

# *Imaging the Night Sky*

Getting started in Astrophotography

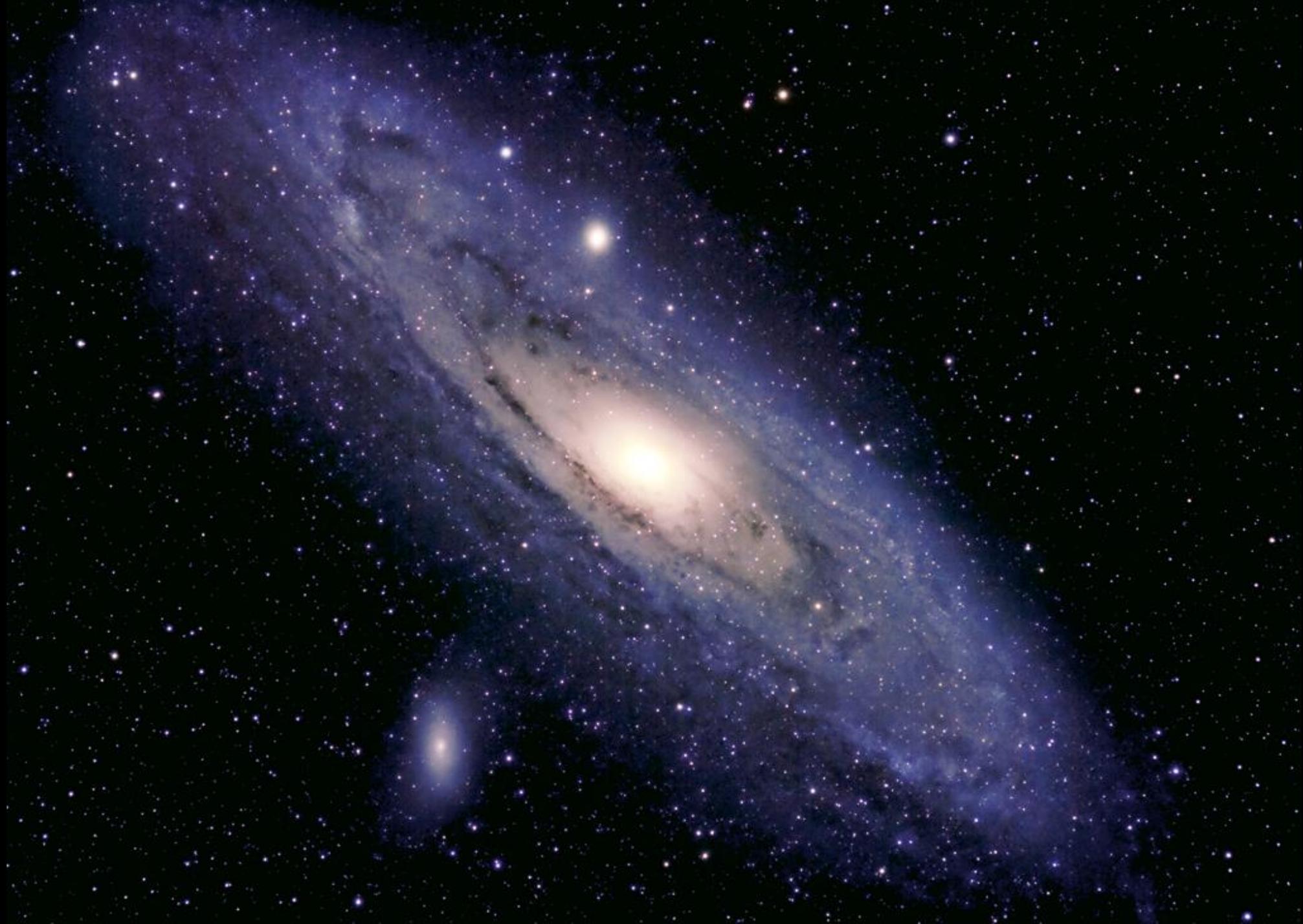
*Paul Klauninger*

Astrophotography comes in many forms and covers a wide variety of object types.

Some of these are relatively simple to capture and only require some basic equipment.



Others require sophisticated cameras, mounts, and telescopes, as well as in-depth knowledge of image processing.











# Today's cameras



*DSLR*



*Mirrorless*



*Astronomical CCD camera*

*Astronomical video camera*



*Camera that allows manual exposure control*

*Wide-angle lens (8 to 50mm) to capture broad vistas*

*OR*

*Telephoto lens (up to ~300mm) to capture images of the Moon*

*Tripod*

*Ballhead mount*

*Shutter release:*

- *Intervalometer*
- *Simple trigger*
- *Wireless remote*
- *Camera self-timer*
- *Not your finger!*  
*(Emergency use only)*

***Basic starter setup***

# *Things to do before anything else*

## *Learn how to set your camera controls for full manual use:*

- Exposure lengths, using either the "M" or "B" setting. The "B" setting stands for "Bulb" and is used to take images that are longer than 30 seconds.
- Lens aperture opening (F-stop)
- ISO level
- Set your camera to record raw images (if available) in addition to or instead of the usual JPGs. The raw images contain the full range of image data that your camera can capture and give you much more flexibility when processing your images. For instance, they allow you to change factors such as the color balance **after** you shoot your image rather than trying to determine the best setting onsite.

## *Practise manually focusing your lens*

- Auto-focus is generally useless or problematic for astro-imaging - turn it OFF (usually on lens) If your lens has image stabilization, turn that OFF as well.
- Try some daytime tests on distant objects. Make sure your camera is firmly mounted on your tripod and then manually focus and take some test shots. Review your images by zooming in as much as possible and see how sharply you pinned the focus. Repeat as necessary to get the sharpest possible image. A little change in focus can make a big difference!

*So what kind of astronomical subjects can be captured with a basic setup?*



*Wide-angle sunsets*



*Creative Sun effects through fog or partial cloudiness*

***You must use a lot of caution whenever you photograph the Sun!***

Special filters are usually required.

It's very easy to damage your equipment and more importantly, your eyesight if you're not ***EXTREMELY CAREFUL!***

***Never*** look through your camera viewfinder while pointing at the Sun, even with filters on. Be safe, not sorry!



*Telephoto Moon views*



*The Back Roads Photographer*

*Astronomically-themed nightscapes in the city or country*

© Kevin Anderson



*Lunar eclipses*





*Auroras*



*SGR Photography*

*Creative star-trailing effects*



Objects other than the Moon or Sun are typically quite faint and so you'll need to get out under a dark sky away from city lights.



*Ottawa's light dome from 25 km out of town*

Being under city lights will easily overwhelm most dimmer stars, meteors, auroras, and the Milky Way.

## *Things to consider when heading out for dark skies*

- > Choose an imaging location as free of ground lights (i.e. houses and cars) as possible.
- > Avoid setting up on asphalt or cemented surfaces in the warm season if possible. These surfaces pick up heat during the day and release it at night. This can cause substantial shimmering in your images.
- > Safety is a consideration. Be mindful of your surroundings, especially if you'll be on the site alone at night. Two-legged and four-legged creatures may interrupt your peaceful night under the stars. In addition, car problems (i.e. a dead battery) can become an issue if you're out in the middle of nowhere and beyond cell phone range.
- > Things to bring, other than your imaging equipment:
  - \* Summer: Insect repellent, a suitable jacket for evening dampness, flashlights, a chair, snacks, water
  - \* Winter: VERY warm jacket, well-insulated boots, thin & thick gloves, flashlights, a chair, a thermos of tea or coffee, snacks, water, lighter or matches
- > Bring a spare battery or two for your camera. Shooting many long exposures or time lapse sequences at night can deplete batteries sooner than usual. Also make sure you have plenty of capacity on your memory chip. Having a spare is a good idea.

*You'll also need a way to keep dew from fogging up your lens*

***A simple solution for dew control***

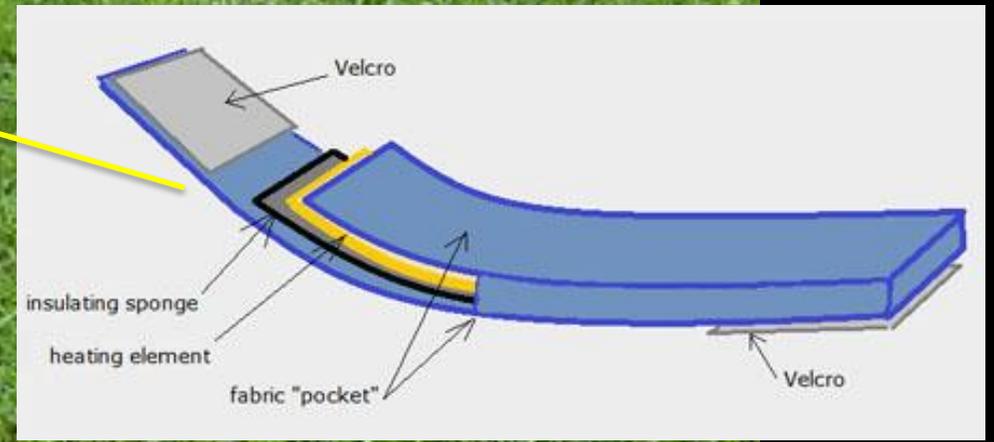


Strap a hand warmer packet to your lens.

I haven't used this method myself, but apparently it does work.

You may want to use a partially-spent packet for this, as they can get quite warm.

**A typical regulated dew control system used by many**



**Dew heater strap**

**+12VDC power supply**

**Dew heater controller**

*www.ryanphoto.com*

## *Suggested camera settings*

- Set your lens aperture to fully-opened: the lowest “f-number” for maximum light input
- Set the initial ISO level to a relatively high value: ISO 800 to 1600
- Set your initial exposure length to 10 seconds
  - > If this winds up being too bright for your site conditions, try shorter times or reduce the ISO.
  - > If the image is too dark, try lengthening the exposure time and/or increase the ISO. Increasing the exposure time will eventually show stars trailing. Increasing ISO will show more noise in the image.
- Set your camera to record raw images (if available), in addition to or instead of the usual JPGs.

## Focusing your image

- Aim your camera at a bright star and try focusing it by using your live view (if available) at maximum magnification. You can also use your view finder for this, but again, you'll need to aim at a bright star.
- Manually focus your lens to get the star looking its tightest and brightest. Then take and review some test shots. Be aware that the difference between a well-focused image and one that is only OK is often just a very small adjustment in your focusing. *DON'T RUSH THIS!* Take the time and do this properly.
  - > NOTE: Sharpest focus will generally NOT be exactly at the infinity mark ( ∞ ) on the lens.



**Next:** Aim your camera at the scene you want, but don't jostle the focus!

**Next:** Take some test shots to determine best exposure settings to use

Canon 70D with 16mm lens at F2.0

10 seconds @ ISO3200



Canon 70D with 16mm lens at F2.0

15 seconds @ ISO3200

*Note how the stars are starting to streak ...*

Canon 70D with 16mm lens at F2.0

30 seconds @ ISO3200

*The longer the exposure, the longer the trails*



Canon 70D with 16mm lens at F2.0

60 seconds @ ISO3200

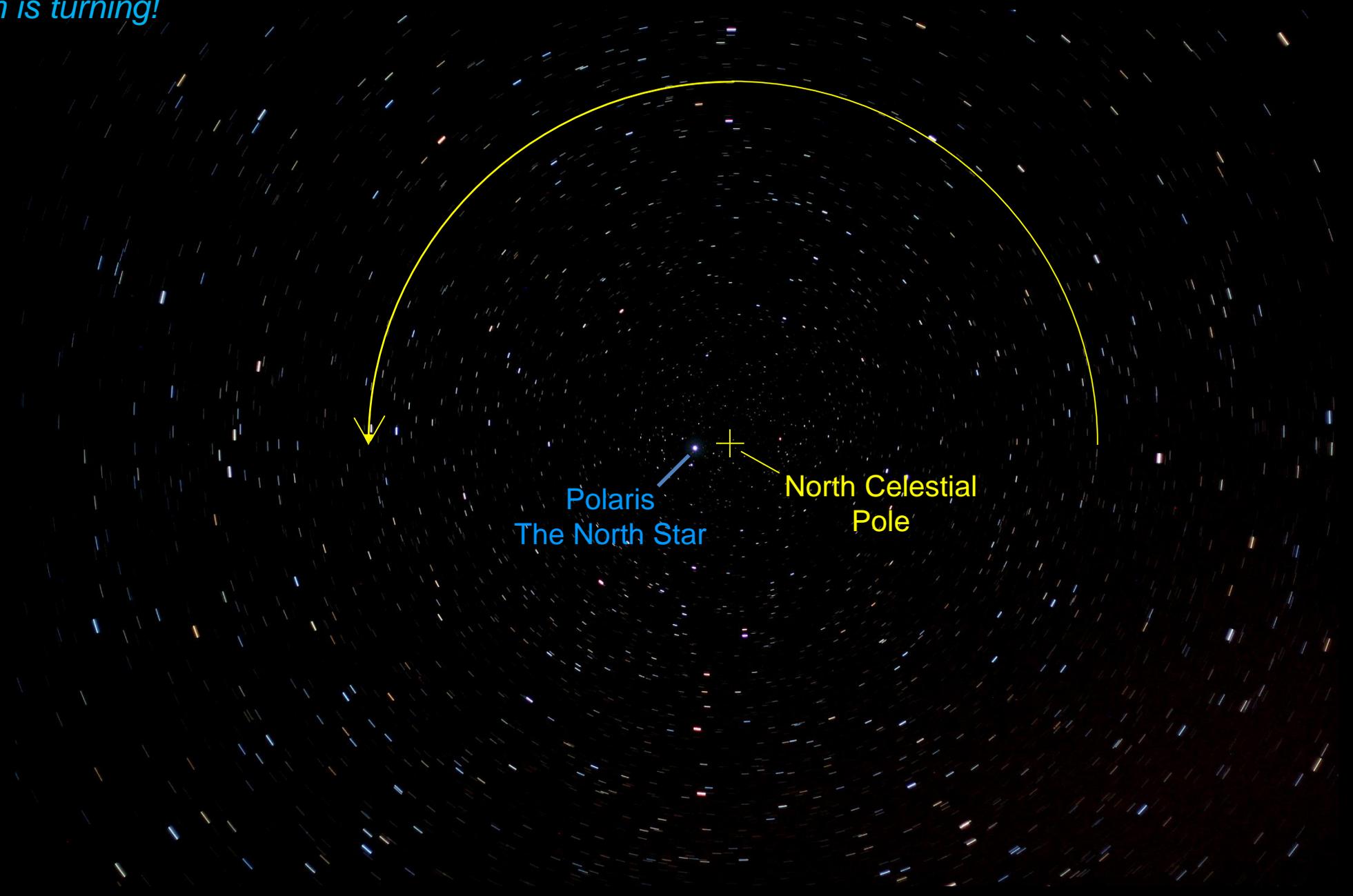
Why?



Canon 70D with 16mm lens at F2.0

120 seconds @ ISO3200

*The Earth is turning!*



Polaris  
The North Star

North Celestial  
Pole

*Find a good balance between exposure depth and stars trailing*



Canon 70D with 16mm lens at F2.0

24 seconds @ ISO3200

*Final processed version*

Canon 70D with 16mm lens at F2.0

24 seconds @ ISO3200



*Star trailing isn't always a bad thing!*

© Beau Liddell



*Most of the time though, you'll want to capture stars as points*



*One final note for special events ...*

A very useful and recommended resource for current events happening in the night sky.

This is updated daily and provides information on auroras, meteor showers, eclipses, comets, and more.

You can even sign up to receive notices of potential impending auroral activity.

The screenshot shows the homepage of spaceweather.com. At the top, there is a navigation bar with a search box for "SpaceweatherNews" and a "go!" button. Below the navigation bar is a pink menu with options: "AURORA ALERTS" (circled in yellow), "SUBMIT YOUR PHOTOS", "CONTACT US", "SUBSCRIBE", "FLYBYS", and "EARTH TO SKY". The main content area is divided into several sections:

- Current Conditions:** Displays solar wind data (speed: 404.5 km/sec, density: 5.4 protons/cm<sup>3</sup>), X-ray Solar Flares (6-hr max: A1 2305 UT Mar26, 24-hr: A1 1101 UT Mar26), and a "Daily Sun: 26 Mar 20" section with a large orange sun icon. Below the sun icon, it states "The sun is blank -- no sunspots. Credit: SDO/HMI".
- Sunspot number:** 0. Includes a link "What is the sunspot number?" and is updated as of 26 Mar 2020.
- Spotless Days:** A table showing the current stretch and historical totals for various years.
- What's up in space:** A section with a date "Friday, Mar. 27, 2020" and a green "AURORA HOLIDAYS" button. It contains text about auroras and a link to "Book now!".
- EMERALD GREEN COMET:** A text block mentioning the comet ATLAS (C/2019 Y4) and providing sky maps for March 25, 26, and 27.
- NOCTILUCENT CLOUDS OVER THE SOUTH PACIFIC:** A text block reporting on the appearance of noctilucent clouds (NLCs) over the South Pacific, with a credit to meteorologist Ashleigh Wilson.
- Archives:** A sidebar with dropdown menus for "March", "27", and "2020", and a "view" button.
- Advertisements:** Three vertical ads on the right side: "THE NINE PLANETS RING", "Get Your Piece of the Universe TOPSS", and "Averted Imagination".



spaceweather.com

News and information about the Sun-Earth environment

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### Current Conditions

**Solar wind**  
speed: 404.5 km/sec  
density: 5.4 protons/cm<sup>3</sup>  
more data: [ACE](#), [DSCOVR](#)  
Updated: Today at 0420 UT

**X-ray Solar Flares**  
6-hr max: A1 2305 UT Mar26  
24-hr: A1 1101 UT Mar26  
[explanation](#) | [more data](#)  
Updated: Today at: 0425 UT



The sun is blank -- no sunspots. Credit: SDO/HMI

**Sunspot number: 0**  
[What is the sunspot number?](#)  
Updated 26 Mar 2020

**Spotless Days**  
Current Stretch: 16 days  
2020 total: 66 days (77%)  
2019 total: 281 days (77%)  
2018 total: 221 days (61%)  
2017 total: 104 days (28%)  
2016 total: 32 days (9%)  
2015 total: 0 days (0%)  
2014 total: 1 day (<1%)

### What's up in space

Friday, Mar. 27, 2020

Solar minimum is here - but even now strangely beautiful auroras are dancing around the poles. Deep inside the Arctic Circle, the expert guides of [Aurora Holidays](#) in Utsjoki, Finland, can help you chase them. [Book now!](#)



**EMERALD GREEN COMET:** Astrophotographers, point your telescopes at the Big Dipper. Emerald green Comet ATLAS (C/2019 Y4) is there, [half as wide as the sun](#) and [rapidly brightening](#). It is not yet visible to the naked eye, but by late May it could be as bright as the planet Venus. **Sky maps:** [March 25](#), [26](#), [27](#).

**NOCTILUCENT CLOUDS OVER THE SOUTH PACIFIC:** You don't see this everyday--or even in 30 years. "Noctilucent clouds (NLCs) have appeared over the South Pacific," reports meteorologist Ashleigh Wilson of the Australian Antarctic Division. "I photographed them from Macquarie Island on Jan. 4th."



Wilson is just wrapping up a year-long stint on the remote island where the Australian government maintains a research station to study climate change and wildlife. "According to John French of the Australian Antarctic Division

archives

March

27

2020

view



SIGN UP FOR