Night Sky Photography

A Brief Introduction

Dave McCaskill

April 13, 2026

Introductions: Dave McCaskill

- Research scientist (PhD in biochemistry)
  - Retired in 2020 after 21 years with Dow AgroSciences in Indianapolis
  - Currently living in Greenwood, IN with my wife and dog
- Spending retirement pursuing native plant restoration projects and fine art photography
  - I started exploring night photography in early 2023.
- Feel free to interrupt with questions as I go along

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What will I cover?

- Planning
  - Software tools to help plan
  - Locations and time for shooting
  - Camera equipment
  - Software tools for editing photos
- Wide angle nightscapes
  - Milky Way
  - The Moon
  - Time lapse videos
  - Star Trails

What will I not cover?

- Deep space imaging (galaxies, nebulae, planets etc)
  - The software and equipment are too different and specialized
- Comets and the Aurora borealis
  - They're too uncommon (comets) or unpredictable (Aurora)
  - I don't have much experience with them

Why do I love photographing the night sky?

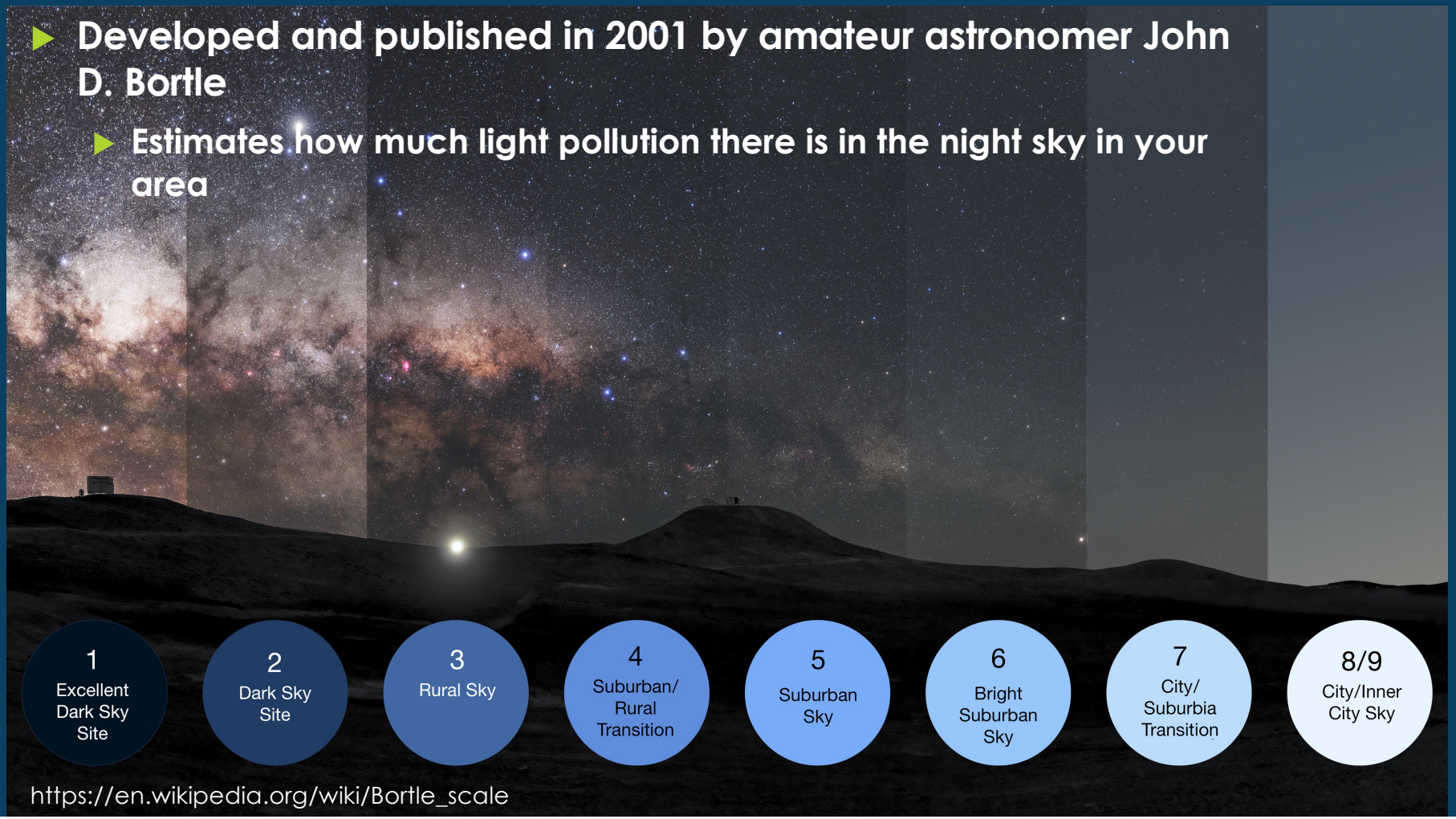
- A third of people have never seen the Milky Way because of light pollution (2016)
  - https://www.aaas.org/news/one-third-people-cannot-see-milky-way
- 80% of Americans can't see the Milky Way from where they live (2016)
  - https://www.nationalgeographic.com/science/article/milky-way-space-science
- Living in "civilization", we're losing our connection with the natural world
  - Nighttime takes up half of our time on Earth

Light pollution affects night sky viewing

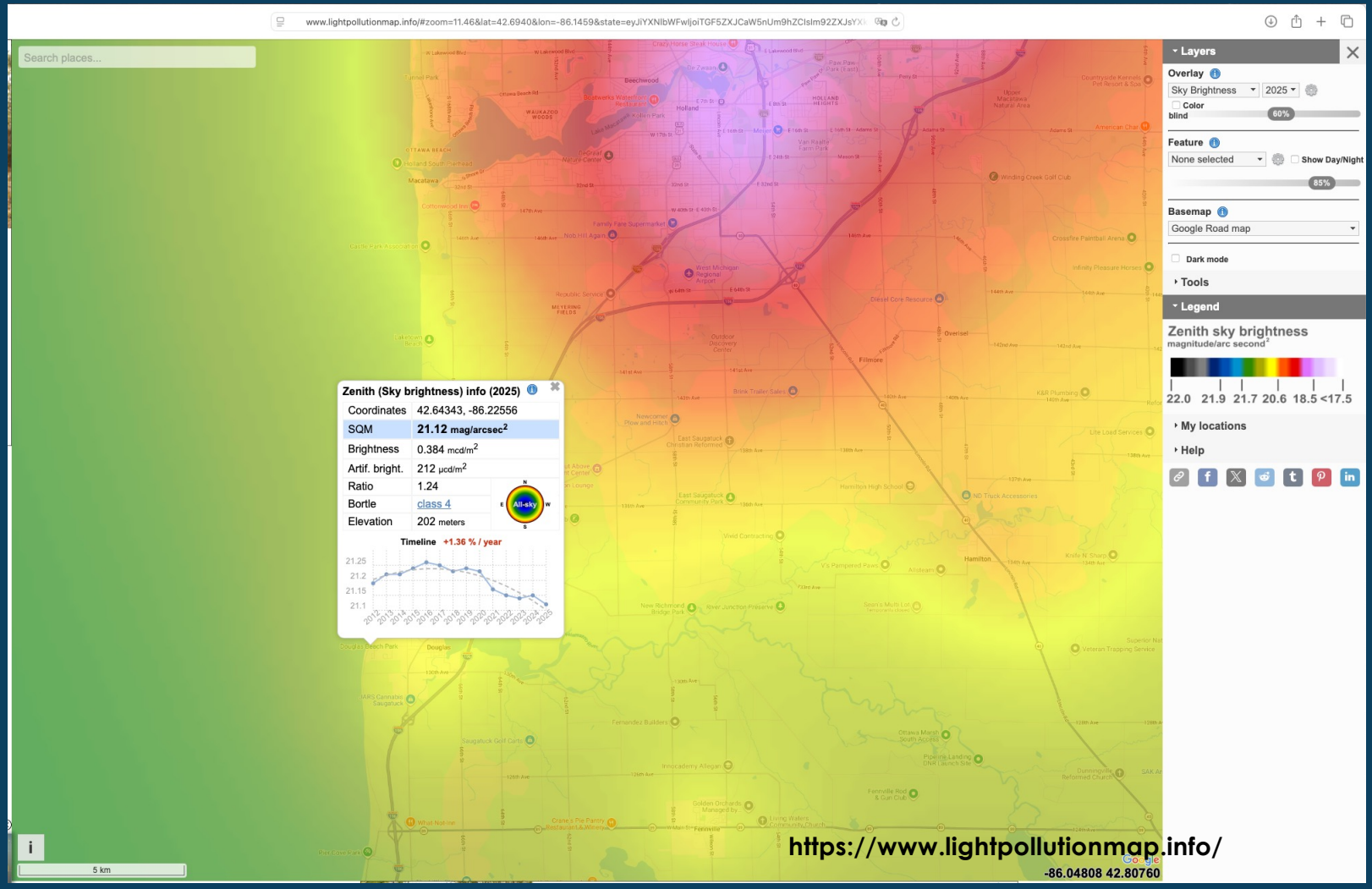
- What are the major sources of light pollution?
  - Poorly designed artificial lighting that shines to the side and upward
- Online resources can give you an idea of how dark the sky is in your area

The Bortle Scale measures how dark the sky is

- Developed and published in 2001 by amateur astronomer John D. Bortle
  - Estimates how much light pollution there is in the night sky in your area



Douglas, MI – Bortle 4



Cameras are much more sensitive than the human eye at night

- Cameras "see" better in the dark than human eyes
  - Cameras see RGB colors equally well in the dark
  - Human vision in the dark is limited to B&W
- Camera lenses let in more light than human eyes
- Cameras collect data over extended periods of time to average a single image
- Photographs can be post-processed

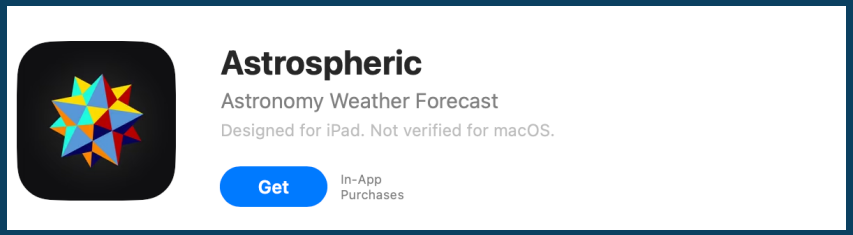
What equipment do I need?

- A camera:
  - Preferably shoot RAW images (or TIFF) instead of jpeg
  - A shutter delay (or remote) to minimize camera shake from pressing the shutter
- A stable tripod (or prop your camera on a log or other stable surface)
- Most current phones have a “night mode” that can give long exposures with image stabilization

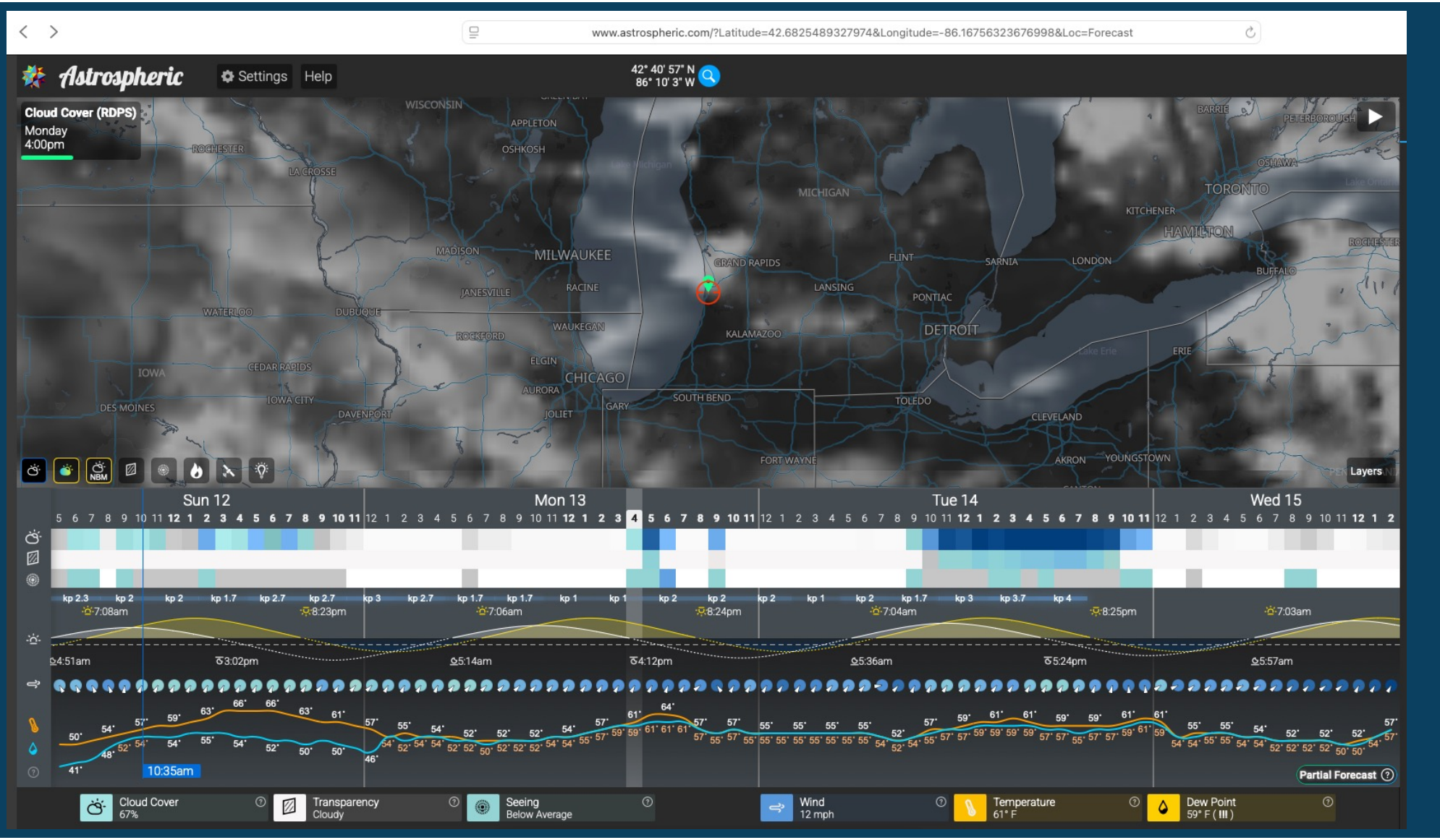
Tips on how to get started

- Plan ahead
  - Location and time
  - Scope out your location in daylight
- Take extra batteries and make sure they're fully charged
- Familiarize yourself with using your camera controls in the dark
- Let someone know where you are and when you plan to be back

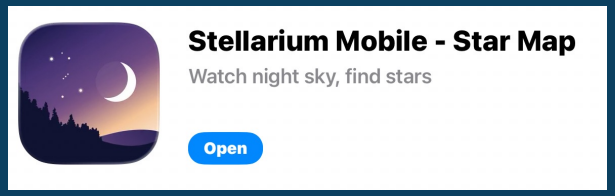
Dark skies are good, but they also need to be clear



- Astrospheric is my go-to app
  - https://www.astrospheric.com/
- Clear Outside
  - https://clearoutside.com/forecast/
- Clear Dark Sky
  - https://www.cleardarksky.com/

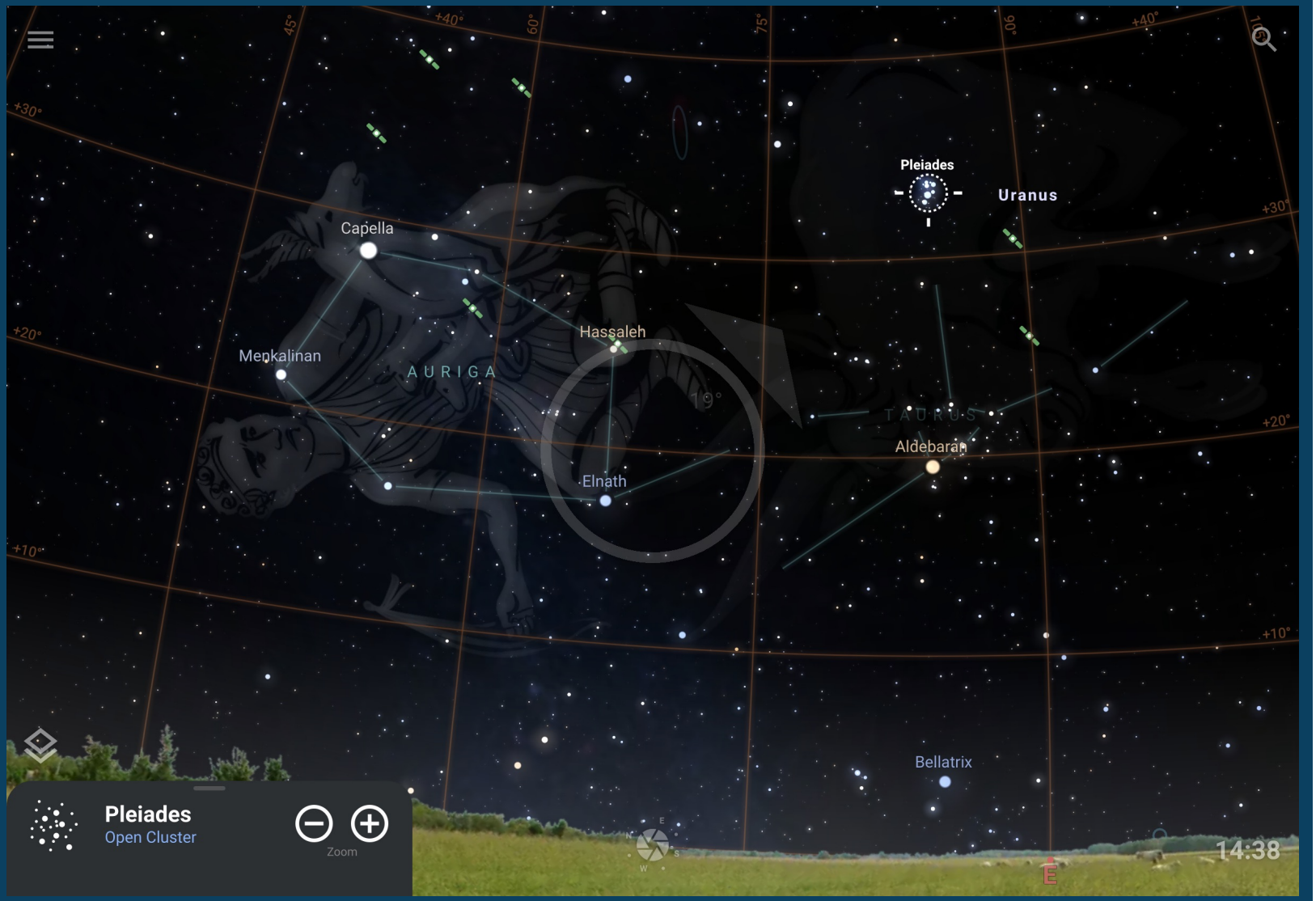

www.astrospheric.com/?Latitude=42.6825489327974&Longitude=-86.16756323676998&Loc=Forecast
Astrospheric
Settings
Help
42° 40' 57" N
86° 10' 3" W
Cloud Cover (RDPS)
Monday
4:00pm
WISCONSIN
APPLETON
OSHKOSH
ROCHESTER
LA CROSSE
MILWAUKEE
MADISON
JANESVILLE
RACINE
WATERLOO
DUBUQUE
ROCKFORD
WAUKEGAN
ELGIN
CHICAGO
AURORA
IOWA
CEDAR RAPIDS
DES MOINES
IOWA CITY
DAVENPORT
JOLIET
GARY
SOUTH BEND
FORT WAYNE
MICHIGAN
GRAND RAPIDS
FLINT
LANSING
PONTIAC
DETROIT
KALAMAZOO
SARNIA
LONDON
TORONTO
KITCHENER
HAMILTON
BARRIE
PETERBOROUGH
OSHAWA
BUFFALO
ERIE
TOLEDO
CLEVELAND
AKRON
YOUNGSTOWN
Layers
Sun 12
Mon 13
Tue 14
Wed 15
kp 2.3 kp 2 kp 2 kp 1.7 kp 2.7 kp 2.7 kp 3 kp 2.7 kp 1.7 kp 1.7 kp 1 kp 1 kp 2 kp 2 kp 2 kp 1 kp 2 kp 1.7 kp 3 kp 3.7 kp 4
7:08am
8:23pm
7:06am
8:24pm
7:04am
8:25pm
7:03am
4:51am
3:02pm
5:14am
4:12pm
5:36am
5:24pm
5:57am
10:35am
Partial Forecast
Cloud Cover
67%
Transparency
Cloudy
Seeing
Below Average
Wind
12 mph
Temperature
61° F
Dew Point
59° F (III)

Planetarium software in your hand

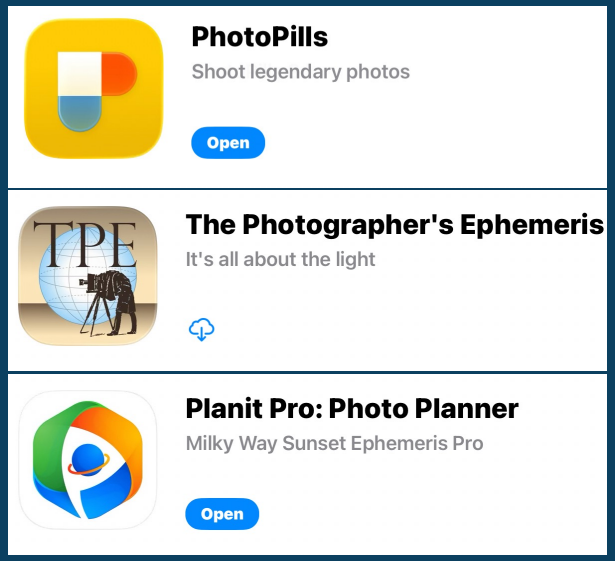


- Stellarium
- Answers the question
  - *"What the heck am I looking at??"*
- Uses your phone's camera and GPS to give an Augmented Reality (AR) view of the night sky

Stellarium

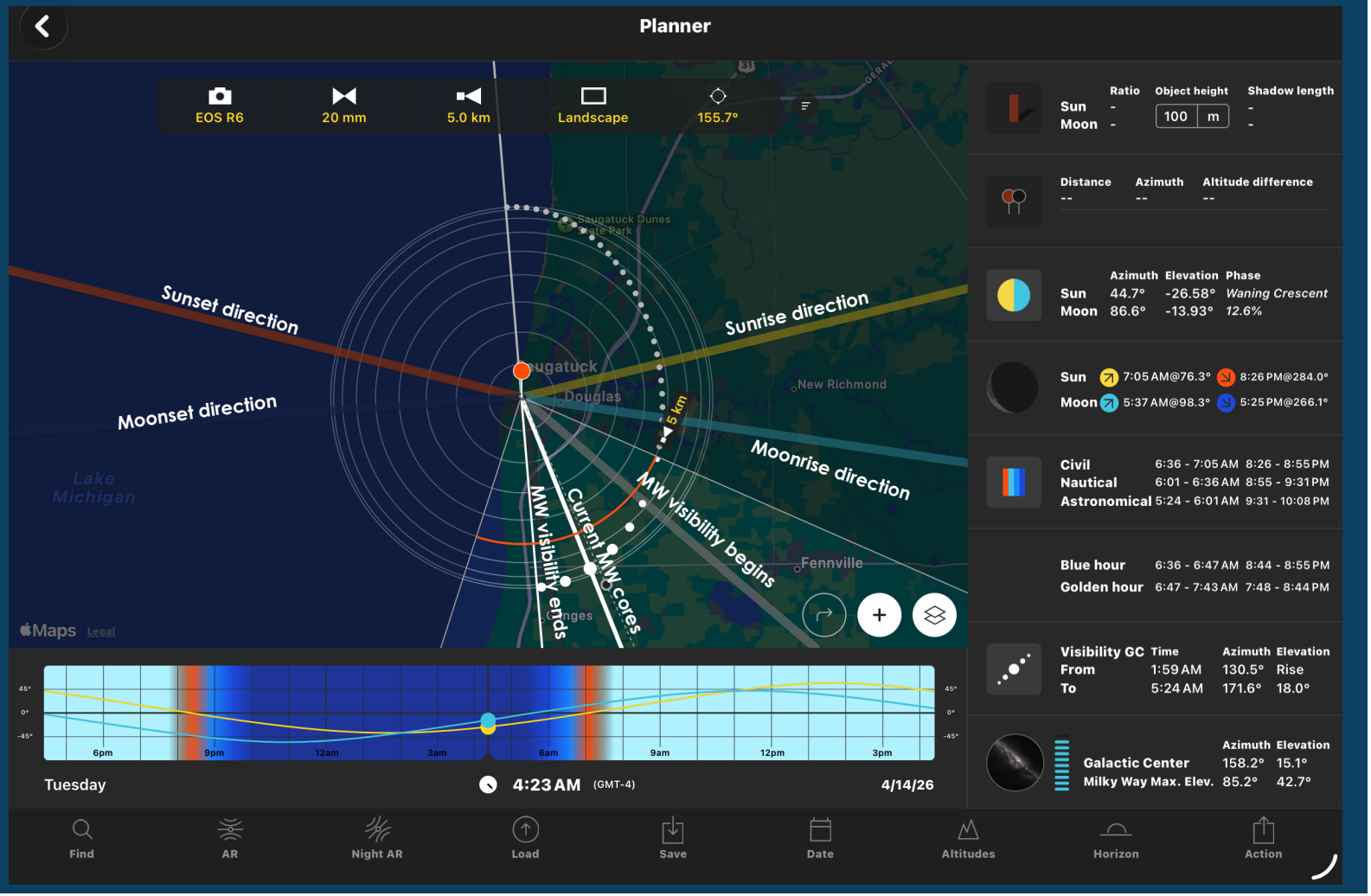

Pleiades
Uranus
Capella
Hassaleh
Menkalinan
AURIGA
TAURUS
Aldebaran
Elnath
Bellatrix
+40°
+30°
+20°
+10°
45°
60°
75°
90°
19°
Pleiades
Open Cluster
Zoom
14:38

Software tools to help plan your shoot



- Predict:
  - Sunrise, sunset
  - Milky Way visibility
  - Any time, any location, anywhere on Earth
- AR views of the night sky with emphasis on MW

PhotoPills (iPad) for Douglas, MI on 04/14/26 @ 4:23 am



Photographing the moon

- The full moon is bright
- Images of a partial moon show better shadows and more definition in the craters than a full moon

- The full moon appears much larger when it is close to the horizon
  - Nearby objects in the foreground trick our eyes into thinking the moon is larger than when it's high in the sky (it isn't)

- *Personal opinion:*
  - Images of the full moon are more compelling with an interesting landscape in the foreground

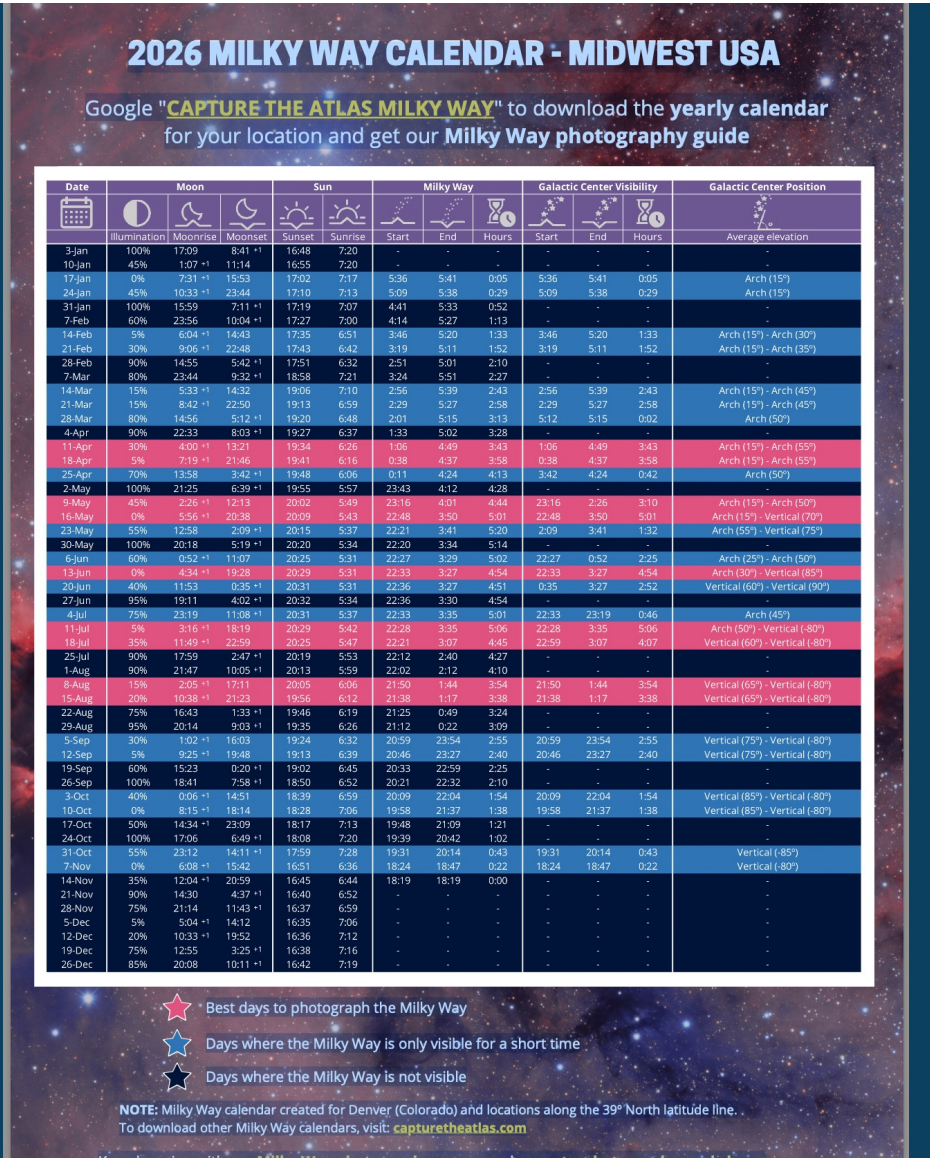
Look for an interesting foreground

Photographing the full moon – get creative

The moon is the 2nd brightest object in the sky

Tips for Milky Way shooting

- Plan ahead (location, time, foreground)
- Capture the Atlas
  - https://capturetheatlas.com/photography/photography-guides/
  - My go-to guide before checking PhotoPills
  - Annual calendars published (free) giving an overview of MW viewing for different latitudes
- "Milky Way season" is from approx. early April through early Sept



Date	Moon			Sun		Milky Way			Galactic Center Visibility			Galactic Center Position
	Illumination	Moonrise	Moonset	Sunset	Sunrise	Start	End	Hours	Start	End	Hours	Average elevation
3-Jan	100%	17:09	8:41 +1	16:48	7:20	-	-	-	-	-	-	-
10-Jan	45%	1:07 +1	11:14	16:55	7:20	-	-	-	-	-	-	-
17-Jan	0%	7:31 +1	15:53	17:02	7:17	5:36	5:41	0:05	5:36	5:41	0:05	Arch (15°)
24-Jan	45%	10:33 +1	23:44	17:10	7:13	5:09	5:38	0:29	5:09	5:38	0:29	Arch (15°)
31-Jan	100%	15:59	7:11 +1	17:19	7:07	4:41	5:33	0:52	-	-	-	-
7-Feb	60%	23:56	10:04 +1	17:27	7:00	4:14	5:27	1:13	-	-	-	-
14-Feb	5%	6:04 +1	14:43	17:35	6:51	3:46	5:20	1:33	3:46	5:20	1:33	Arch (15°) - Arch (30°)
21-Feb	30%	9:06 +1	22:48	17:43	6:42	3:19	5:11	1:52	3:19	5:11	1:52	Arch (15°) - Arch (35°)
28-Feb	90%	14:55	5:42 +1	17:51	6:32	2:51	5:01	2:10	-	-	-	-
7-Mar	80%	23:44	9:32 +1	18:58	7:21	3:24	5:51	2:27	-	-	-	-
14-Mar	15%	5:33 +1	14:32	19:06	7:10	2:56	5:39	2:43	2:56	5:39	2:43	Arch (15°) - Arch (45°)
21-Mar	15%	8:42 +1	22:50	19:13	6:59	2:29	5:27	2:58	2:29	5:27	2:58	Arch (15°) - Arch (45°)
28-Mar	80%	14:56	5:12 +1	19:20	6:48	2:01	5:15	3:13	5:12	5:15	0:02	Arch (50°)
4-Apr	90%	22:33	8:03 +1	19:27	6:37	1:33	5:02	3:28	-	-	-	-
11-Apr	30%	4:00 +1	13:21	19:34	6:26	1:06	4:49	3:43	1:06	4:49	3:43	Arch (15°) - Arch (55°)
18-Apr	5%	7:19 +1	21:46	19:41	6:16	0:38	4:37	3:58	0:38	4:37	3:58	Arch (15°) - Arch (55°)
25-Apr	70%	13:58	3:42 +1	19:48	6:06	0:11	4:24	4:13	3:42	4:24	0:42	Arch (50°)
2-May	100%	21:25	6:39 +1	19:55	5:57	23:43	4:12	4:28	-	-	-	-
9-May	45%	2:26 +1	12:13	20:02	5:49	23:16	4:01	4:44	23:16	2:26	3:10	Arch (15°) - Arch (50°)
16-May	0%	5:56 +1	20:38	20:09	5:43	22:48	3:50	5:01	22:48	3:50	5:01	Arch (15°) - Vertical (70°)
23-May	55%	12:58	2:09 +1	20:15	5:37	22:21	3:41	5:20	2:09	3:41	1:32	Arch (55°) - Vertical (75°)
30-May	100%	20:18	5:19 +1	20:20	5:34	22:20	3:34	5:14	-	-	-	-
6-Jun	60%	0:52 +1	11:07	20:25	5:31	22:27	3:29	5:02	22:27	0:52	2:25	Arch (25°) - Arch (50°)
13-Jun	0%	4:34 +1	19:28	20:29	5:31	22:33	3:27	4:54	22:33	3:27	4:54	Arch (30°) - Vertical (85°)
20-Jun	40%	11:53	0:35 +1	20:31	5:31	22:36	3:27	4:51	0:35	3:27	2:52	Vertical (60°) - Vertical (90°)
27-Jun	95%	19:11	4:02 +1	20:32	5:34	22:36	3:30	4:54	-	-	-	-
4-Jul	75%	23:19	11:08 +1	20:31	5:37	22:33	3:35	5:01	22:33	23:19	0:46	Arch (45°)
11-Jul	5%	3:16 +1	18:19	20:29	5:42	22:28	3:35	5:06	22:28	3:35	5:06	Arch (50°) - Vertical (-80°)
18-Jul	35%	11:49 +1	22:59	20:25	5:47	22:21	3:07	4:45	22:59	3:07	4:07	Vertical (60°) - Vertical (-80°)
25-Jul	90%	17:59	2:47 +1	20:19	5:53	22:12	2:40	4:27	-	-	-	-
1-Aug	90%	21:47	10:05 +1	20:13	5:59	22:02	2:12	4:10	-	-	-	-
8-Aug	15%	2:05 +1	17:11	20:05	6:06	21:50	1:44	3:54	21:50	1:44	3:54	Vertical (65°) - Vertical (-80°)
15-Aug	20%	10:38 +1	21:23	19:56	6:12	21:38	1:17	3:38	21:38	1:17	3:38	Vertical (65°) - Vertical (-80°)
22-Aug	75%	16:43	1:33 +1	19:46	6:19	21:25	0:49	3:24	-	-	-	-
29-Aug	95%	20:14	9:03 +1	19:35	6:26	21:12	0:22	3:09	-	-	-	-
5-Sep	30%	1:02 +1	16:03	19:24	6:32	20:59	23:54	2:55	20:59	23:54	2:55	Vertical (75°) - Vertical (-80°)
12-Sep	5%	9:25 +1	19:48	19:13	6:39	20:46	23:27	2:40	20:46	23:27	2:40	Vertical (75°) - Vertical (-80°)
19-Sep	60%	15:23	0:20 +1	19:02	6:45	20:33	22:59	2:25	-	-	-	-
26-Sep	100%	18:41	7:58 +1	18:50	6:52	20:21	22:32	2:10	-	-	-	-
3-Oct	40%	0:06 +1	14:51	18:39	6:59	20:09	22:04	1:54	20:09	22:04	1:54	Vertical (85°) - Vertical (-80°)
10-Oct	0%	8:15 +1	18:14	18:28	7:06	19:58	21:37	1:38	19:58	21:37	1:38	Vertical (85°) - Vertical (-80°)
17-Oct	50%	14:34 +1	23:09	18:17	7:13	19:48	21:09	1:21	-	-	-	-
24-Oct	100%	17:06	6:49 +1	18:08	7:20	19:39	20:42	1:02	-	-	-	-
31-Oct	55%	23:12	14:11 +1	17:59	7:28	19:31	20:14	0:43	19:31	20:14	0:43	Vertical (-85°)
7-Nov	0%	6:08 +1	15:42	16:51	6:36	18:24	18:47	0:22	18:24	18:47	0:22	Vertical (-80°)
14-Nov	35%	12:04 +1	20:59	16:45	6:44	18:19	18:19	0:00	-	-	-	-
21-Nov	90%	14:30	4:37 +1	16:40	6:52	-	-	-	-	-	-	-
28-Nov	75%	21:14	11:43 +1	16:37	6:59	-	-	-	-	-	-	-
5-Dec	5%	5:04 +1	14:12	16:35	7:06	-	-	-	-	-	-	-
12-Dec	20%	10:33 +1	19:52	16:36	7:12	-	-	-	-	-	-	-
19-Dec	75%	12:55	3:25 +1	16:38	7:16	-	-	-	-	-	-	-
26-Dec	85%	20:08	10:11 +1	16:42	7:19	-	-	-	-	-	-	-

My first Milky Way image – 03/21/23 – no edits

- Bortle 3 area, new moon
- Stars are out of focus

My first Milky Way image – original edit from 03/23

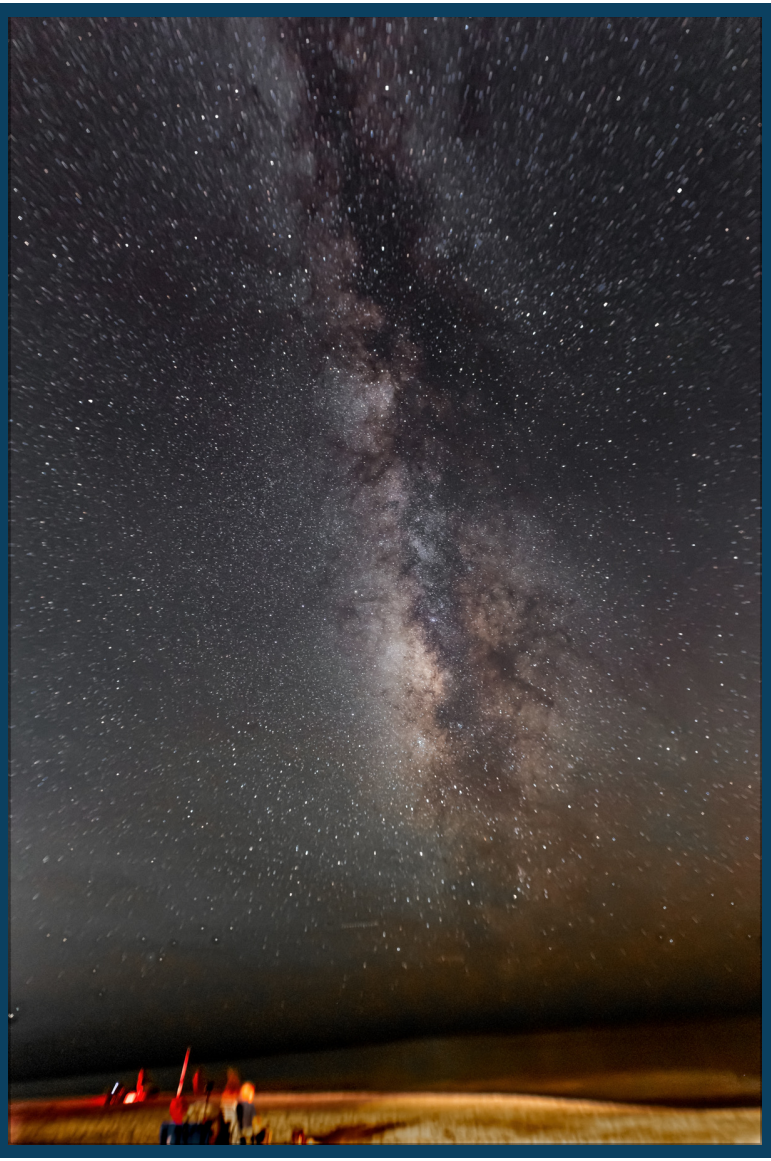
My first Milky Way image – re-edit from 02/26

There is no “wrong” aesthetic style for editing

- But editing styles evolve and improve with experience
- *Personally*, I prefer a subtle editing style
  - enhance what can be seen with the naked eye, rather than introducing anything new
- With wide angle night scape images:
  - Look for an interesting landscape
  - The night sky forms a backdrop for the landscape

Cape San Blas – 09/23/24

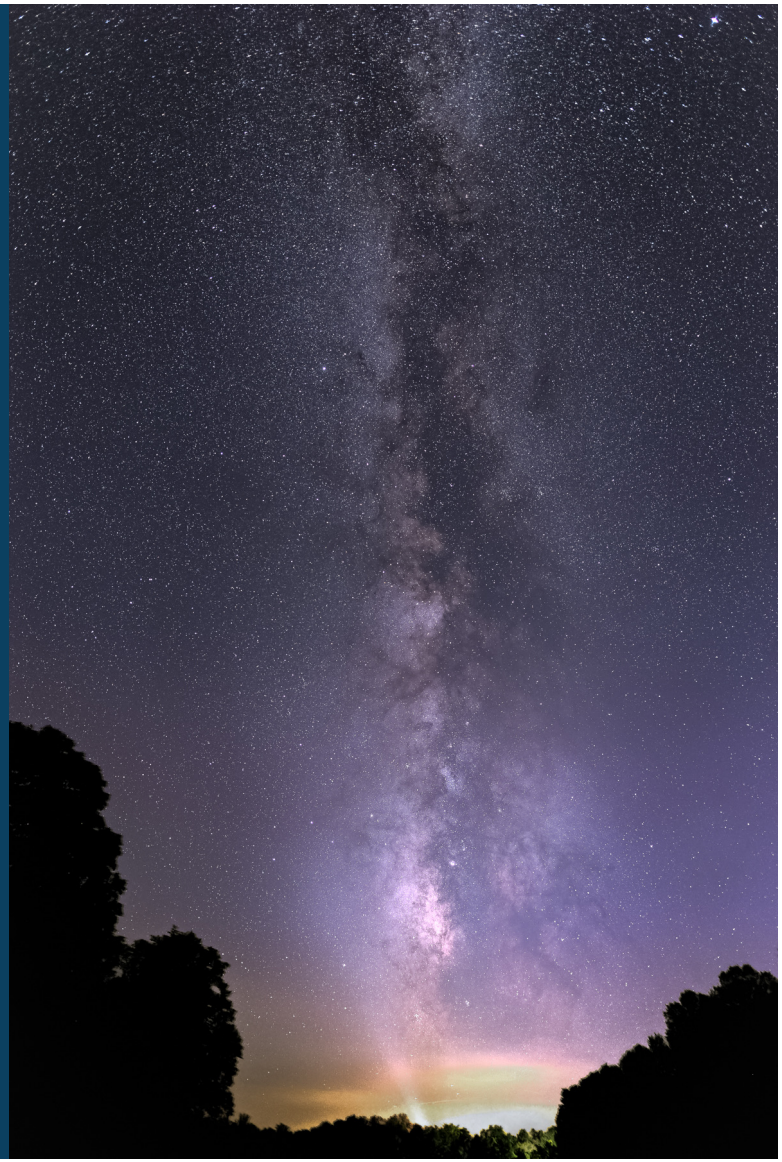
- Same location as previous example
- More interesting foreground with the beach campfire
- Stars are in focus ☺
- If your camera allows it, manually focus your lens on a bright star



Most modern cameras do well with a single exposure

Stacked Milky Way image

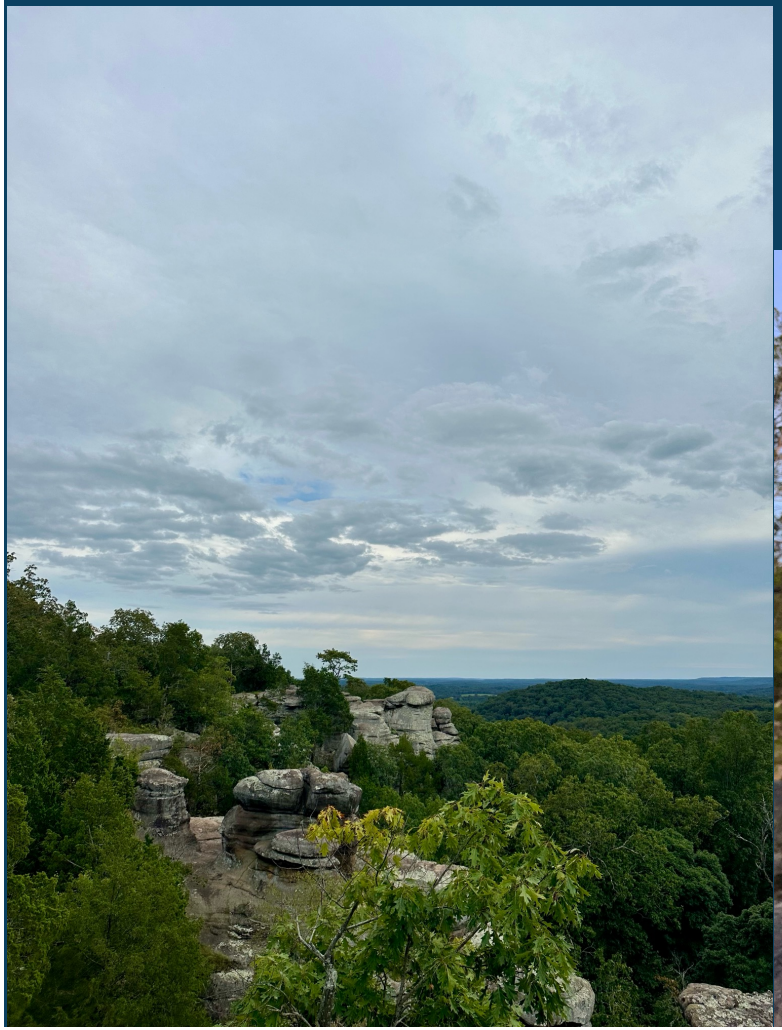
- Take multiple (8 – 24-ish) images
  - Stack together in post-processing
- Improves S/N and image quality
  - Complicates post-processing
- *Personal opinion:* online social media posts don't need the improved quality from stacking images
  - If you're thinking of printing your images, consider stacking images

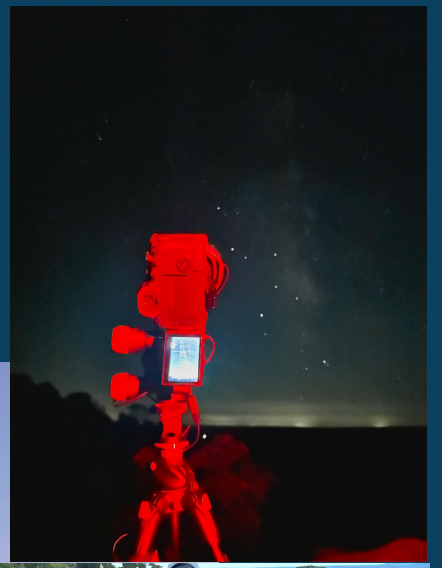


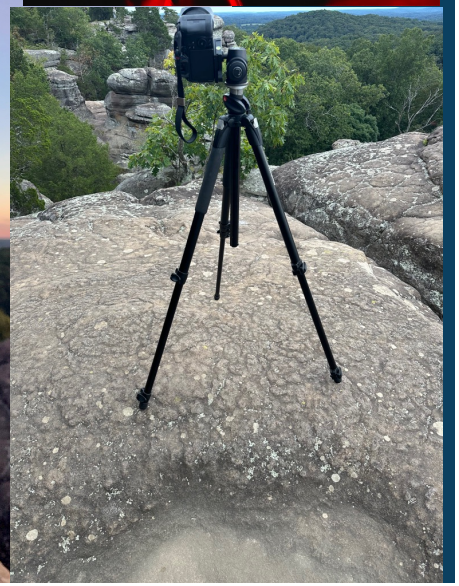
Be prepared for the unexpected

The importance of planning in daylight

The importance of planning in daylight – Safety!







Cell phone Milky Way image

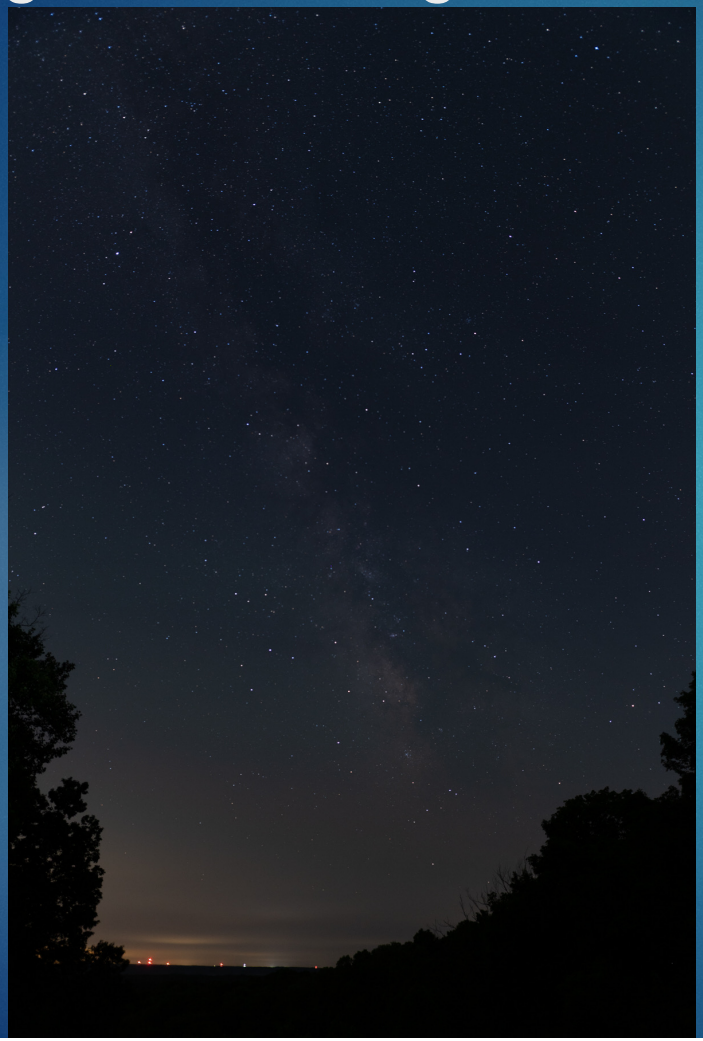
- Hand-held, 1 sec
  - Still need a tripod, use “night-mode”
- Dedicated cameras with full manual control and large sensors will still give better quality than a cell phone

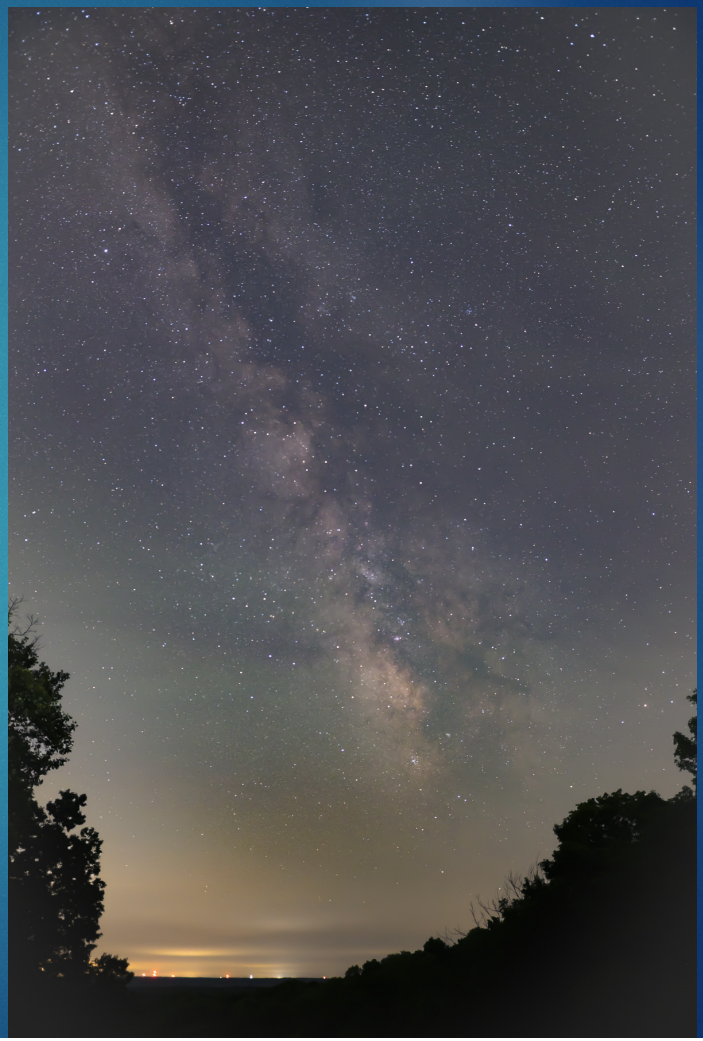
Time-lapse video in Garden of the Gods, IL

Star trails

- Composite images showing the movement of the stars through the night sky
- Using a stable tripod, point your camera at a spot in the night sky and start taking photos
- Hundreds of consecutive photos stacked in post-processing to give the final image

Editing raw files brings out shadows and details





- **Thank you!**
- **Questions?**

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