Afocal AstroPhotography using a smartphone.

Afocal imaging uses a camera (or smartphone) attached to a telescope eyepiece

Effective Afocal Focal Length, **EFL = m * CFL** (CFL is Camera FL)

Magnification, **m = TFL / EPFL** (TFL is telescope FL, EPFL is Eyepiece FL)

Example: Skywatcher 150, TFL = 1200mm, f/8, using eyepiece, EPFL = 9mm
m = 1200 / 9 = 133x Add 2X Barlow lens ➔ TFL = 1200 * 2 = 2400mm, m = **267x**

With iPhone 6s, CFL = 4.15mm ➔ afocal EFL = 267*4.15 = **1107mm** , focal ratio: **f/7.4**
(Note, EFL is shorter than TFL because of short CFL even with Barlow.)

For max. exposure for untracked AP, Niko suggests using Frédéric Michaud's NPF Rule at
http://sahavre.fr/wp/regle-npf-rule/

Screenshot of NPF Rule shown on next slide
NPF Rule ➔ max. exposure **0.2 sec.**, more than enough for brighter planets

Using NightCap app in video mode on iPhone for planets

Process planet videos with FREE programs: PIPP, AutoStakkert!3, RegiStax6
then postprocess in Photoshop

NPF RULE

CALCULATE THE EXPOSURE TIME FOR PIN POINT STARS WHEN SHOOTING WITHOUT STAR TRACKING.

© CREATED BY FREDERIC MICHAUD FROM LE HAVRE ASTRONOMICAL SOCIETY.

DSLR data

SENSOR'S SIZE (ignore)

Canon APS-C

SENSOR'S WIDTH (IN PIXELS) (*)

4032

Number of pixels width

PIXEL'S DIMENSION (MM)

Approximate dimension in micrometers. If you know the exact value, enter it manually.

1.22 µm

Lens data

FOCAL LENGTH (MM) (*)

1107

APERTURE (*)

7.4

Accuracy and declination

FORMULA ACCURACY (K)

Pin point stars

DECLINATION (Δ °)

0

Declination of the object you frame. If you don't know it, keep 0 °.

Results

FULL NPF

0.2 s

t = k * (16.856 * N + 0.0997 * f + 13.713 * p) / (f * cos (δ))

4-CROP RULE

4-Crop not accurate for CF>2
CF of iPhones = 7.21,
which gives NEGATIVE time!

0.2 s

t = 100 * (4-crop) / f

SIMPLIFIED NPF

0.3 s

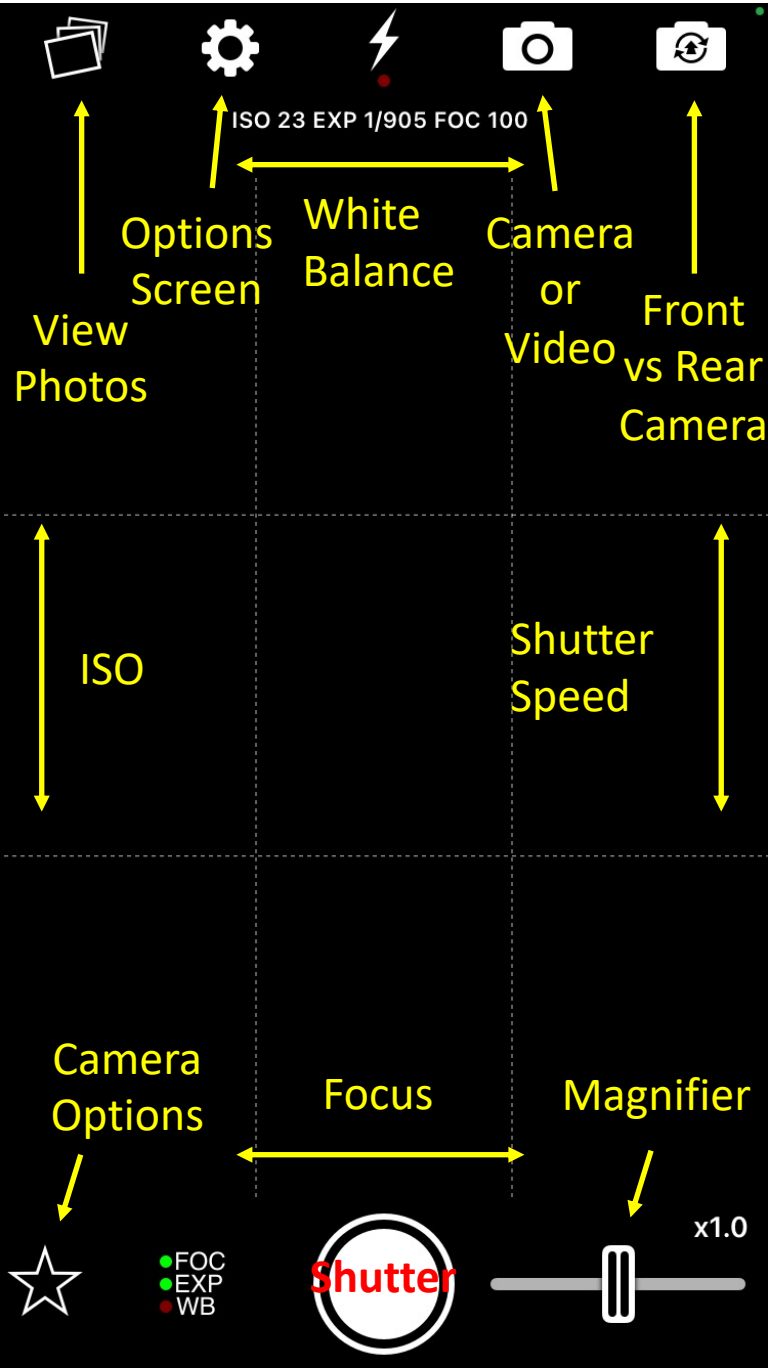
t = (35 * N + 30 * p) / f

RULE OF 500 (FOR INFO ONLY)

0.3 s 0.06 s Also inaccurate for CF>2

t = 500 / (crop * f) - Fails with most modern DSLR and

NightCap app Controls



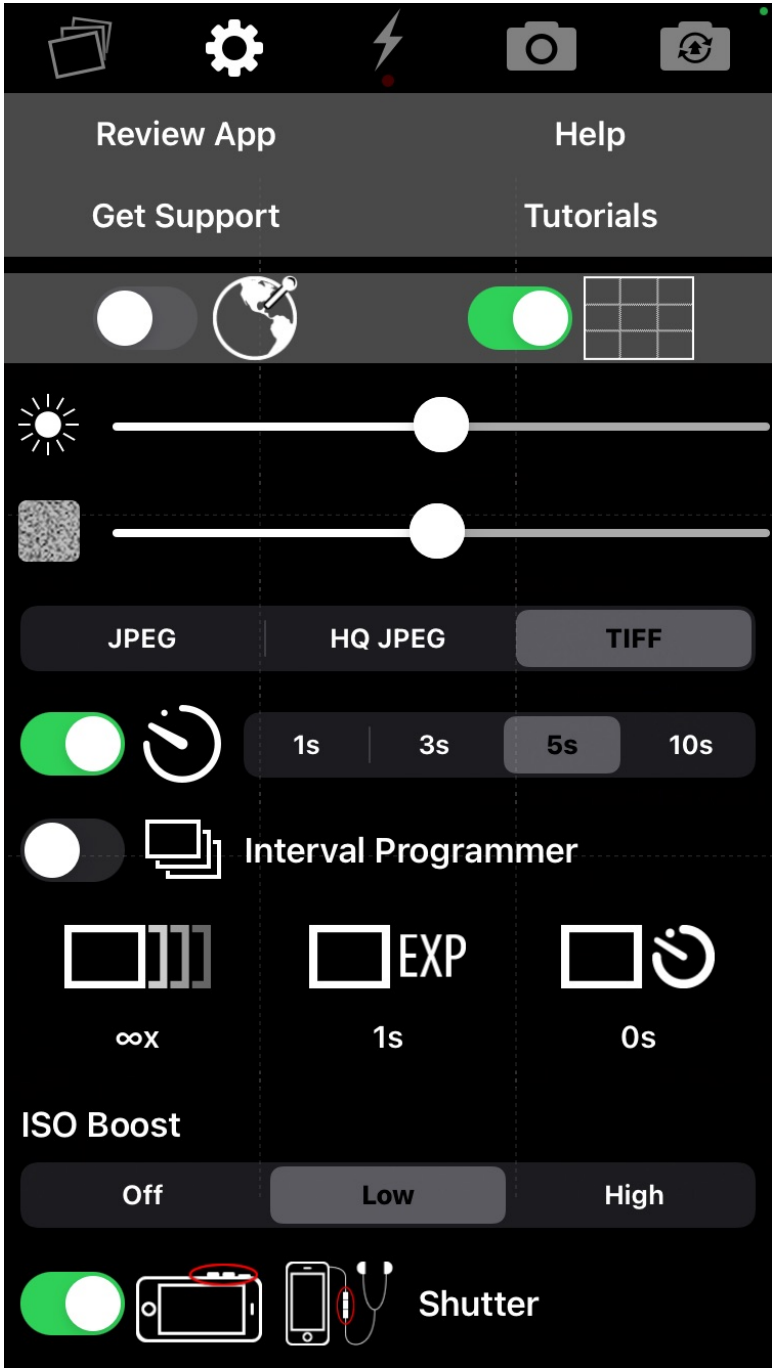
Light Boost →

Noise Red. →

Delay →

Interval: Repeat Photo, Averaging Time, Delay Between →

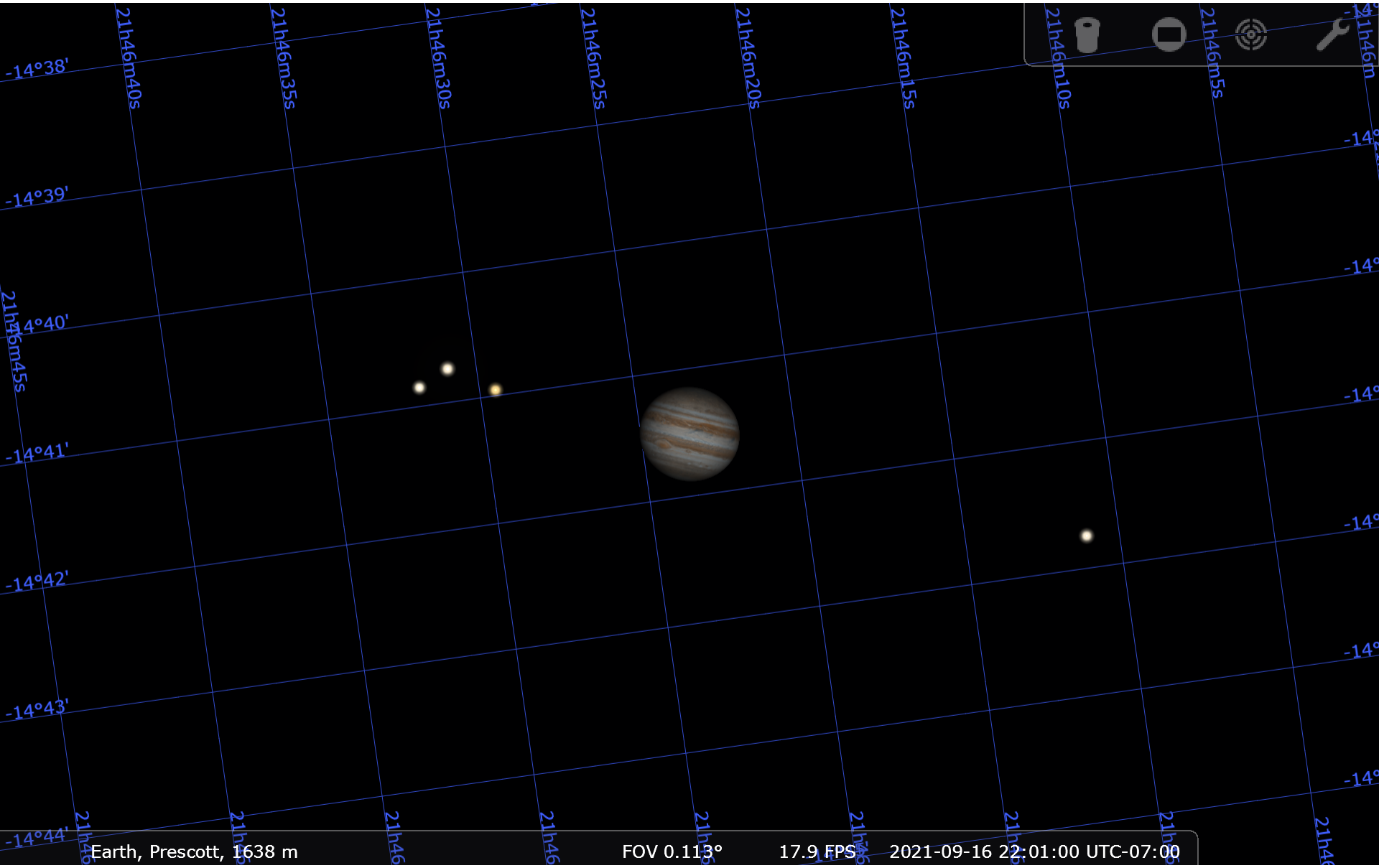
Volume or BT Shutter →



Jupiter @266x 9-16-21
ISO 400 1/250s
1107mm FL 37s video
Stellarium confirmed
Ganymede not in line
w/other moons

Saturn @266x 9-16-21
ISO1600 1/400s
1107mm FL 40s video

Stellarium Screenshot (not reversed)



Deep-Sky Afocal Examples
(not video)

M42 2-14-21, ISO3200
1/10s (1s), 38x, 158mm FL
NightCap averaging mode
FL = 158mm (cropped)
5*10 frames stacked
Slightly egg-shaped stars
fixed in Photoshop

Question: Would video help with these?
How would PIPP work with non-planet?

Dbl Cluster 2-14-21, ISO3200
1/10s (1s), 38x, 158mm FL
NightCap averaging mode
NightCap averaging mode
FL = 158mm (cropped)
3*3 frames stacked
Slightly egg-shaped stars
fixed in Photoshop

For More Information

Request copy of presentation: fredoswald@gmail.com

Cloudy Nights Forums: https://www.cloudynights.com/index/

Smartphone Astrophotography Discussion (~1750 messages)

https://www.cloudynights.com/topic/549926-smartphone-astrophotography/

NightCap “Tutorial”:

https://www.cloudynights.com/topic/693694-nightcap-long-exposure-mode-for-iphone/?p=10874177

Tutorial for Planetary Video: “How to image Jupiter: Using PIPP, Autostakkert, Registax and GIMP” https://www.youtube.com/watch?v=FQagPJ8pM7Y I’ve found that his settings work very well for Jupiter. (I used Photoshop instead of GIMP.)