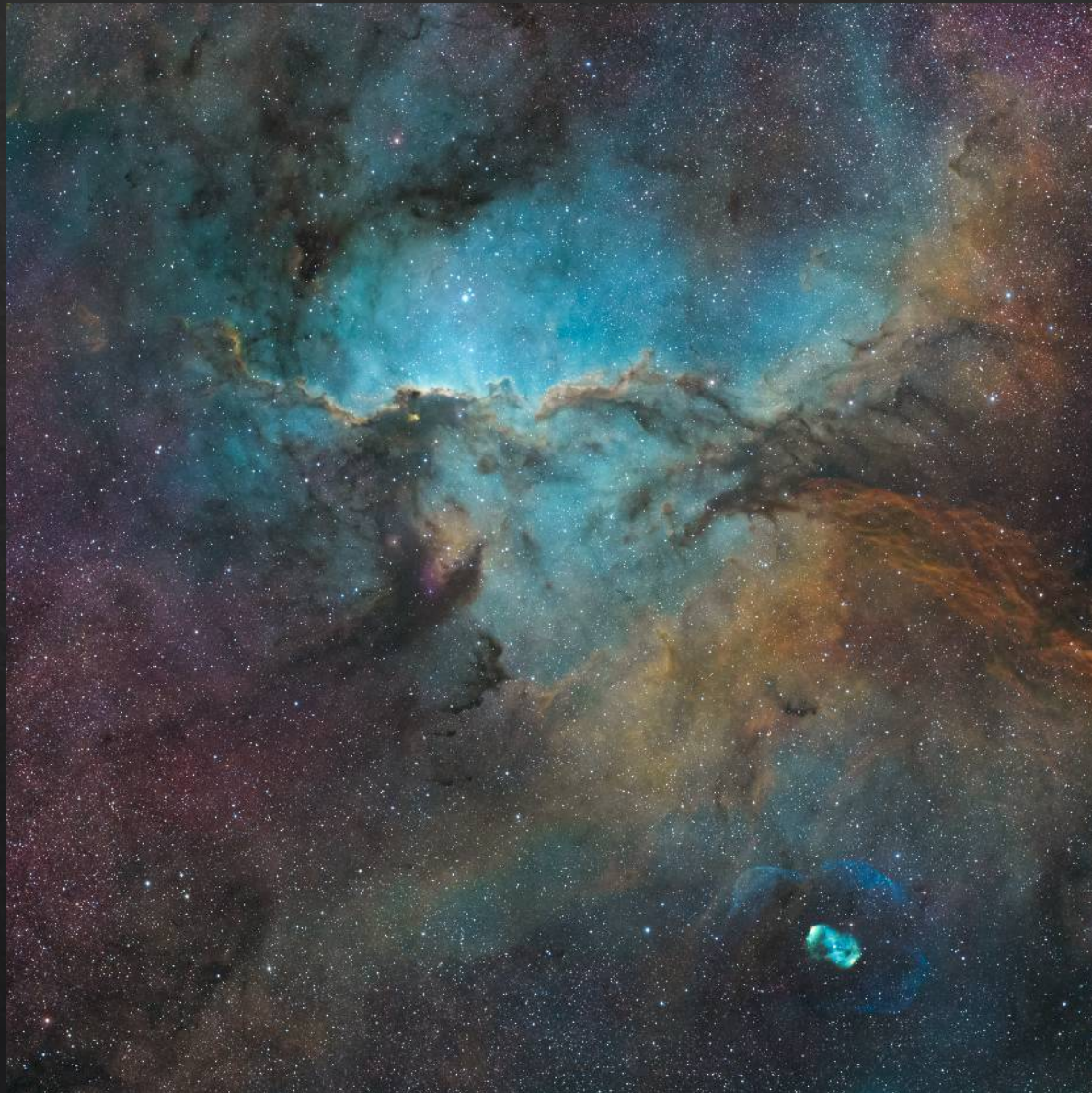
≠



~ 5 000 eur



Pas le même niveau... !



AM5 / FF65 / 533MC (1,85 "/pix) - Gilmour Dickson



Evscope 2 (1,33"/pix) - Russ Brassler

*Que peut-on faire avec ?*



# Capture via EAA

Image « **View** »



Pour post-traitement  
« basique »  
Projeter sur grand écran  
« live »  
Présentation / Découverte  
Public/privé

« *Pour faire joli* »

Image « **Stack(n)** »



Pour post-traitement  
« moyen »  
Astrophoto de base  
=> Dérotation !

« *Faire au mieux* »

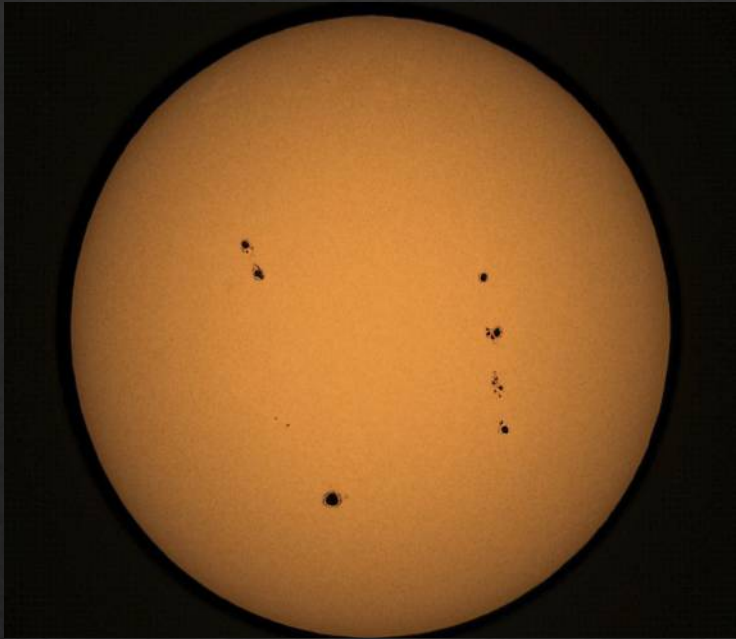
Image « **RAW** »



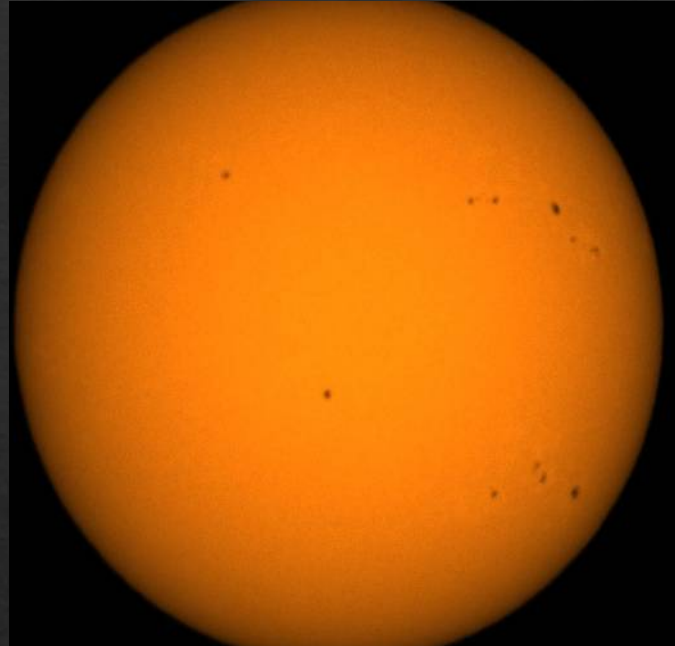
Pour post-traitement  
« lourd »  
Science / Défi

« *Que peut-on en sortir ?* »

# Solaire, Lunaire et planétaire



Vespera



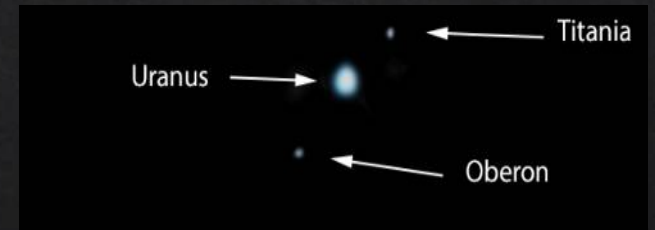
EQ1 & EQ2



S50



Pluton





# Solaire, Lunaire et planétaire



ETX125 + Sony A7s, stack 8 images

View



Dwarf II, 1 image, mode auto

# Solaire, Lunaire et planétaire

View



Equinox 2

View



Equinox 1



# Unistellar : Equinox 1 & 2, D=112, F=450, 1,2 / 4 Mpix, 2,9µ

~ 2800 objets, 600 000 images, 1,6 TB)



EQ1 & EQ2



Mise en station  
Orientation automatique  
PL Haute  
Images brutes  
Modes (planète, science)  
Résolution  
Rapidité stack  
Visualisation  
MAP  
« ViVid » mode (2024 EQ2 : png)



Suivi  
Stack (qualité)  
Calibration  
Extraction images  
WIFI  
APP Android & IOS



Port USB inutile...  
Récupération images  
Protocole de contrôle  
Planification

- Usage
  - **Public (« event ») => stack le +rapide**
  - Champ réduit
  - Modes
    - « science »
    - « accentué »
  - **Filtres : que Sol (cher), accès images**
- Traitement
  - image finale
  - images independantes, dark
  - images astronomiques
- Capture
  - **Catalogue petits objets**
  - 0,01 - 4 sec
  - période moyenne (1-2 h possible)

- Images
  - PNG = immediat  
Accès : smartphone / tablette  
Usage = montrer...
  - TIFF,FITS = mémoire télescope
  - Accès : **upload/download wifi (std)**  
V 3.\* : « file transfert » expérimental  
Usage = traiter
  - USB A+C : **inexploitable données**
- Memoire : 64 GB
- Image : 6MB (stack, light, dark)
- **10000 images**  
(4 sec = 11h capture)



**Accès aux RAW : indispensable !**

**Filtres : oui / non ?**

**Idéal pour « public »  
Le + rapide  
Le plus sensible  
Le + grand diamètre**



EQ1

- M81
- stack auto
- PL high
- 40 min



EQ2

- stack auto
- std mode
- PL high
- 48 min



***EQ 1 : Sans un accès aux RAW,  
l'usage est très limité...***

***EQ2 : new « Vivid » algo pour le View,  
du bricolage...***

M81 - EQ2  
48 min, PL High  
Siril / Pix / Affinity





M13 - Equinox 1

- Sky SQM 18, **PL HIGH**
- 1,2 Mpix
- 15 min (4 sec/img)
  
- Siril Stack
- Pix
- Affinity







M13 - Equinox 2

- Sky SQM 18, **PL HIGH**
- 4 Mpix
- 21 min / 315 img (4 sec/img)
- Siril Stack
- Pix
- Affinity





Image Enhancement VIVID (Oct 2024, V3.5) : **PL High**

RAW



M33 - EQ2 (CLS) - 1h30 (Raw post-process) , PL High

M33 - EQ2 - 10 min, view mode, VIVID Mode , PL High

View

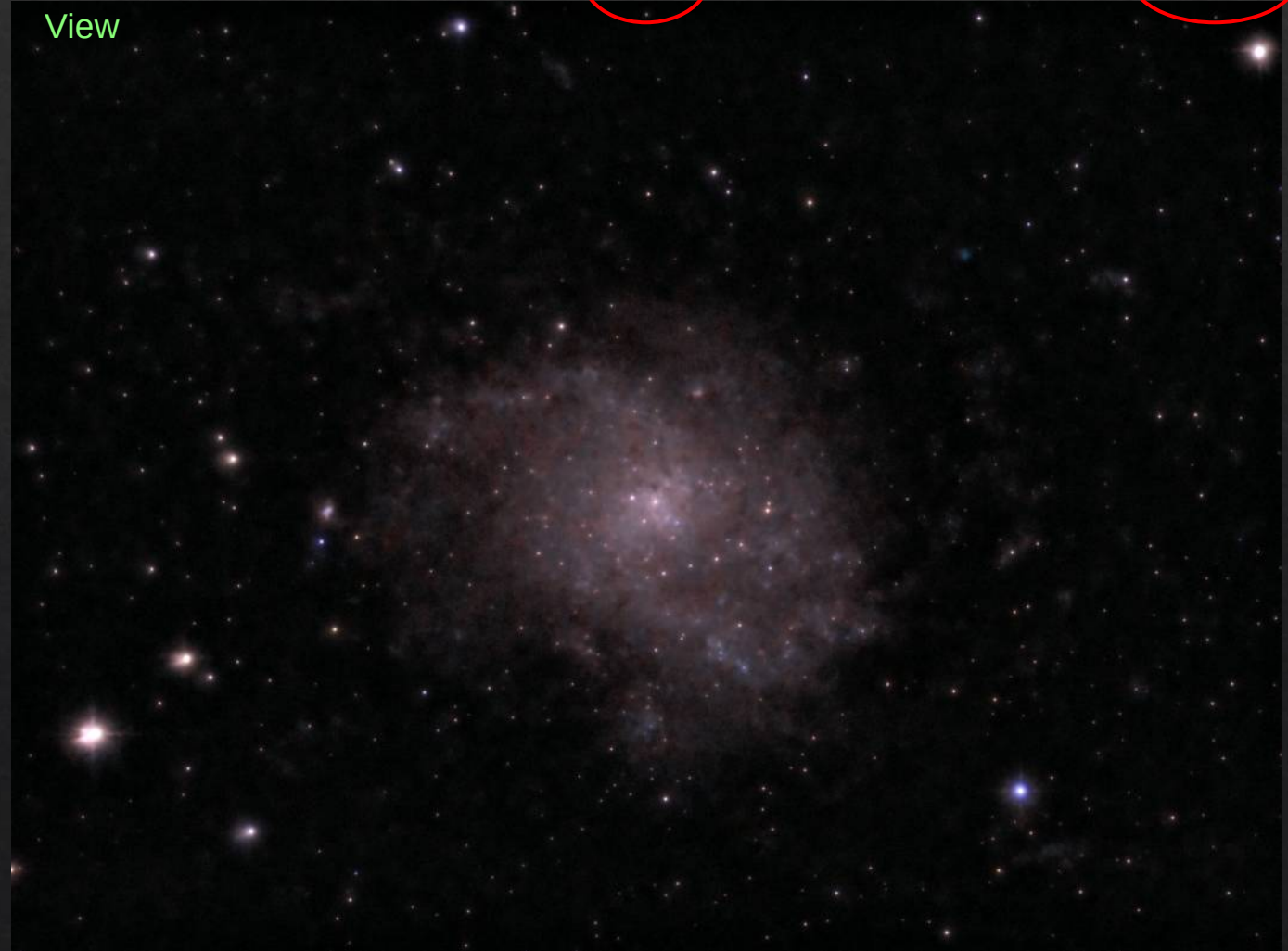




Image Enhancement (Oct 2024, V3.5) : **PL HIGH**

2 Min : Basculement de mode...

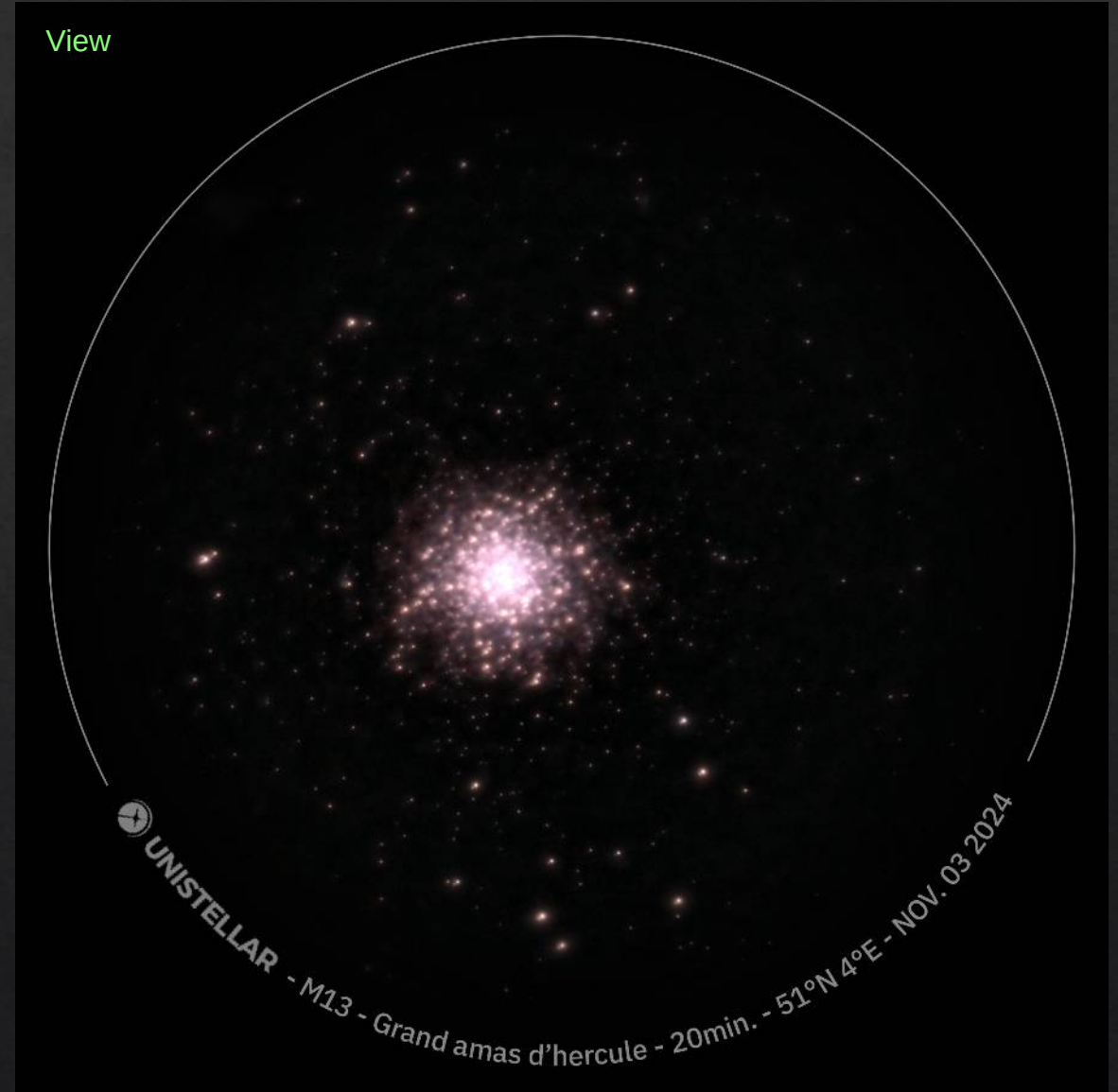
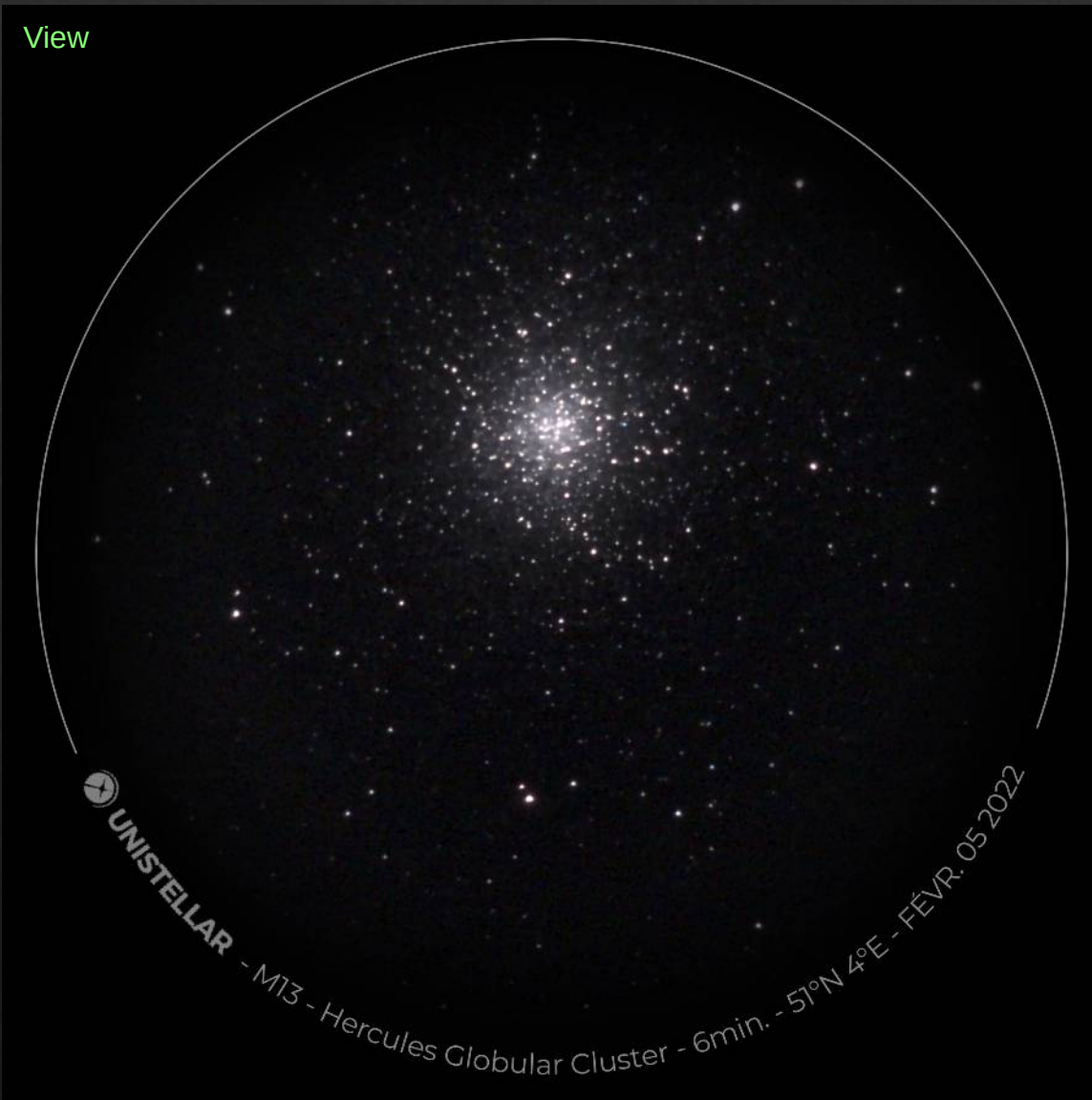
Amas de la Chouette - EQ2 - 1 min 56, PL High



Amas de la Chouette - EQ2 - 2min30 (Vivid active), PL High





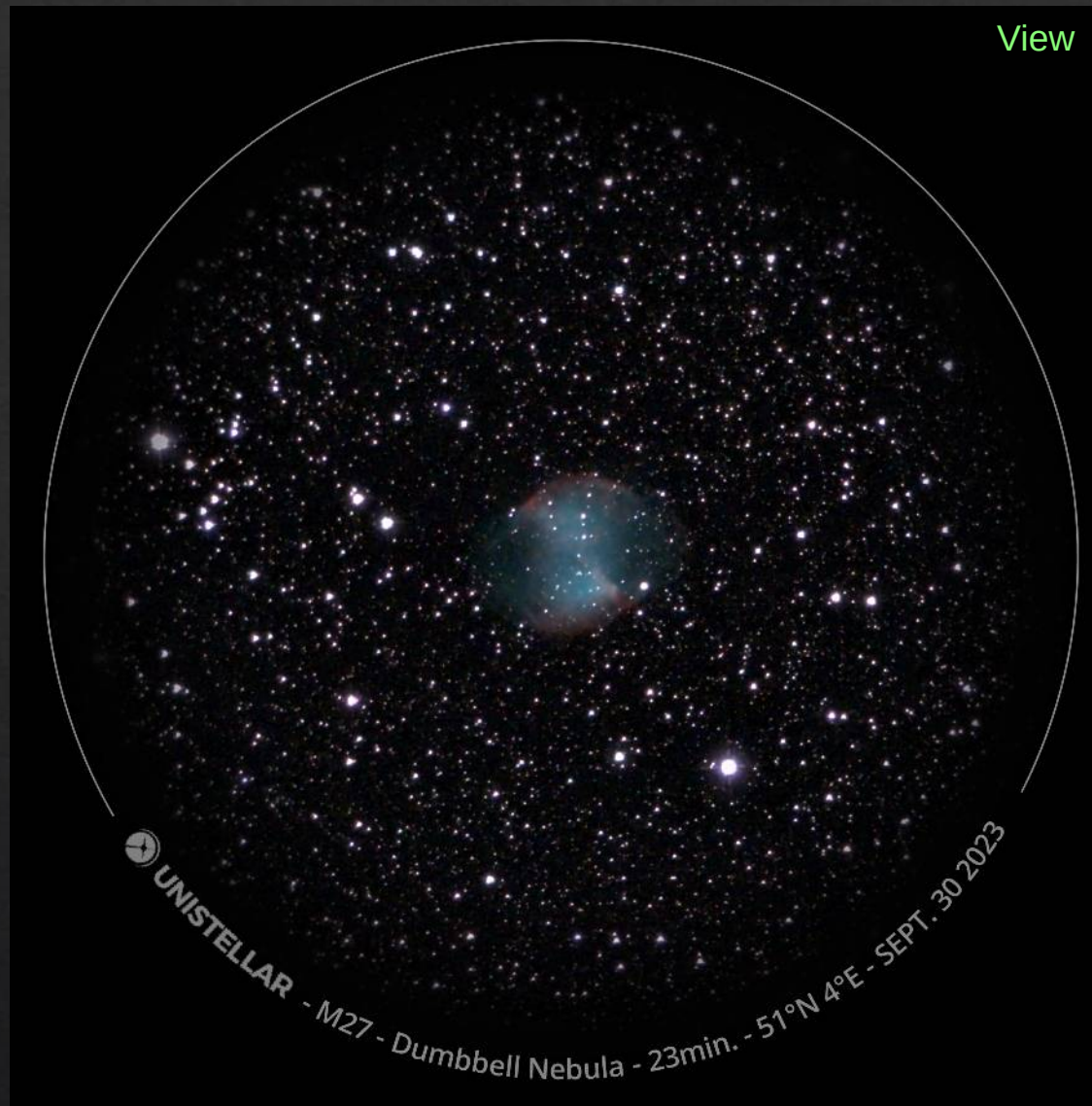


**EQ2 : « Vivid » au-dessus de 3 min, le désactiver ?**

# Meilleure « belle » image ?



EQ1 (std, non Vivid, PL High)



EQ2 (std, non ViVid, PL Low)



Meilleure « belle » image ?

RAW



Celestron C8

ASI 2600

AM5

1h

PL Low

M. Werny / Astronamur



# Meilleure « belle » image ?

VIEW



png,  
Vivid mode, View (20 min)  
No Filter  
**PL-High**



Meilleure « belle » image ?

VIEW



png,  
Vivid mode, View (20 min)  
Full  
1x L-Pro  
**PL-High**



Meilleure « belle » image ?



RAW

Fits,  
Addition Stacks (20 min)  
Crop (derotation)  
1x L-Pro  
1x Sans filtre  
**PL High**



# Vaonis Vespera : 2 Mpix, D=50, F=200, 2 Mpix, 2,9 $\mu$ , 2,99 arcsec/pix

~ 382 objets, 66 000 images, 0,5 TB)



Vespera / Pro



Orientation automatique  
Modes (solaire)  
Résolution  
Champ uniforme  
Visualisation  
MAP  
Filtres (PL, Solaire)  
APP iOS  
Mosaïque  
Anti-Buée



Suivi  
PL Moyenne  
WIFI  
APP Android  
Images brutes  
Planification



**Interrupteur**  
Récupération images  
Protocole de contrôle  
Images de contrôle

- Usage
  - Perso / Public privé, **pas de preview**
  - Large champ
  - **Mode « Mosaïque »**
  - filtre Sol / PL **cher, mais existant..**
  - **Interrupteur. accès image**
- Traitement
  - **uniquement** image finale
  - **image décorative...**
- Capture
  - **planification**
  - 10, 20, 30 sec
  - période moyenne (1-2 h possible)
  - adéquation champ + capteur
  - **anti-buée.**
- Images
  - JPEG = immédiat  
Accès : smartphone / tablette  
Usage = montrer...
  - TIFF, FITS = mémoire télescope  
Accès : **FTP**  
Usage = traiter
  - « USB like » : **inexploitable**
  - Mémoire : **10 GB**
  - Image = variable... (stack)



**Usage : PL ou pas ?**

**Idéal pour « privé »**  
**Mise au point auto**  
**Résolution**  
**Mosaïque**

Stack



Vespera I / 40 min



## Rosette Nebula

3 h

Site PL / filtre PL actif

- 1 image Stacked (Mosaic mode)

- Pix + GrapXpert + Affinity

Stack

Vespera I  
s : 2,99 arsec/pix



Stack



Que 50mm !  
Et back to FTP (90's) pour  
accéder les images...



# DWARFLab : Dwarf II



Dwarf II



Orientation automatique  
Modes (solaire, photo, telephoto)  
Champ uniforme  
Visualisation  
MAP  
Filtres (PL, Solaire)  
APP iOS & Android  
Catalogue  
Images brutes  
Récupération images



Résolution  
RTFM !  
Images de contrôle  
PL Basse  
Erreur de pointage !



Logique des boutons  
Logique des fonctions  
Images de contrôle

- Usage
  - Public => stack (50 % ratés)
  - **Ultra Portable (1,5 kg !!!)**...
  - Champ réduit (vertical)
  - **Filtre PL + Solaire (fourni)**
  - Modes
    - **visuel (normal / tele)**
    - **stack**
- Traitement
  - image finale
  - **images independantes**
- Capture
  - **Catalogue visuel**
  - 10, 20, 30 sec
  - **50 % pertes (PL)**
  - période moyenne (1-2 h)
- Images
  - JPEG = immediat  
Accès : smartphone / tablette  
Usage = montrer...
  - TIFF, FITS = mémoire télescope  
Accès : **USB C (MTP)**  
Usage = traiter
  - **WIFI : STA mode... (LAN,FTP)**
  - **Retraitement :**
  - Mémoire : 64 GB
  - Image = 4MB (light) - 12MB (stack)



**API : utilisable ou pas ?**  
**Equatorial utilisable ?**

**De poche (1,5 kg)**  
**Permanent voiture**  
**Photo normale & astro**  
**Mise au point auto**  
**Filtres**  
**Tracking**



M92 ?????

Stack



Stack



M27 - 20min - PL High - full



Stack



RAW

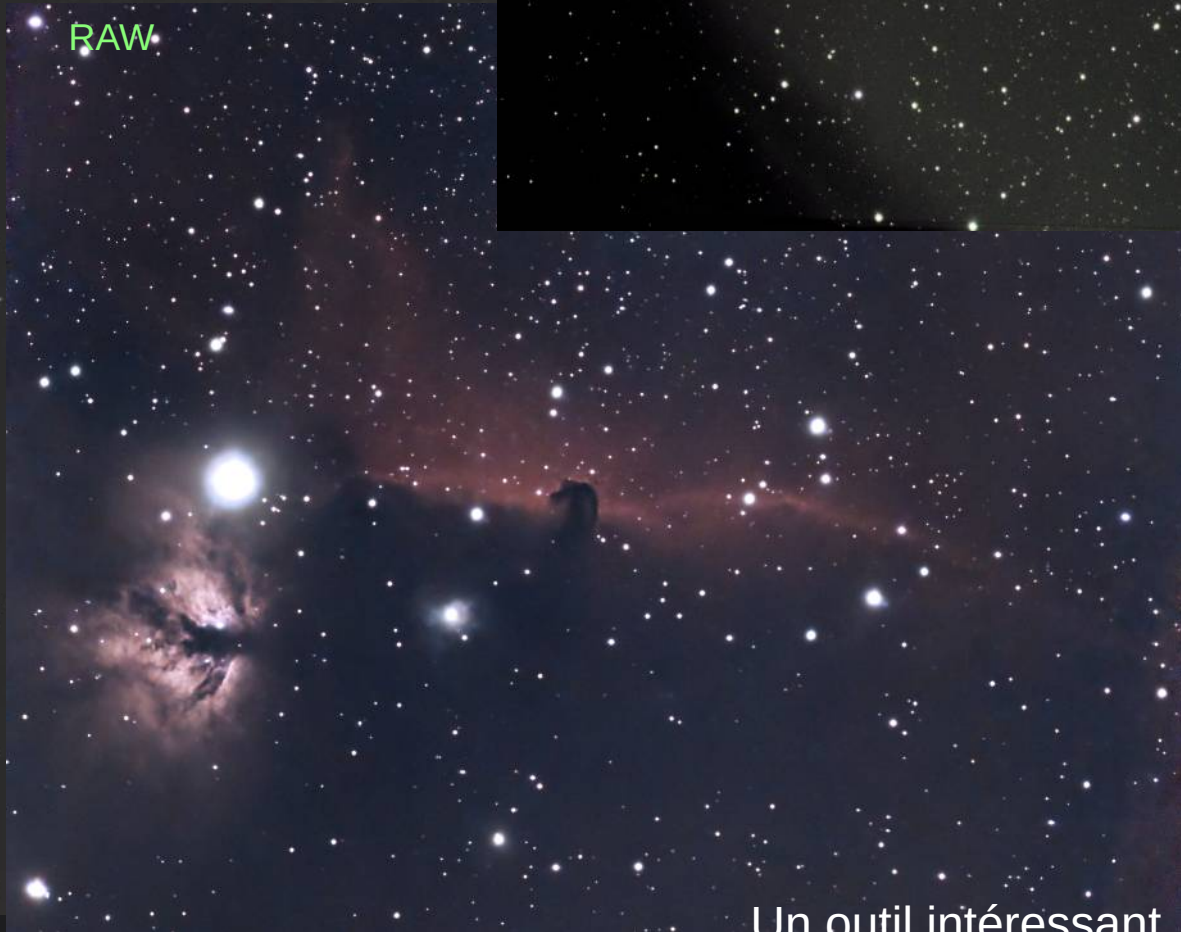


**Erik Van Lierde**  
**Urania**

RAW



RAW



Un outil intéressant, mais ***complexe***  
***et faillible***

## DWARFLab : Dwarf III



Dwarf III

PAS ENCORE RECU!



# ZWO : SeeStar 50, D=50, F=250, 2 Mpix, 2,9 $\mu$ , 2,39 arcsec/pix

~ 165 objets, 32000 images, 0,2 TB)



S50



Orientation automatique  
Modes (solaire, photo)  
Résolution  
Champ uniforme  
Visualisation  
MAP  
PL Haute  
Filtres (PL, Solaire)  
APP iOS & Android  
Catalogue  
PL Map



Images brutes  
Planification  
Récupération images



Protocole de contrôle  
Planification  
Synchro nébuleuses faibles  
Stack lent...



Images de contrôle

- Usage
  - Public => stack (50 % ratés)
  - **Ultra Portable (sac cabine avion)...**
  - Champ réduit (vertical)
  - **Filtre PL + Solaire (fourni)**
  - Modes
    - **visuel**
    - **stack**
- Traitement
  - image finale
  - **images indépendantes**
- Capture
  - **Catalogue visuel**
  - 10, 20, 30 sec
  - **20-50 % pertes (PL)**
  - période moyenne (1-2 h)
- Images
  - JPEG = immédiat  
Accès : smartphone / tablette  
Usage = montrer...
  - TIFF, FITS = mémoire télescope  
Accès : **USB C**  
Usage = traiter
  - **WIFI : STA mode... (LAN,FTP)**
  - **Retraitement** : via APP
  - Mémoire : 64 GB
  - Image = 4MB (light) - 12MB (stack)



**API : utilisable ou pas ?**

**Idéal pour « voyage »**  
**Mise au point auto**  
**Filtres**  
**Résolution**  
**Accès Images**  
**Traitement APP**



Smartphone Image Enhancement  
« astronomy image »



Smartphone Image Enhancement  
« more details »





# SeeStar 50

M13 (20 min => 4 min stack)

View



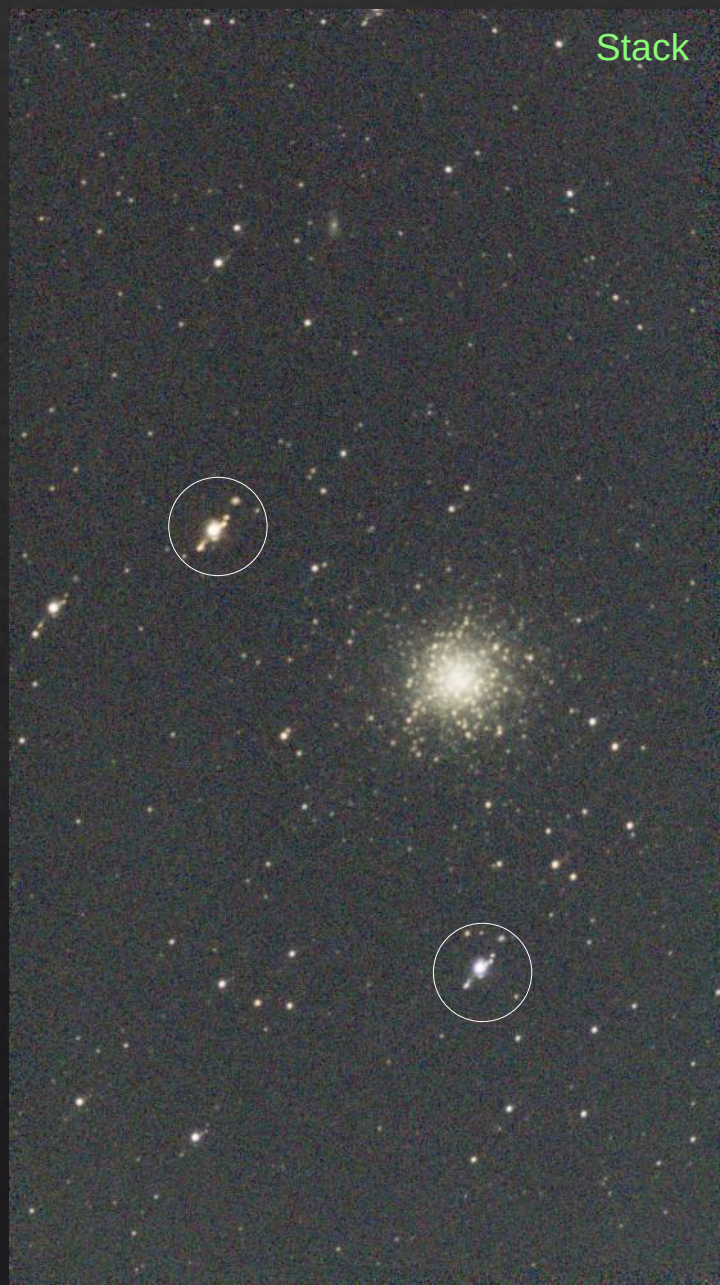
Seestair S50

50°N, 04°E / 2024-07-19 23:11

M 13

4min

Stack



App Re-Stack





# SeeStar 50

M81 (75min)

View

Stack

RAW

View

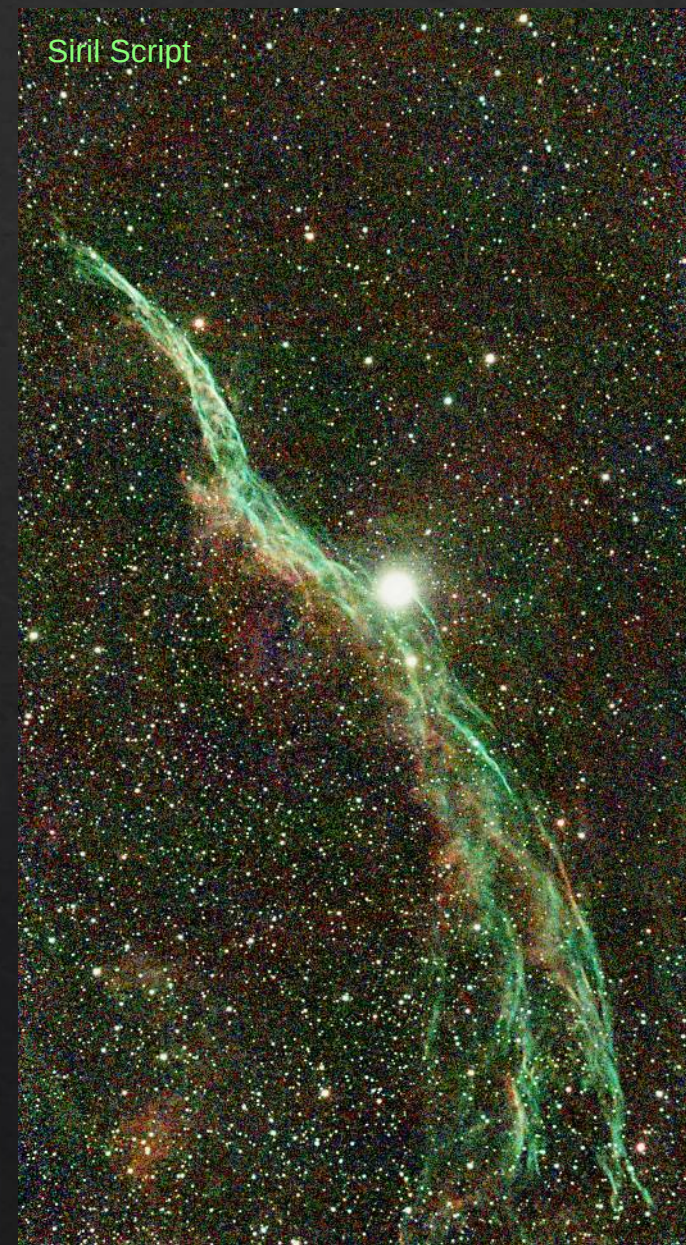
M 81

37min





# VA et... Filtres : SeeStar 50





# Mosaic Mode



# New SeeStar ?



F/5  
30/150mm



Mosaic Mode (Oct 2024)



# Vaonis Vespera Pro : 12 Mpix, D=50, F=250, 12 Mpix, 2 $\mu$ , 1,65 arcsec/pix

~ 50 objets, 8000 images, 0,5 TB)



Vespera / Pro



Orientation automatique  
Modes (solaire)  
Résolution  
Visualisation  
MAP  
Filtres (PL, Solaire)  
APP iOS  
Anti-Buée



Suivi  
PL Faible  
Champ uniforme  
WIFI  
APP Android  
Sensibilité  
Images brutes  
Planification  
Lenteur générale



Interrupteur  
Port USB C ignoré  
Récupération images  
PL Moyenne et Haute  
Protocole de contrôle

- Usage
  - Public privé
  - Large champ
  - Mode « Mosaïque »
  - filtre Sol / PL cher, mais existant..
  - Interrupteur. accès image
- Traitement
  - **uniquement** image finale
  - **image décorative...**
- Capture
  - **planification**
  - 10, 20, 30 sec
  - période moyenne (1-2 h possible)
  - adéquation champ + capteur : **mitigé**
- Images
  - JPEG = immédiat  
Accès : smartphone / tablette  
Usage = montrer...
  - Processeur : **insuffisant** (50%)
  - TIFF, FITS = mémoire télescope  
Accès : **FTP**  
Usage = traiter
  - USB C : **inexploitable**
  - Mémoire : 256 GB
  - Image = variable... (stack)
- « PRO » : pas convaincant à ce stade....



**Usage : PL ou pas ?**

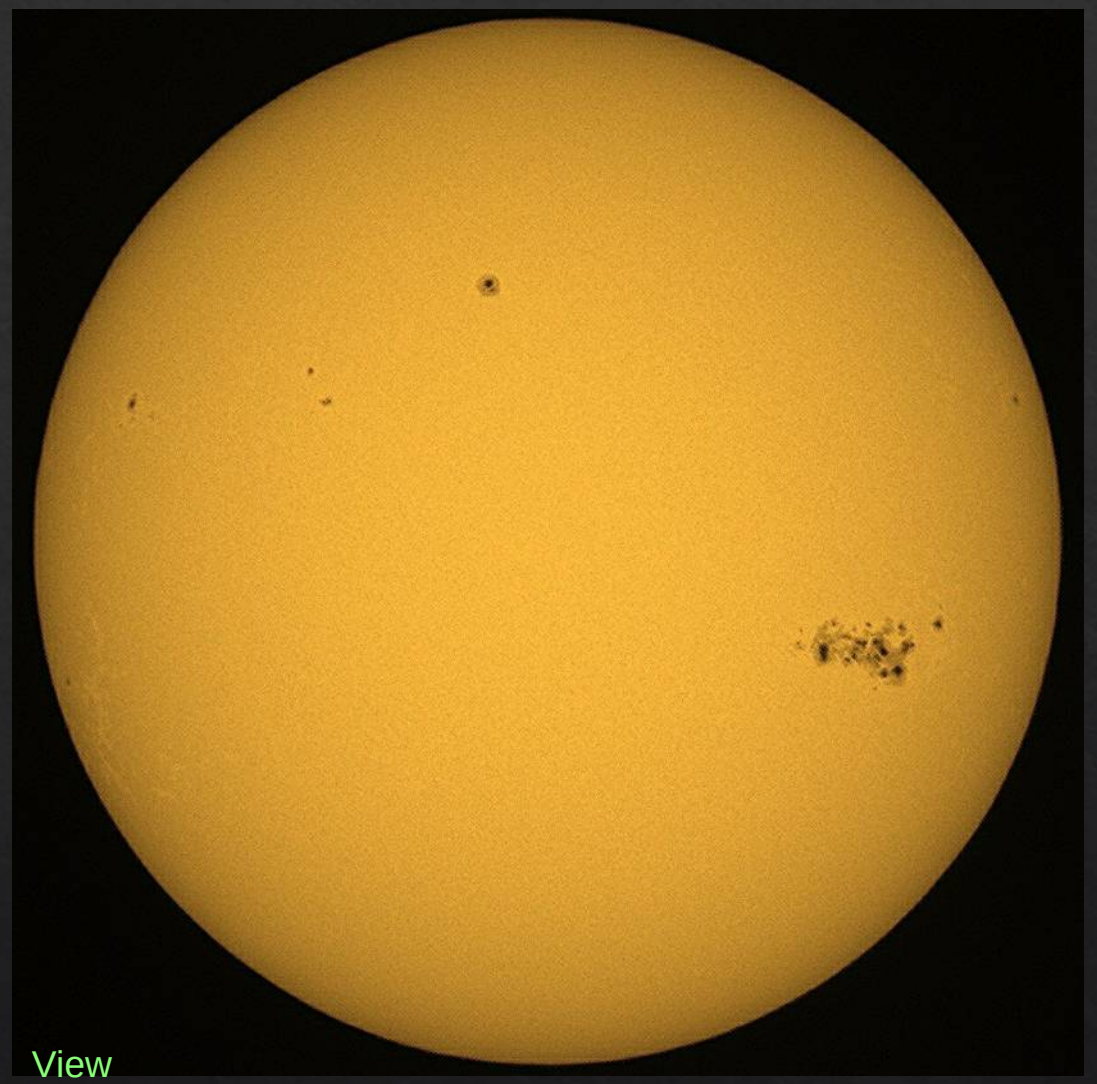
**Pour public avisé  
Mise au point auto  
Résolution  
Mosaïque**



# Solaire et planétaire



Vespera



Vespera Pro



M13 - 1h



Stack



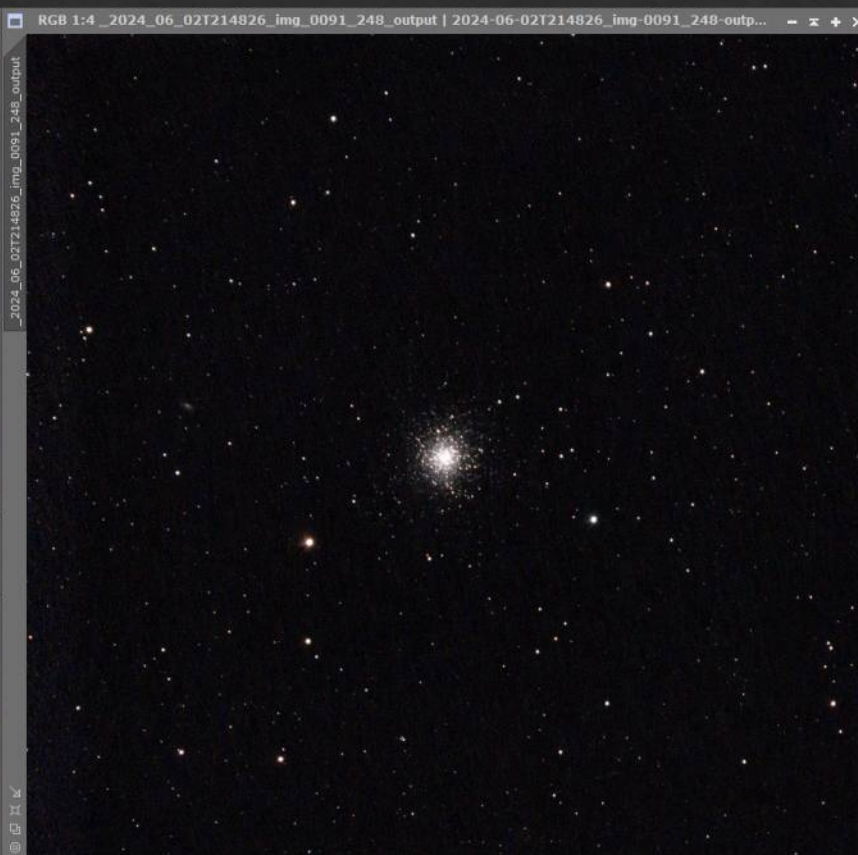
Stack, std, PL Low



2024-05-  
09T21:38:45

Statistics - Text View			
_2024_05_09T213845_img_0090_126_output			
	R	G	B
count (%)	82.08658	84.30558	80.66798
count (px)	8079043	8297439	7939423
mean	0.059	0.048	0.061
median	0.043	0.035	0.047
avgDev	0.046	0.038	0.044
MAD	0.035	0.029	0.035
minimum	0.004	0.004	0.004

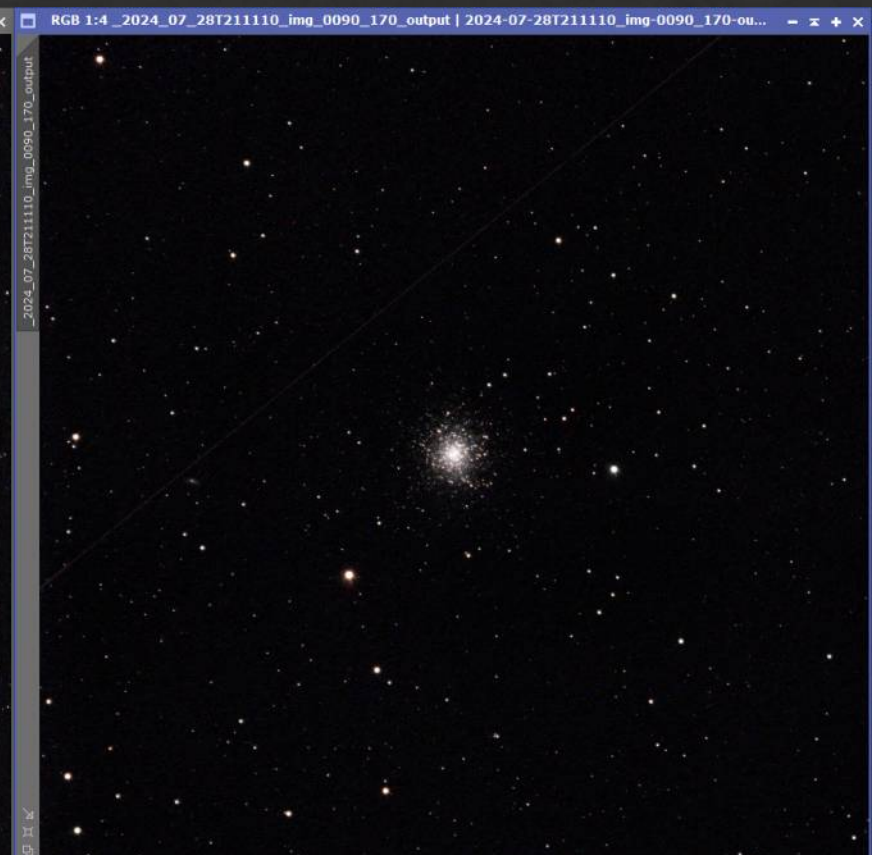
Stack, std, PL High



2024-06-  
02T21:48:26

Statistics - Text View			
_2024_06_02T214826_img_0091_248_output			
	R	G	B
count (%)	81.11089	83.75083	80.06597
count (px)	8393355	8666536	8285227
mean	0.058	0.047	0.066
median	0.047	0.035	0.055
avgDev	0.044	0.036	0.048
MAD	0.041	0.029	0.041
minimum	0.004	0.004	0.004

Stack, Mosaic, PL High, CLS



2024-07-  
28T21:11:10

Statistics - Text View			
_2024_07_28T211110_img_0090_170_output			
	R	G	B
count (%)	75.28254	73.25901	75.89001
count (px)	7877565	7665823	7941131
mean	0.037	0.030	0.044
median	0.024	0.020	0.031
avgDev	0.030	0.026	0.033
MAD	0.023	0.017	0.023
minimum	0.004	0.004	0.004
maximum	0.996	0.996	0.996





RAW



GraXpert, Xblur, Affinity



***A l'utilisation...***



## Hardware : évolution et problèmes

Marque	Modèle	< 2020	2020	2021	2022	2023	2024	2025
Unistellar	EQ1		x	ok	ok (CLS)	ok (CLS)	ok (CLS)	ok (CLS) ?
	EQ1				Nok/SAV OK	ok	ok	ok ?
	EQ1			x	ok	ok	nok (batterie)	
	EQ2				x	ok	ok (L-PRO)	ok (L-PRO) ?
Vaonis	Vespera I			x	ok (switch)	ok (switch)	Nok/SAV NOK	ok (switch)
	Vespera Pro						x	ok ?
	Hestia						NOK	pièces détachées
ZWO	SeeStar				x	ok	ok (SAV OK)	ok ?
	ASI AIR Pro			x	ok	ok	ok	ok ?
	ASI120MC		x	ok	ok	ok	ok	ok ?
	ASI185MC			x	ok	ok	ok	ok ?
	ASI178MC					x	ok	ok ?
	ASI178MM				x	ok	ok	ok ?
DwarfLab	Dwarf II				x	ok	ok	ok ?
	Dwarf III						x ?	
Celestron	NexStar		x	ok (WIFI)	ok (WIFI)	Nok (Batt)	ok (WIFI+220)	ok (WIFI+220)
	StarSense		x	ok	ok	Nok	ok	ok
SkyWatcher	EQ6	2007	ok	ok	ok	ok	ok	ok
	AZ/GTI		ok	ok	ok	ok	ok	ok
	Adventurer Mini	2019	ok	ok	ok	ok	ok	ok
Vixen	Sphynx	2004	ok	ok	ok	ok	ok	ok
Meade	ETX125	1998	ok	ok	ok	LCD	LCD	LCD



NGC 225	SeeStar	Vespera	VesperaPro	Equinox1
Nbr captures files (fits)	1221	1496	793	4282
Nbr stack images (jpg)	872	1496	760	1
Capture Time / img	10	10	10	3,971754
Total capture (min)	203,50	249,33	132,17	283,45
Start Capture	29/07/24 22:41	29/07/24 23:11	29/07/24 23:02	29/07/24 20:46
End capture	30/07/24 03:32	30/07/24 03:26	30/07/24 03:27	30/07/24 01:29
Elapsed time (HMS)	04:51:00	04:15:00	04:25:00	04:43:14
Elapsed time (min)	291	255	265	283
Capture/elapsed (%)	70	98	50	100
Capture size (pix)	1080x1920	1920x1080	3536x3536	1304x0976
Stack size (pix)	1080x1920	1920x1080	3536x3536	1296x0976
Image filesize (MB)	3,95	3,95	23,8	2,43
Stack image filesize (MB)	0,6	0,4	71,5	2,43
Focal Length (mm)	250	200	250	450
Diam (mm)	50	50	50	112
F/D	5	4	5	4
Pixel size (µm)	2,9	2,9	2	2,9
Mpixels	2	2	12	1
Total capture filesize (GB)	5,56	7,23	19,4	10,16



Capture : ED80 / ASI178

**En finale : Rien de vraiment exploitable !**

Efficacité de capture

SeeStar : 70 %  
 Vespera Pro : 50 %

=> il faudra poser 2h pour avoir 1h effective



# VA et...Comparer M1, condition **PL haute**, ciel dégagé et identique , 1h de capture

Stellarium

EQ1 (CLS, 1h, 4s / img)

Stack

EQ2 (1h, 4s / img)

Stack

Vespera ( 1h, 10s/img)  
Filter PL

Stack

SeeStar (1h, 10s/img)  
Filter « on »

Stack

Vespera Pro

« Not found »



SkyChart

S : 1,72 arsec/pix  
/ R : 1,07 "

s : 1,33 arsec/pix  
/ R : 1,07 "

s : 2,99 arsec/pix  
/ R : 2,4 "

S : 2,39 arsec/pix  
/ R : 2,4 "



# Faut-il rajouter un filtre sur Equinox ?

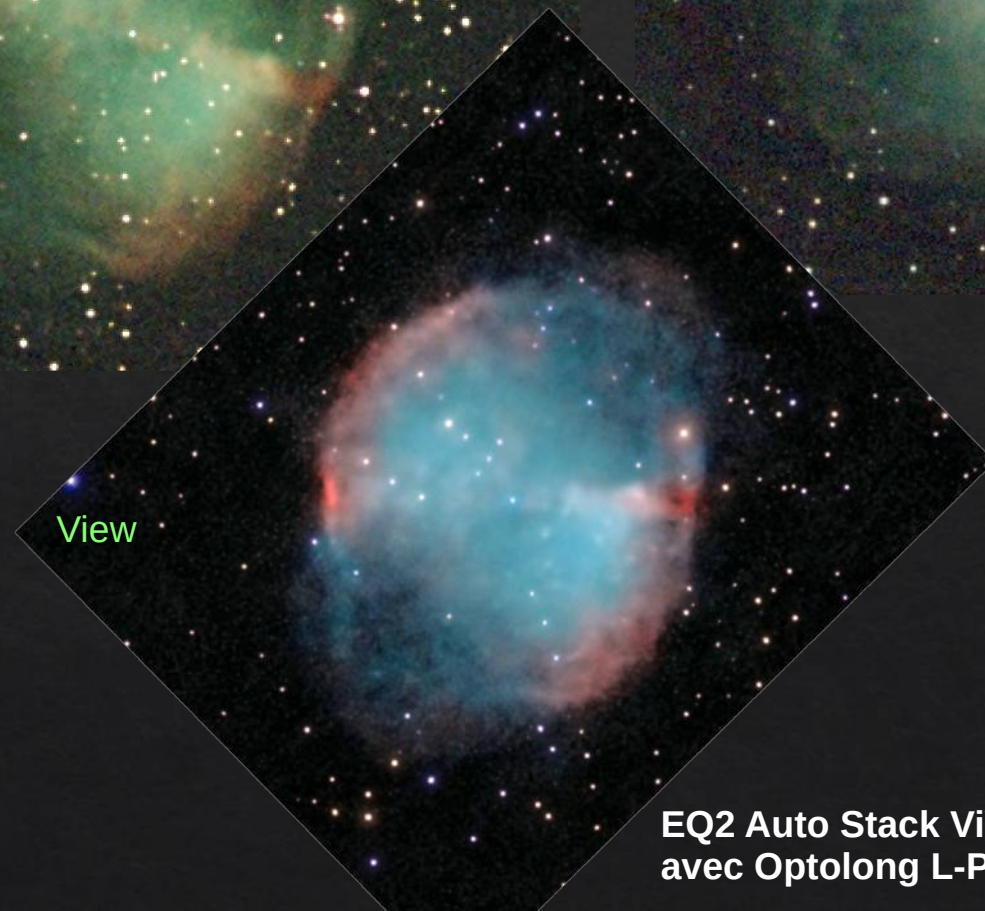
M27, 360 x 4 sec, 24 min, PL Haute

EQ2 Auto Stack avec Optolong L-Pro



EQ1 Auto Stack avec SVBony CLS

EQ2 Auto Stack sans filtre



EQ2 Auto Stack ViVid avec Optolong L-Pro



# VA et... Filtres : galaxies

Stack



Equinox 2

Stack



S50+Filtre

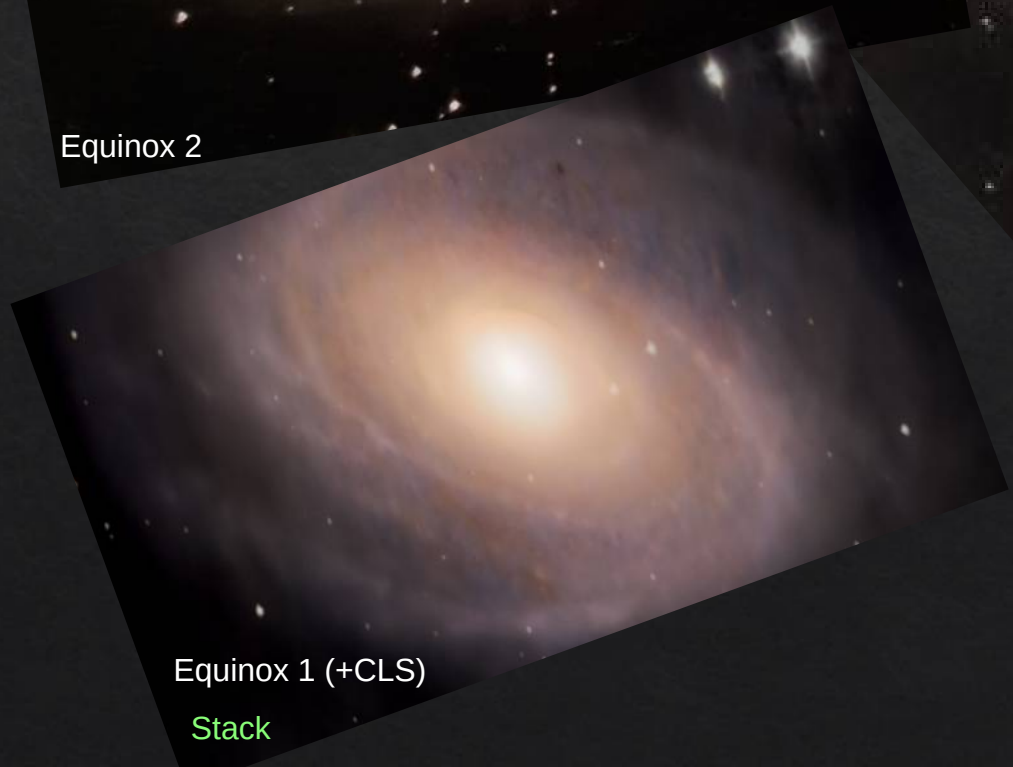
Stack



Vespera+PL

Equinox 1 (+CLS)

Stack





# Les images « brutes » (FITS)

## Unistellar

### Unistellar Stacksum (fits)

```

SIMPLE = 1 / conforms to FITS standard
BITPIX = 16 / array data type
NAXIS = 2 / number of array dimensions
NAXIS1 = 1048
NAXIS2 = 1536
BUNIT = 'ADU'
ORIGIN = 'Unistellar' / institution responsible for creating this file
DATE = '2024-03-09T19:16:04.164' / date of file creation
TIMESYR = 0.2 / systematic error on time, in TIMEUNIT
TELESCOP = 'IM2047' / name of telescope
INSTRUME = 'IM2047' / name of instrument
SERIALNB = 'xxxxxx' / Serial number of the telescope
DATE-OBS = '2024-03-07T19:11:37.071' / date of the start of the obs
DATE-MID = '2024-03-07T19:11:39.071' / date of the mid of the obs
DATE-END = '2024-03-07T19:11:41.071' / date of the end of the obs
MJD-OBS = 60376.7997361805 / modified Julian date of the start obs
MJD-MID = 60376.79975778607 / modified Julian date of the mid obs
MJD-END = 60376.79978934156 / modified Julian date of the end obs
EXPTIME = 3.999997 / exposure time, in TIMEUNIT
TIMEUNIT = 's' / time unit
LATITUDE = 30.000000 / latitude in degrees north of observing site
LONGITUDE = 4.000000 / longitude in degrees east of observing site
ALTITUDE = 104 / altitude in meters of observing site
GAIN = 0.1298063187045237 / gain in e-/ADU
GAINB = 18.3 / gain in decibel used in the e/Scope
CHOSTEMP = 10 / sensor temperature in Celsius
OBSMODE = 'EnhancedVision' / observation mode of the frame
FOVDESC = 'Stacksum' / usage of the frame
SEQID = 8 / number of image in recording sequence
FOVRA = 47.74072 / Field of view Right Ascension in deg (J2000.0)
FOVDEC = 6.57932 / Field of view Declination in deg (J2000.0)
FOVREFX = 1024 / X reference pixel for FOVRA, FOVDEC
FOVREFY = 768 / Y reference pixel for FOVRA, FOVDEC
SOFTVER = '3.0-8a13c790' / Software Versions
BIASLVL = 39312.0 / Black level in ADU in 16 bits
ACCLAVX = -0.00408 / Average Acceleration X in m.s^-2
ACCLAVY = -8.88472 / Average Acceleration Y in m.s^-2
ACCLAVZ = 5.04047 / Average Acceleration Z in m.s^-2
ACCLMAXX = -0.00778 / Maximum Acceleration X in m.s^-2
ACCLMAXY = -8.687139989999999 / Maximum Acceleration Y in m.s^-2
ACCLMAXZ = 5.04167 / Maximum Acceleration Z in m.s^-2
TELRAT = 29.3828271162753 / Telescope altitude in degrees
TELAR = 241.3208312988281 / Telescope azimuth in degrees
BAYERPAT = 'RGB' / Bayer pattern
BSCALE = 1
BIERO = 32768
END

```

### Unistellar Stackinput (fits)

```

SIMPLE = 1 / conforms to FITS standard
BITPIX = 16 / array data type
NAXIS = 2 / number of array dimensions
NAXIS1 = 1088
NAXIS2 = 1536
BUNIT = 'ADU'
ORIGIN = 'Unistellar' / institution responsible for creating this file
DATE = '2024-01-10T19:56:39.407' / date of file creation
TIMESYR = 0.2 / systematic error on time, in TIMEUNIT
TELESCOP = 'eScope v2.0' / name of telescope
INSTRUME = 'IM2047' / name of instrument
SERIALNB = 'xxxxxx' / Serial number of the telescope
DATE-OBS = '2024-01-08T20:07:14.765' / date of the start of the obs
DATE-MID = '2024-01-08T20:07:16.765' / date of the mid of the obs
DATE-END = '2024-01-08T20:07:18.765' / date of the end of the obs
MJD-OBS = 60317.83938848346 / modified Julian date of the start obs
MJD-MID = 60317.83938848397 / modified Julian date of the mid obs
MJD-END = 60317.83841163199 / modified Julian date of the end obs
EXPTIME = 3.999997 / exposure time, in TIMEUNIT
TIMEUNIT = 's' / time unit
GAIN = 0.1298063187045237 / gain in e-/ADU
GAINB = 18.3 / gain in decibel used in the e/Scope
OBSMODE = 'EnhancedVision' / observation mode of the frame
USEFRM = 'StackInput' / usage of the frame
STACKED = 0 / number of images stacked
FOVRA = 114.52605 / Field of view Right Ascension in deg (J2000.0)
FOVDEC = 38.18244 / Field of view Declination in deg (J2000.0)
FOVREFX = 1044 / X reference pixel for FOVRA, FOVDEC
FOVREFY = 768 / Y reference pixel for FOVRA, FOVDEC
BAYERPAT = 'RGB' / Bayer pattern
BSCALE = 1
BIERO = 32768
END

```

```

STACKINPUT
<sn>_yyyy-mm-ddTHH-MM-SS.mmm_ENHANCEDVISION
<sn>_yyyy-mm-ddTHH-MM-SS.mmm_DEFENSE
<sn>_yyyy-mm-ddTHH-MM-SS.mmm_OCCULTATION
<sn>_yyyy-mm-ddTHH-MM-SS.mmm_Science_Comet (...)
<sn>_yyyy-mm-ddTHH-MM-SS.mmm_Science_Darkframe
<sn>_yyyy-mm-ddTHH-MM-SS.mmm_DarkframeMean
<sn>_yyyy-mm-ddTHH-MM-SS.mmm_STACKSUM.fits
<sn>_yyyy-mm-ddTHH-MM-SS.mmm_STACKSUM.json
<sn>_yyyy-mm-ddTHH-MM-SS.mmm_DARKFRAMEMEAN.fits
<sn>_yyyy-mm-ddTHH-MM-SS.mmm_DARKFRAMEMEAN.json

```

Missing : object name

<android>

<model>:yyyymmdd-HHMMSS.jpg

### Vespera Pro

```

SIMPLE = 1 / file does conform to FITS standard
BITPIX = 16 / number of bits per data pixel
NAXIS = 2 / number of data axes
NAXIS1 = 3536 / length of data axis 1
NAXIS2 = 3536 / length of data axis 2
EXTEND = 1 / FITS dataset may contain extensions
BIERO = 32768
BSCALE = 1
DATE-OBS = '2024-08-05T10:30:26' / Capture time
EXPOSURE = 10. / [s] Total Exposure Time
TEMP = 22. / [C] Temperature
FOCAL = 200 / [mm] Focal length
INSTRUME = 'vesperapro-xxxxxx' / VESPERA PRO by Vaonis
BAYERPAT = 'GBRG' / Bayer pattern
GAIN = 180 / [0.1e5] Sensor gain
HCG = 1 / gain HCG mode
OFFSET = 240 / Camera brightness parameter
PIXSZ = 2. / [um] Pixel size
WB_B = 85 / White balance (blue)
WB_R = 70 / White balance (red)
FILTER = 'CIS'
COMMENT VESPERA PRO by Vaonis
END

```

### Vespera

```

SIMPLE = 1 / file does conform to FITS standard
BITPIX = 16 / number of bits per data pixel
NAXIS = 2 / number of data axes
NAXIS1 = 1920 / length of data axis 1
NAXIS2 = 1080 / length of data axis 2
EXTEND = 1 / FITS dataset may contain extensions
BIERO = 32768
BSCALE = 1
DATE-OBS = '2022-10-09T18:11:29 UTC' / Capture time
EXPOSURE = 10000 / [ms] Total Exposure Time
FOCAL = 200 / [mm] Focal length
INSTRUME = 'vesperapro-xxxxxx' / STELLINA by Vaonis
BAYERPAT = 'GBRG' / Bayer pattern
GAIN = 201 / [0.1e5] Sensor gain
OFFSET = 240 / Camera brightness parameter
PIXSZ = 2.9 / [um] Pixel size
WB_B = 68 / White balance (blue)
WB_R = 62 / White balance (red)
COMMENT STELLINA by Vaonis
END

```

Sub-dir naming

yyyy-mm-dd\_HH-MM-SS\_observation\_<object>

<nn>-images-initial

img-<nnnn>.fits

img-<nnnn>-output.jpg

img-<nnnn>.tif

yyyy-mm-dd\_HH-MM-SS\_plan\_<plan name>

<nn>-observation\_<object>

<nn>-images-initial

img-<nnnn>.fits

img-<nnnn>-output.jpg

img-<nnnn>.tif

yyyy-mm-dd\_HH-MM-SS\_plan\_sun-mode

<nn>-observation

<nn>-images-(nn)

yyyy-mm-dd\_HH-MM-SS\_(nnn).jpg

Sub-dir naming

expert-mode

<nn>-images-initial

image-brutes

params.json

yyyy-mm-dd\_HH-MM-SS\_moon

<nn>-images-initial

yyyy-mm-dd\_HH-MM-SS\_(nnn).jpeg

<android>:pictures/Singularity Album

yyyy-mm-dd-(nn).jpg

### SeeStar (fits)

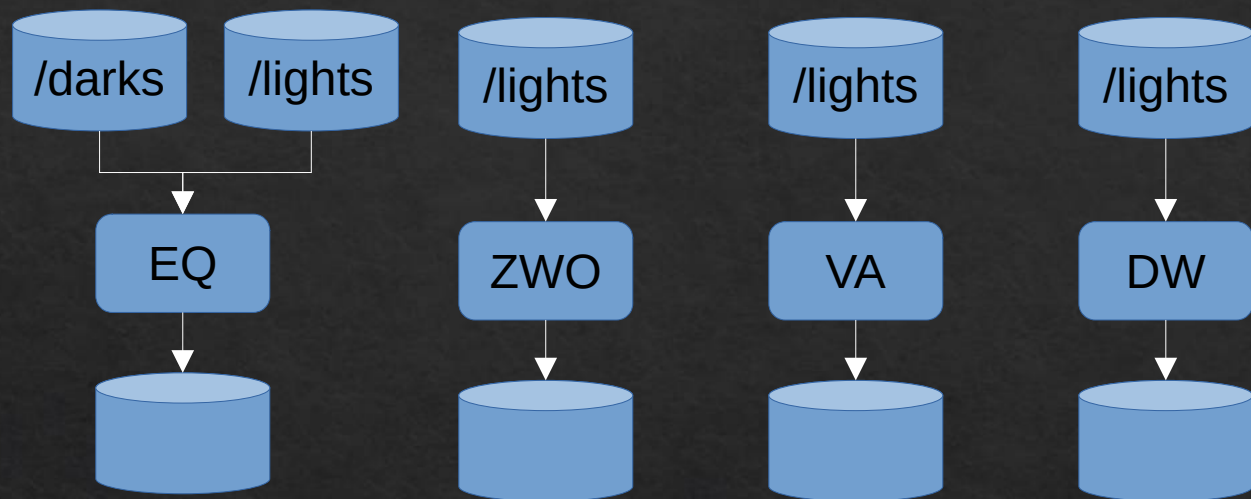
```

SIMPLE = 1 / file does conform to FITS standard
BITPIX = 16 / number of bits per data pixel
NAXIS = 2 / number of data axes
NAXIS1 = 1068 / length of data axis 1
NAXIS2 = 1536 / length of data axis 2
EXTEND = 1 / FITS dataset may contain extensions
BIERO = 32768 / offset data range to that of unsigned short
BSCALE = 1 / default scaling factor
CAPTION = 'RUC SeeStar880' / Capture software
NOBFRAME = 0 / Subframe N position in binned pixels
NOBPIXEL = 0 / Subframe Y position in binned pixels
FOCALLEN = 280 / Focal length of telescope in cm
NAXIS1BIN = 1 / Camera X Bin
NAXIS2BIN = 1 / Camera Y Bin
NAXIS3BIN = 1 / Camera Z Bin
NAXIS4BIN = 1 / Camera X Bin
NAXIS5BIN = 1 / Camera Y Bin
NAXIS6BIN = 1 / Camera Z Bin
NAXIS7BIN = 1 / Camera X Bin
NAXIS8BIN = 1 / Camera Y Bin
NAXIS9BIN = 1 / Camera Z Bin
NAXIS10BIN = 1 / Camera X Bin
NAXIS11BIN = 1 / Camera Y Bin
NAXIS12BIN = 1 / Camera Z Bin
NAXIS13BIN = 1 / Camera X Bin
NAXIS14BIN = 1 / Camera Y Bin
NAXIS15BIN = 1 / Camera Z Bin
NAXIS16BIN = 1 / Camera X Bin
NAXIS17BIN = 1 / Camera Y Bin
NAXIS18BIN = 1 / Camera Z Bin
NAXIS19BIN = 1 / Camera X Bin
NAXIS20BIN = 1 / Camera Y Bin
NAXIS21BIN = 1 / Camera Z Bin
NAXIS22BIN = 1 / Camera X Bin
NAXIS23BIN = 1 / Camera Y Bin
NAXIS24BIN = 1 / Camera Z Bin
NAXIS25BIN = 1 / Camera X Bin
NAXIS26BIN = 1 / Camera Y Bin
NAXIS27BIN = 1 / Camera Z Bin
NAXIS28BIN = 1 / Camera X Bin
NAXIS29BIN = 1 / Camera Y Bin
NAXIS30BIN = 1 / Camera Z Bin
NAXIS31BIN = 1 / Camera X Bin
NAXIS32BIN = 1 / Camera Y Bin
NAXIS33BIN = 1 / Camera Z Bin
NAXIS34BIN = 1 / Camera X Bin
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NAXIS36BIN = 1 / Camera Z Bin
NAXIS37BIN = 1 / Camera X Bin
NAXIS38BIN = 1 / Camera Y Bin
NAXIS39BIN = 1 / Camera Z Bin
NAXIS40BIN = 1 / Camera X Bin
NAXIS41BIN = 1 / Camera Y Bin
NAXIS42BIN = 1 / Camera Z Bin
NAXIS43BIN = 1 / Camera X Bin
NAXIS44BIN = 1 / Camera Y Bin
NAXIS45BIN = 1 / Camera Z Bin
NAXIS46BIN = 1 / Camera X Bin
NAXIS47BIN = 1 / Camera Y Bin
NAXIS48BIN = 1 / Camera Z Bin
NAXIS49BIN = 1 / Camera X Bin
NAXIS50BIN = 1 / Camera Y Bin
NAXIS51BIN = 1 / Camera Z Bin
NAXIS52BIN = 1 / Camera X Bin
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NAXIS54BIN = 1 / Camera Z Bin
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NAXIS61BIN = 1 / Camera X Bin
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NAXIS64BIN = 1 / Camera X Bin
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NAXIS67BIN = 1 / Camera X Bin
NAXIS68BIN = 1 / Camera Y Bin
NAXIS69BIN = 1 / Camera Z Bin
NAXIS70BIN = 1 / Camera X Bin
NAXIS71BIN = 1 / Camera Y Bin
NAXIS72BIN = 1 / Camera Z Bin
NAXIS73BIN = 1 / Camera X Bin
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NAXIS75BIN = 1 / Camera Z Bin
NAXIS76BIN = 1 / Camera X Bin
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NAXIS79BIN = 1 / Camera X Bin
NAXIS80BIN = 1 / Camera Y Bin
NAXIS81BIN = 1 / Camera Z Bin
NAXIS82BIN = 1 / Camera X Bin
NAXIS83BIN = 1 / Camera Y Bin
NAXIS84BIN = 1 / Camera Z Bin
NAXIS85BIN = 1 / Camera X Bin
NAXIS86BIN = 1 / Camera Y Bin
NAXIS87BIN = 1 / Camera Z Bin
NAXIS88BIN = 1 / Camera X Bin
NAXIS89BIN = 1 / Camera Y Bin
NAXIS90BIN = 1 / Camera Z Bin
NAXIS91BIN = 1 / Camera X Bin
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NAXIS127BIN = 1 / Camera X Bin
NAXIS128BIN = 1 / Camera Y Bin
NAXIS129BIN = 1 / Camera Z Bin
NAXIS130BIN = 1 / Camera X Bin
NAXIS131BIN = 1 / Camera Y Bin
NAXIS132BIN = 1 / Camera Z Bin
NAXIS133BIN = 1 / Camera X Bin
NAXIS134BIN = 1 / Camera Y Bin
NAXIS135BIN = 1 / Camera Z Bin
NAXIS136BIN = 1 / Camera X Bin
NAXIS137BIN = 1 / Camera Y Bin
NAXIS138BIN = 1 / Camera Z Bin
NAXIS139BIN = 1 / Camera X Bin
NAXIS140BIN = 1 / Camera Y Bin
NAXIS141BIN = 1 / Camera Z Bin
NAXIS142BIN = 1 / Camera X Bin
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NAXIS148BIN = 1 / Camera X Bin
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NAXIS167BIN = 1 / Camera Y Bin
NAXIS168BIN = 1 / Camera Z Bin
NAXIS169BIN = 1 / Camera X Bin
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NAXIS200BIN = 1 / Camera Y Bin
NAXIS201BIN = 1 / Camera Z Bin
NAXIS202BIN = 1 / Camera X Bin
NAXIS203BIN = 1 / Camera Y Bin
NAXIS204BIN = 1 / Camera Z Bin
NAXIS205BIN = 1 / Camera X Bin
NAXIS206BIN = 1 / Camera Y Bin
NAXIS207BIN = 1 / Camera Z Bin
NAXIS208BIN = 1 / Camera X Bin
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NAXIS211BIN = 1 / Camera X Bin
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## Les images « brutes »

### Traitement



Equinox

ZWO

Vespera

Dwarf

Science  
Voyage

Observation  
Suivi

[www.tfonweb.be](http://www.tfonweb.be) (pour 2025)

ZWO\_Lights\_only\_Preprocessing.ssf

Vespera\_Lights\_only\_Preprocessing.ssf

Unistellar\_Lights&Darks\_only\_Preprocessing.ssf

Dwarf\_Lights\_only\_Preprocessing.ssf



***Ce que l'on ne lit pas  
souvent...***



## Problèmes généraux

### Qualité des APP

Un « mauvais update » et l'ensemble devient inutile (aucun réemploi)  
=> **obsolescence** ? (sur tous les points...)



PAS de « version control » chez aucun !

=> **si problème, totalement bloqué !**



### Récupération d'images

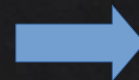
- Les ingénieurs français ferait bien de copier...  
*Les chinois !*
- Un USB totallement fonctionnel, à ce prix de matériel, est **un minimum** !

### Systematiquement

- Plus stable et mieux testées sous iOS
- Meilleures connexions réseau sous iOS
- Comportement différent sous iOS
  
- Fichiers mieux gérés et accessibles sous Android
- Mieux identifiables sous Android
- Solution moins chère sous Android

### Souvent

- « *push to market* »
- ex : Vaonis Hestia
  - : **inexploitable** sous Android « Low cost »
  - : oblige à des smartphones **couteux**...



Emulation sous PC ?

=> Possible, mais pas dans tous les cas/ versions

API ?

=> Que ZWO (non officiel) et Dwarf (faible)



## Fonctions : Bon à savoir

**Pointer la Lune...**

Exige généralement les étoiles... Sauf SeeStar

**Mode de capture...**

SeeStar : le seul qui propose zoom (1,2,4x), photo et video (RAW mode)

**Pointer les planètes...**

Il faut du diamètre... Seul Unistellar s'en sort avec des « détails »

**Photométrie...**

Equinox : réponse assez linéaire... Mais pose courte (signal faible).  
: **mode « science » et calibration préalable** (split RGB)  
: **filtre** « rouge » ou « vert » (Johnson), selon le cas...  
=> *ASTAP, SIRIL, ImageJ* : ok  
=> *HOPS* : en expérimentation...

Vaonis : que avec le PRO (en théorie), et un bon ciel...

SeeStar : ajouter un filtre est complexe... **Mieux vaut découper l'image en plans couleur séparés**, puis évaluer la qualité de la capture.

Dwarf : On pourrait ajouter un filtre format standard...  
Mais la **capture est complexe à gérer**.



## Bugs & Good to Known...

**Vespera** : Exige un **ciel noir**... (même si étoiles visibles, le plus long plate solving de tous)... ***Si l'interrupteur fonctionne et n'a pas vidé la batterie !***

**Equinox** : Une cible à 2° de l'horizon = ***plantage systématique du télescope***...  
Reboot !

**Vespera APP** : « Limite » de sauvetage de 200 MB...  
Même si on dispose 128 GB ! Et la récupération est...  
***D'une lenteur affligeante !***

**DWARF** : La séquence de capture est **tout, sauf intuitive**...  
Bien vérifier avant de laisser « toutner » !

**DWARF** : Exige une « **autorisation** » (après démarrage du télescope et connexion avec l'APP) pour pouvoir accéder la mémoire et transférer...

**Equinox** : ***Ne se charge pas sous 10° !*** Donc, durée de capture réduite au froid !  
(batterie externe, ou pas connectée...)

**Vespera Mosaic** : Un vrai « plus » avec petit capteur (2 Mpix), ***Dubitatif avec plus gros***...  
(puissance CPU => 4x le temps...)

**SeeStar** : Stack performance ne **dépasse pas 70 %**...

**SeeStar** : Suivi parfois surprenant...

**SeeStar** : Sur les objets « **moins connus** », goto rate souvent ! Pas d'entrée avec coordonnées...

**DWARF** : Rien ne fonctionne sans **connexion au télescope**  
(ni même l'accès à l'album personnel !)



***Conclusion***



<b>Matériel + APP</b>	<b>Unistellar EQ1/EQ2</b>	<b>Vaonis Vespera I</b>	<b>Vaonis Vespera Pro</b>	<b>ZWO SeeStar 50</b>	<b>DwarfLab Dwarf II</b>
<b>Adapté PL</b>	Toutes	PL moyenne	PL basse	Toutes	PL Moyenne
<b>Usage</b>	Montrer un objet du ciel en 5 min	Montrer de belles images	Montrer de belles images	Canif suisse	Canif carte crédit
<b>Objets</b>	Tous	Large	Large	Large	Très large
<b>Qualité immédiate</b>	Moyenne	Bonne	Bonne	Bonne	Faible
<b>Qualité Post-Traitement</b>	Bonne	Très Bonne	Bonne	Bonne	Moyenne
<b>Filtres</b>	Préférable	CLS (si PL Haute)	Trop cher	Inclus	Inclus
<b>Accès aux images</b>	PNG, Fits, TIFF	Jpeg,Fits,TIFF	Jpeg,Fits,TIFF	Jpeg, Fits	Jpeg, Fits
<b>Facilité d'accès aux brutes</b>	Long, mais automatique (1)	Back to 90's	Back to 90's	Parfait	Correct
<b>Post-Traitement</b>	Selon le cas	Selon le cas	Selon le cas	Selon le cas	Obligatoire
<b>Fits quality</b>	Bonne	Limitée	Limitée	Bonne	Minimale
<b>Science</b>	Possible	Pas possible	??? (2)	Limité	Difficile

(1) Tant que Unistellar le permet... L'évolution planifiée (APP) => on passe de « long » à « 90's »

(2) Quand un vrai mode « pro » sera disponible, on testera...



## Observation « publique »

- Découverte
- Initiation
- Cours (Solaire / Nuit)



EQ1, EQ2, SeeStar

## Observation « météo ok »

- Météo ok rare...
- PL élevée
- Légèreté
- Événement astro (Nova, etc...)
- Astrophoto plaisir...
- Voyage



EQ2,  
SeeStar,  
Vespera I



## Observation « régulière »

- Petits corps
- Impact lunaires
- Variables
- Visuel / Radio
- Champ large



EQ1, EQ2,  
Dwarf II,  
Vespera Pro,  
SeeStar



# By Plane....

SeeStar & APN



+



+



+



= 9 kg

Bagage à main

NGC2467  
Italy





***Amusez-vous !***

***Merci pour votre  
attention...***