

# ASTROPHOTOGRAPHY & STAR TRAILS

*An Introduction to Shooting the Night Sky*

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# BEGINNER ASTROPHOTOGRAPHY

- Required Equipment
- Preparing for a Night Shoot
  - Camera Settings
- How to Focus & Frame
  - Exposure Settings
- Evaluating Your Images

# Required Equipment

1. **Camera** that can be put in full manual mode:
  - DSLR
  - Mirrorless
2. **Lens** that can be focused manually:
  - 12-24mm
  - f/4 or below
3. **Tripod w. Head**
  - Mobility matters, stability matters more
  - Any head will work
4. **Headlamp**:
  - Red light option

- Strong, small **flashlight**

Recommended (Optional):

- Electrical **tape**

- **Remote shutter/cable release**

# Preparing for a Night Shoot

1. **Familiarize** yourself with your equipment:
  - Tripod
  - Headlamp
  - Camera buttons
2. **Fully Charge** multiple batteries for all components
3. **Packing:**
  - Single bag (if possible)
  - Take everything with you (even in your backyard)
4. **Date/Location Specifics:**
  - Moon Phase & Rise/Set
  - Cloud Cover
  - Temperature
  - Bugs
  - Location Access



# Camera Settings (Non-Exposure)

1. Camera and Lens in FULL MANUAL
2. File Type: - Must shoot RAW, not JPEG
3. White Balance: - AUTO is fine, will adjust in post-processing  
- Can also use Custom or K, as you wish
4. Drive Mode: - If shooting by hand, select "2-sec"  
- If using remote, select appropriate drive mode
5. Image Stabilization/VR Turned ON: - Could be body or lens
6. Long Exposure Noise Reduction Turned OFF

# Focusing w. LCD Screen at Night

1. **Set Up & Turn On** all equipment:
  - Balance/secure tripod
  - Set camera/lens to manual
  - Attach components
2. **Set ISO and Aperture** for Rough Focus:
  - ISO 3200/6400
  - Lowest f-stop
3. **Set Focus Distance on Lens:**
  - Set just before infinity symbol
4. **Use LCD Screen to Find a Star:**
  - Use digital zoom (5x)
  - Center the star
  - Max digital zoom (10x)

*\*You can use a star that is not in your intended frame\**

5. **Manually Focus the Star:**
  - Star should be small and sharp
  - Secure focus ring with tape!



# Framing at Night

1. Use Light on Foreground Object:
  - Flashlight or headlamp
  - Light marker/phone
  - Trial and error if no light
2. Use LCD Screen to Frame Stars:
  - ISO 3200/6400
  - Lowest f-stop
  - Use bright stars as markers
3. Level the Horizon: - Use the electronic level in your camera
4. Leave Room in Frame to Crop/Straighten in Post-Processing

*If you have CHANGED your FOCAL DISTANCE, you MUST REFOCUS!*

# Camera Settings (Exposure)

*EXPOSURE SETTINGS ARE ALWAYS SITUATION DEPENDENT!*

1. **Aperture:**
  - Start with lowest possible f-stop (wide open)
  - If conditions allow, could stop down 1x or 2x
2. **ISO:**
  - Lowest possible ISO to achieve usable image
  - Usually 800-3200, depends on equipment/conditions
3. **Exposure Length:**
  - Shortest possible to achieve usable image
  - Can vary based on cardinal direction
  - Use “300 Rule” as a VERY GENERAL guide



# “300 RULE”

Equation to Determine VERY GENERAL Exposure Length for Pinpoint Stars (No Trailing)

$$300 \setminus * \text{equivalent focal length of your lens} \\ = \\ \text{Recommended Exposure Length}$$

\* (Focal length of lens) x (crop factor of camera/sensor)

# “300 RULE”

## Example Using 16mm Lens

### Full Frame Cameras

(Crop Factor = 1x)

$$300/16\text{mm} = 18 \text{ secs}$$

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### Cropped Sensor Cameras

(Crop Factor = 1.5x, 1.6x, 2x)

Nikon (1.5x):  $300/24\text{mm} = 12 \text{ secs}$

Canon (1.6x):  $300/25\text{mm} = 12 \text{ secs}$

Sony (2x):  $300/32\text{mm} = 9 \text{ secs}$



# Evaluating/Checking Your Images

1. Don't Judge Image on LCD Screen!:
  - JPEG image & small
  - Mostly in dark/left third
2. Histogram, Histogram, HISTOGRAM:
  - Clipping can be present
  - Do not over expose stars
3. Check Stars & Horizon w. Digital Zoom:
  - If not level, will straightening cut off composition?
  - Look for oblong stars or star trails
  - Inspect the WHOLE sky, not just one corner

# INTERMEDIATE ASTROPHOTOGRAPHY

## *(Star Trails)*

- Required Equipment
- Framing (Cardinal Direction)
  - Camera Settings
- Equipment/Exposure Settings
- Suggestions for Post-Processing

# Required Equipment

1. **Camera** that can be put in full manual mode:
  - DSLR
  - Mirrorless
2. **Lens** that can be focused manually:
  - 12-24mm
  - f/4 or below
3. **Tripod**:
  - Mobility matters
  - Stability matters more
4. **Headlamp**:
  - Red light option
5. **Intervalometer**:
  - Sometimes in camera, usually an accessory

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Recommended (Optional):

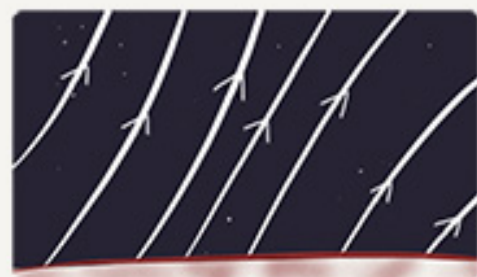
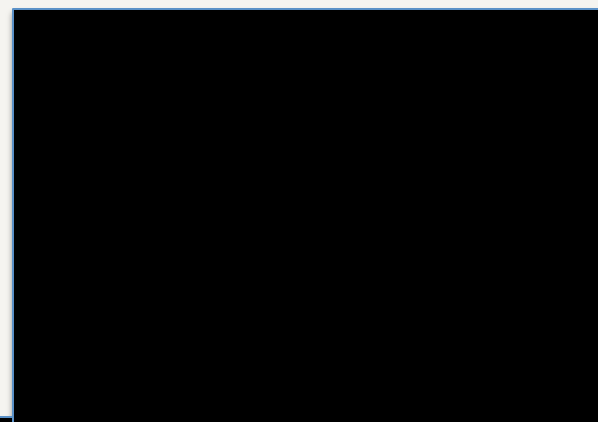
- Strong, small **flashlight**
- Electrical **tape**

# Star Trails - Northern Hemisphere

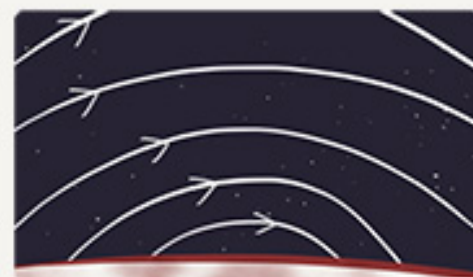
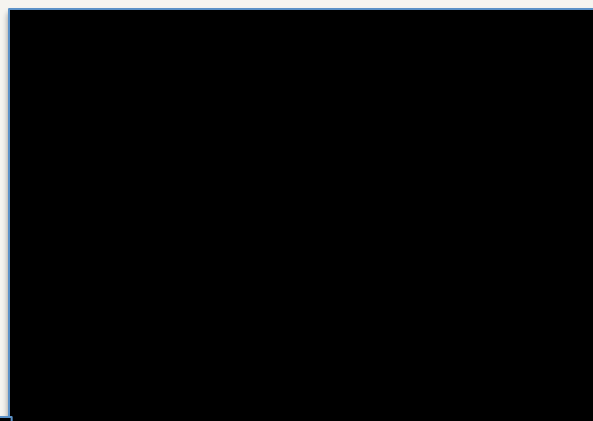
Depending on the direction you're aiming your camera, you'll get all these different star trails patterns.



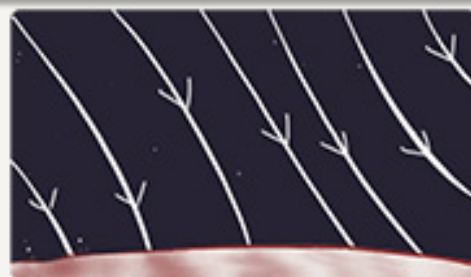
North



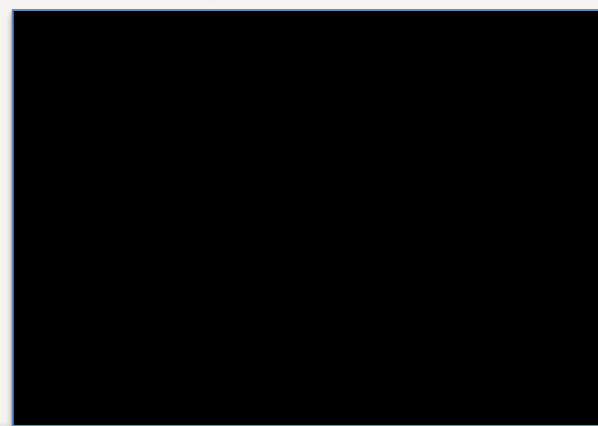
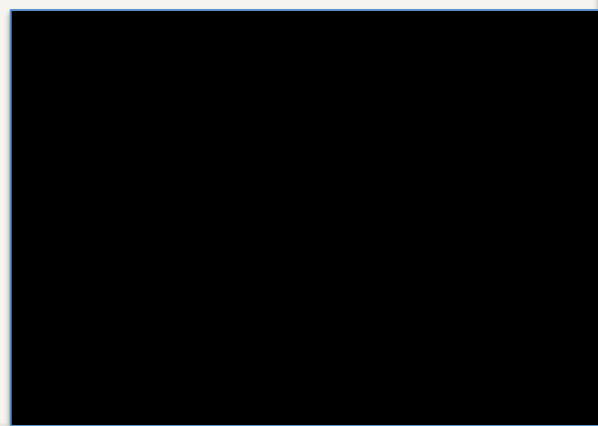
East



South



West







# Framing/Planning Star Trails

1. **Choose Star Trail Effect:**
  - Circular vs. Curved
  - Cardinal direction determines effect
2. **Moon Phase:**
  - You CAN shoot during full moon!
  - Beware if moon will enter your frame
3. **Foreground Objects:**
  - More effective, but more challenging
  - Use silhouetted object when starting
4. **Weather:** - Need fully clear skies, no clouds
5. **Time Needed:** - Plan on 1-2 hours of shooting time
6. **Batteries:** - Fully charged battery/ies or battery grip
7. **The Cocktail You Plan to Enjoy While Your Camera is Working!**

# Camera Settings (Non-Exposure)

1. Lens in FULL MANUAL, Camera in MANUAL or BULB

2. File Type: - RAW is best, but JPEG will be used for final image

3. White Balance: - AUTO is fine, can adjust in post-processing  
- Can also use Custom or K, as you wish

4. Drive Mode: - Select appropriate drive mode for remote or built-in intervalometer

5. Image Stabilization Turned ON: - Could be in body or on lens

6. Long Exposure Noise Reduction Turned OFF

# Equipment/Exposure Settings

EXPOSURE SETTINGS ARE ALWAYS SITUATION DEPENDENT!

1. **Aperture:**
  - Start with lowest possible f-stop (wide open)
  - If conditions allow, could stop down 1x or 2x
  
2. **ISO:**
  - Lowest possible ISO to achieve usable image
  - Usually 800-1600, depends on equipment/conditions
  
3. **Exposure Length:**
  - Do you want to use individual frames?
    - \* If **yes**, determine max exposure length & adjust other settings to taste
    - \* If **no**, I suggest 30-60sec exposures
  - No limits since star trails are what we want!

# Equipment/Exposure Settings (cont.)

- Do you want to use individual frames?

## 3. Exposure Length:

- \* If **yes**, determine max exposure length and adjust other settings to taste
- \* If **no**, I suggest 30-60sec exposures

- No limits since star trails are what we want!

- Exposure Length (30s or 60s)

- Number of Exposures (1hr/2hr/3hr)

- \* **30s**: 120/240/360

- \* **60s**: 60/120/180

## 4. Intervalometer Settings:

- Interval between exposures

- \* Shortest possible time to record image on card and shoot next image: **2-5 secs (?)**

# Star Trail Exposure/Equipment Settings

ISO: 1600

Aperture: f/4 - f/5.6

Exposure Length: 30sec or 60sec

Number of Exposures: 120 - 360

Interval: 3 - 5secs



# Post Processing

## 1. Download/Install StarStaX (FREE):

- <https://markus-enzweiler.de/software/starstax/>
- Windows or Mac

## 2. Edit/Export Your Images:

- If RAW, edit (ALL) and export as JPEG
- If JPEG, edit (ALL) and save

## 3. Use StarStaX to Build Image:

- Import JPEGS
- Choose blending mode (Gap Filling)
- Press “Start Processing”
- Watch the build (w. cocktail)

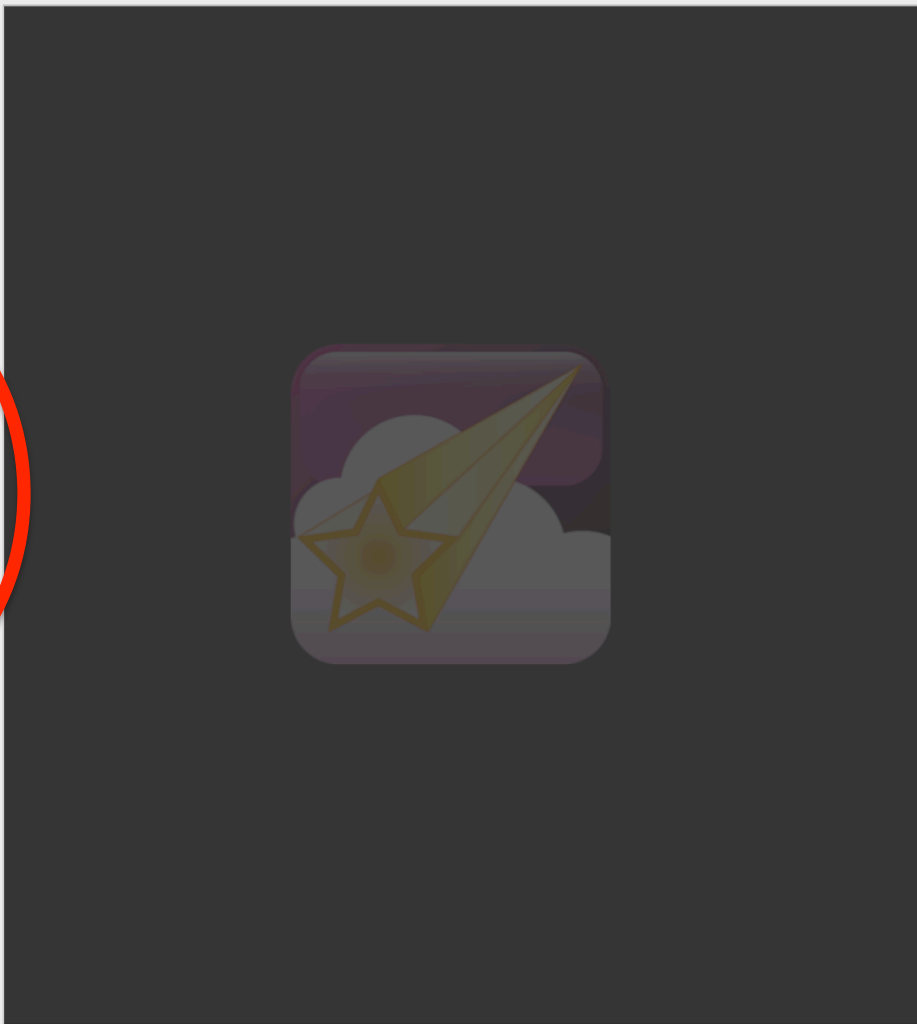
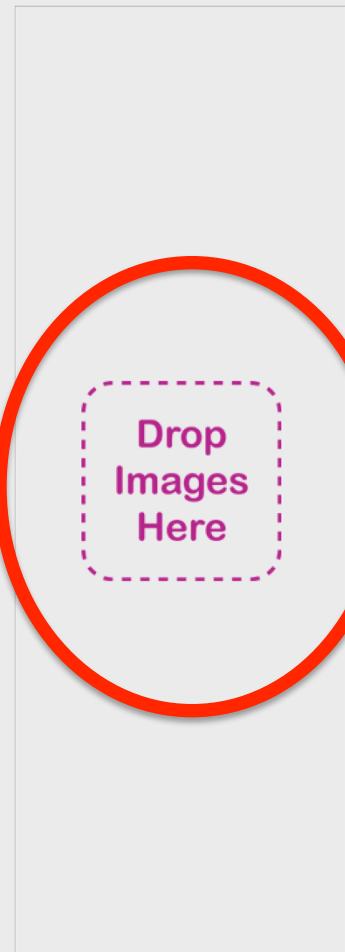
Tutorial

<https://youtube.com/watch?v=ETk0RdgILJI>



# StarStaX

[Download and Installation](#)



Preferences

- Blending
- Images
- General

Blending Mode

Gap Filling

Comet Mode

Process images in reverse order

Dark Images

Subtract Dark Images

Cumulative Image Saving

Save after each step









# Other Media

- Short video of star trails forming

## 1. Star Trail "Build":

- Select "Cumulative Image Saving" in StarStax

- Use these images to build short time lapse



# Other Media

1. **Star Trail “Build”:**
  - Short video of star trails forming
  - Select “Cumulative Image Saving” in StarStax
  - Use these images to build short time lapse
  
2. **Time Lapse:**
  - Use Photoshop to make Time Lapse
  - File > Open – Select FIRST JPEG of star trail images
    - Check “Image Sequence”
    - Click “Open”
    - Select 15 or 24 FPS (frames per sec)
  - Window > Timeline (brings up timeline view)
    - Spacebar to preview time lapse
  - File > Export > Render Video

Sossus Cabin

- Open Sky
- AP Equipment
- Creative Clou...
- Devices
  - Temujin's Ma...
  - Macintosh HD
  - Remote Disc
  - 4TB TKN...
- Media
  - Music
  - Photos
  - Movies
- Tags

Sossus Cabin Star Trails - 1.jpg  
Sossus Cabin Star Trails - 2.jpg  
Sossus Cabin Star Trails - 3.jpg  
Sossus Cabin Star Trails - 4.jpg  
Sossus Cabin Star Trails - 5.jpg  
Sossus Cabin Star Trails - 6.jpg  
Sossus Cabin Star Trails - 7.jpg  
Sossus Cabin Star Trails - 8.jpg  
Sossus Cabin Star Trails - 9.jpg  
Sossus Cabin Star Trails - 10.jpg  
Sossus Cabin Star Trails - 11.jpg  
Sossus Cabin Star Trails - 12.jpg  
Sossus Cabin Star Trails - 13.jpg  
Sossus Cabin Star Trails - 14.jpg  
Sossus Cabin Star Trails - 15.jpg  
Sossus Cabin Star Trails - 16.jpg

Open cloud documents Enable: All Readable Documents  
Format: JPEG  
 Image Sequence

Options Cancel Open

Histogram

Adjustments

Add an adjustment layer

Layers

Kind

Normal

Lock

Eye icons for layers

## Frame Rate

Frame Rate:

24



24

fps

OK


Cancel



Mode: Normal Type: Content-Aware Create Texture Proximity Match

Red Yellow Blue Green Combo.tif @ 31.4% x Inverted SHO 1 Starless.tif @ 31.4% (Lay...

200 0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600



33.33% 5760 px x 3840 px (72 ppi)

Timeline

04f 08f 12f 16f 20f

Video Group 1

Audio Track

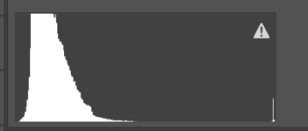
0:00:00:00 (24.00 fps)

- Arrange
- Workspace
- Find Extensions on Exchange...
- Extensions
- 3D
- Actions F9
- ✓ Adjustments F5
- Brush Settings
- Brushes
- Channels
- Character
- Character Styles
- Clone Source
- Color F6
- Glyphs
- Gradients
- ✓ Histogram
- History
- Info F8
- Layer Comps F7
- ✓ Layers
- Learn
- Libraries
- Measurement Log
- Navigator
- Notes
- Paragraph
- Paragraph Styles
- Paths
- Patterns
- Properties
- Shapes
- Swatches
- ✓ Timeline
- Tool Presets
- Application Frame
- Options
- Tools
- Red Yellow Blue Green Combo.tif
- Inverted SHO 1 Starless.tif
- Light orange Pink.tif

Untitled-8 @ 33.3% (Layer 1, RGB/8\*)

00 4600 4800 5000 5200 5400 5600 5800 6000

Histogram Navigator



Adjustments Libraries

Add an adjustment

Layers Channels Paths

Kind

Normal Opacity: 100%

Lock: Fill: 100%

Video Group 1

Layer 1

fx

- New... ⌘N
- Open... ⌘O
- Browse in Bridge... ⇧⌘O
- Open as Smart Object...
- Open Recent
- Close ⌘W
- Close All ⇧⌘W
- Close Others ⇧⌘P
- Close and Go to Bridge... ⇧⌘W
- Save ⌘S
- Save As... ⇧⌘S
- Revert F12
- Export**
- Generate
- Share...
- Share on Behance...
- Search Adobe Stock...
- Place Embedded...
- Place Linked...
- Package...
- Automate
- Scripts
- Import
- File Info... ⇧⌘I
- Print... ⌘P
- Print One Copy ⇧⌘P

- Quick Export as PNG
- Export As... ⇧⌘W
- Export Preferences...
- Save for Web (Legacy)... ⇧⌘S
- Artboards to Files...
- Artboards to PDF...
- Export For Aero...
- Layer Comps to Files...
- Layer Comps to PDF...
- Layers to Files...
- Color Lookup Tables...
- Paths to Illustrator...
- Render Video...**
- Zoomify...

