



**Climate Action  
and  
Light Pollution Threat**



**Project number:  
KA220-SCH-A710136B**

Hands-on classroom activities  
for light pollution monitoring

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CliC-PoLi Summer School  
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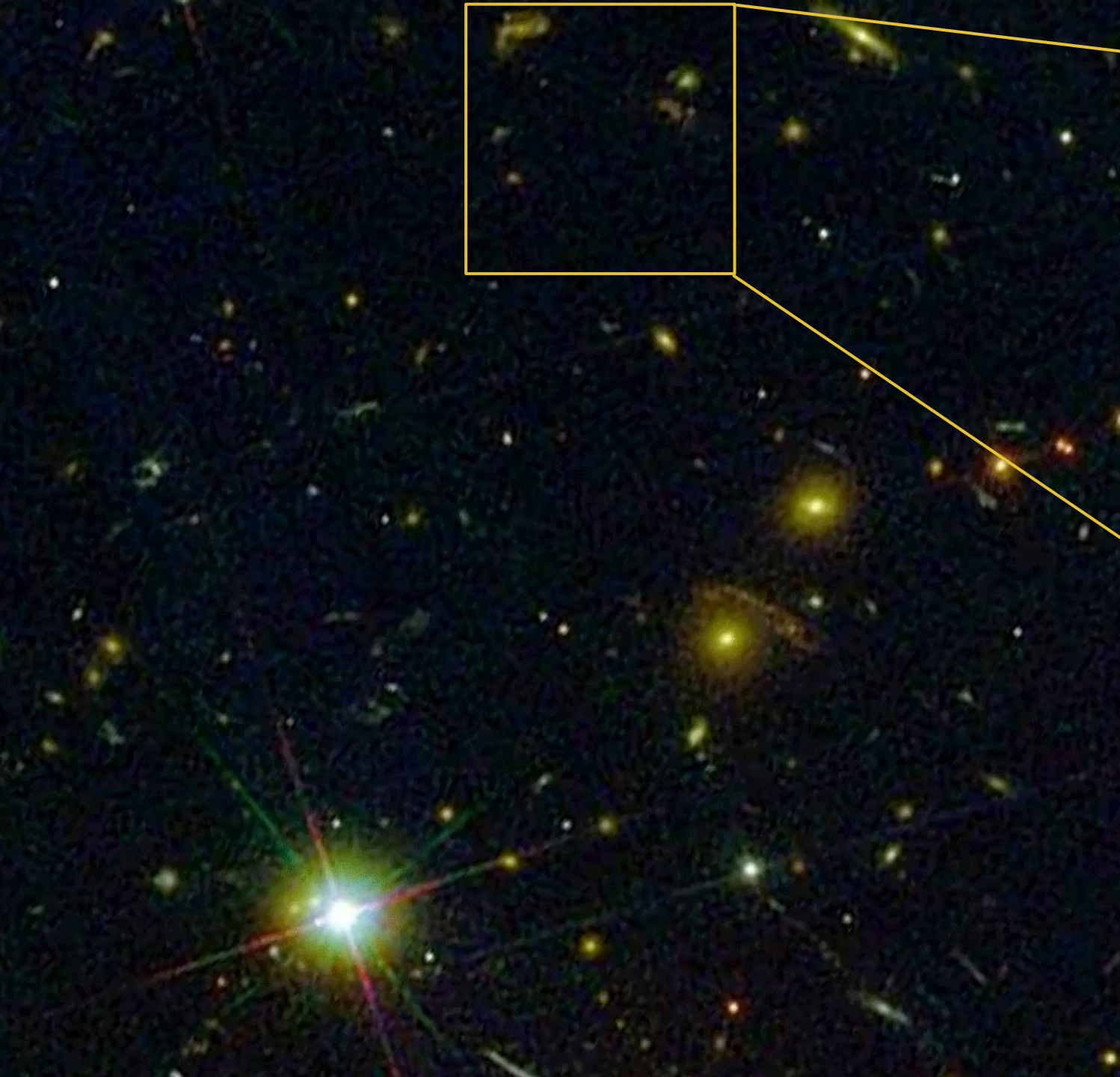
**Before we start ...**



**Webb's First Deep Field:  
Galaxy cluster SMACS 0723**

**Cluster light emitted  
4.6 billion years ago**

**Current Distance  
5 billion light-years**



## Hubble vs. Webb

*2.4 m vs 6.5 m mirror*

HST Deep Field - 10 days exposure

JWST First "Deep" Field - 12 hour exposure

# Summar y



Light Shielding

Van Gogh's paintings

Spectroscope

Recommended Sites and Apps

Limiting Magnitude

# Light Shielding



# Light Shielding



# Connection with Arts Van Gogh's paintings



*Starry Night over the Rhône (1888)*





Arles, 1888

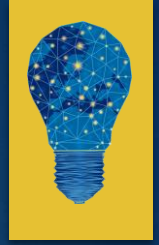


Arles, 2008

Cafe Terrace at Night (1888)



# Activities with a spectroscope



Low-cost spectroscopes can be built easily using household materials



- Compact disc (CD)
- Cardboard tube approximately 30 cm long and 10 cm diameter
- Cardboard
- Razor knife
- Scissors
- Tape

# Activities with a spectroscope



Low-cost spectroscopes can be built easily using household materials



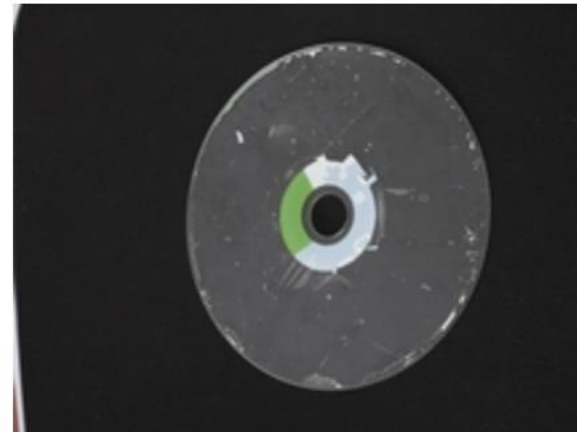
Scratch a bit of paint from the edge



Put a tape on the scratch



Remove the tape with paint



Ready !!!

# Activities with a spectroscope



Low-cost spectroscopes can be built easily using household materials

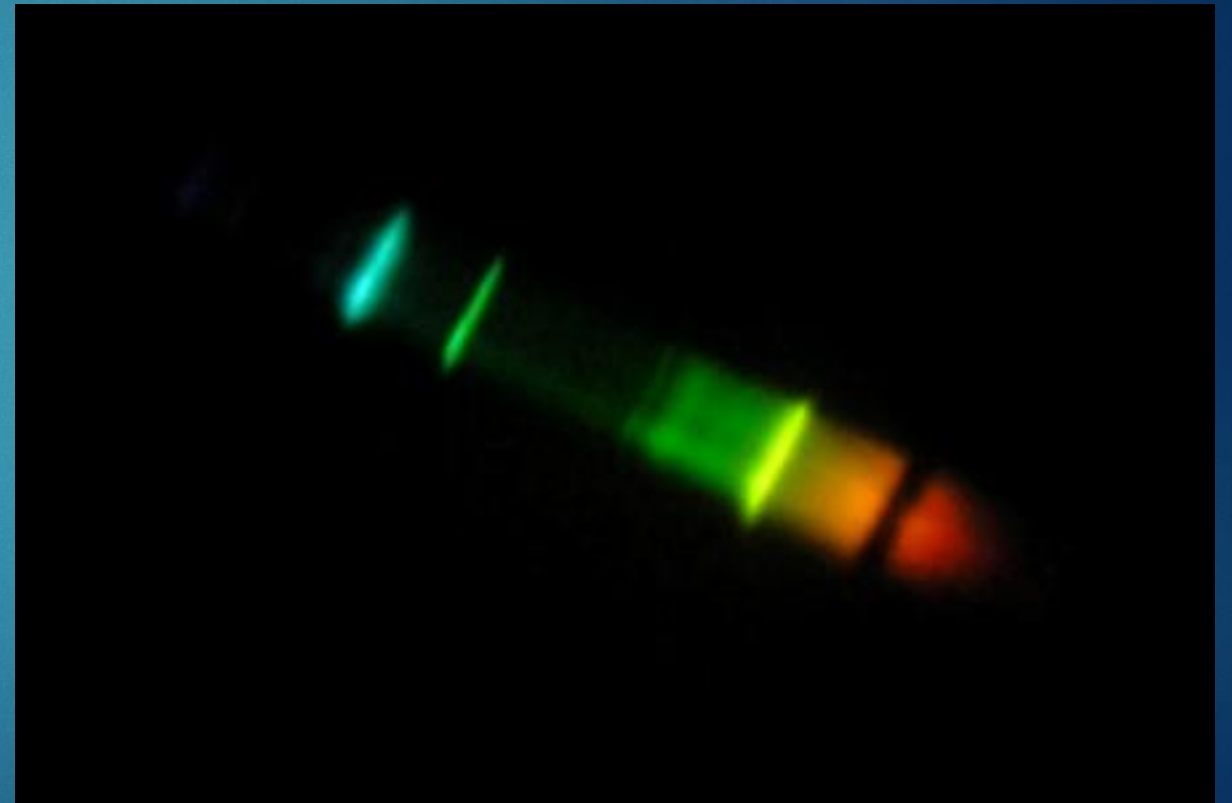


Position the CD at a 30-degree angle with the tube

# Activities with a spectroscope



Low-cost spectroscopes can be built easily using household materials



# Activities with a spectroscope



LPS**	Low-pressure sodium – a nearly monochromatic yellow-orange light source used mostly in areas near astronomical observatories and sea turtle nesting beaches.	1.0	0.4
HPS***	High-pressure sodium – A golden-yellow light source, widely used throughout the world.	2.4	1.0
FLED****	Filtered warm-white light-emitting diode – a straw-yellow LED lamp with a filter that removes most emission with wavelength shorter than 500 nanometers.	3.6	1.5
LED 2400K	Light-emitting diode with "correlated color temperature" (CCT) of 2400K – a "warm-white" LED. This type of LED has not seen wide use.	4.3	1.8
LED 4100K	Light-emitting diode with CCT of 4100K – a "cool-white" LED. This is a common LED type in recent LED area lighting installations.	6.4	2.7
LED 5100K	Light-emitting diode with CCT of 5100K – a "cool-white" LED. This also is a common LED type in recent LED area lighting installations.	7.9	3.3

Use the spectroscope to explore spectra from different types of light sources.

LEDs can light-pollute almost 8 times more than low-pressure sodium lamps!



# Recommended Websites

- International Dark Sky Association - <https://www.darksky.org/>
- Globe at Night Campaign - <https://www.globeatnight.org/>
- Dark Sky Rangers - <http://dsr.nuclio.pt/>
- Light Pollution Map - <https://www.lightpollutionmap.info/>





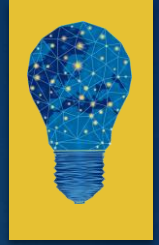
# Recommended Apps



Lux Light Meter Pro



Light Pollution Map



# Practical Activity TONIGHT!!!

Evaluate the limiting magnitude of this location

HOW?

- Use a constellation near the zenith
- With a reasonable range of magnitudes (1 to 5 in steps on 0.5 mag)
- Go to a site without direct incidence of artificial lights
- Adapt your eyes to the dark (10 - 15 minutes).
- Avoid using your smartphone. If essential, keep the screen brightness to minimum.
- Use a red-light flashlight (or app) to preserve low light eye adaptation
- Identify the faintest star you can see in the area and compare with the star chart



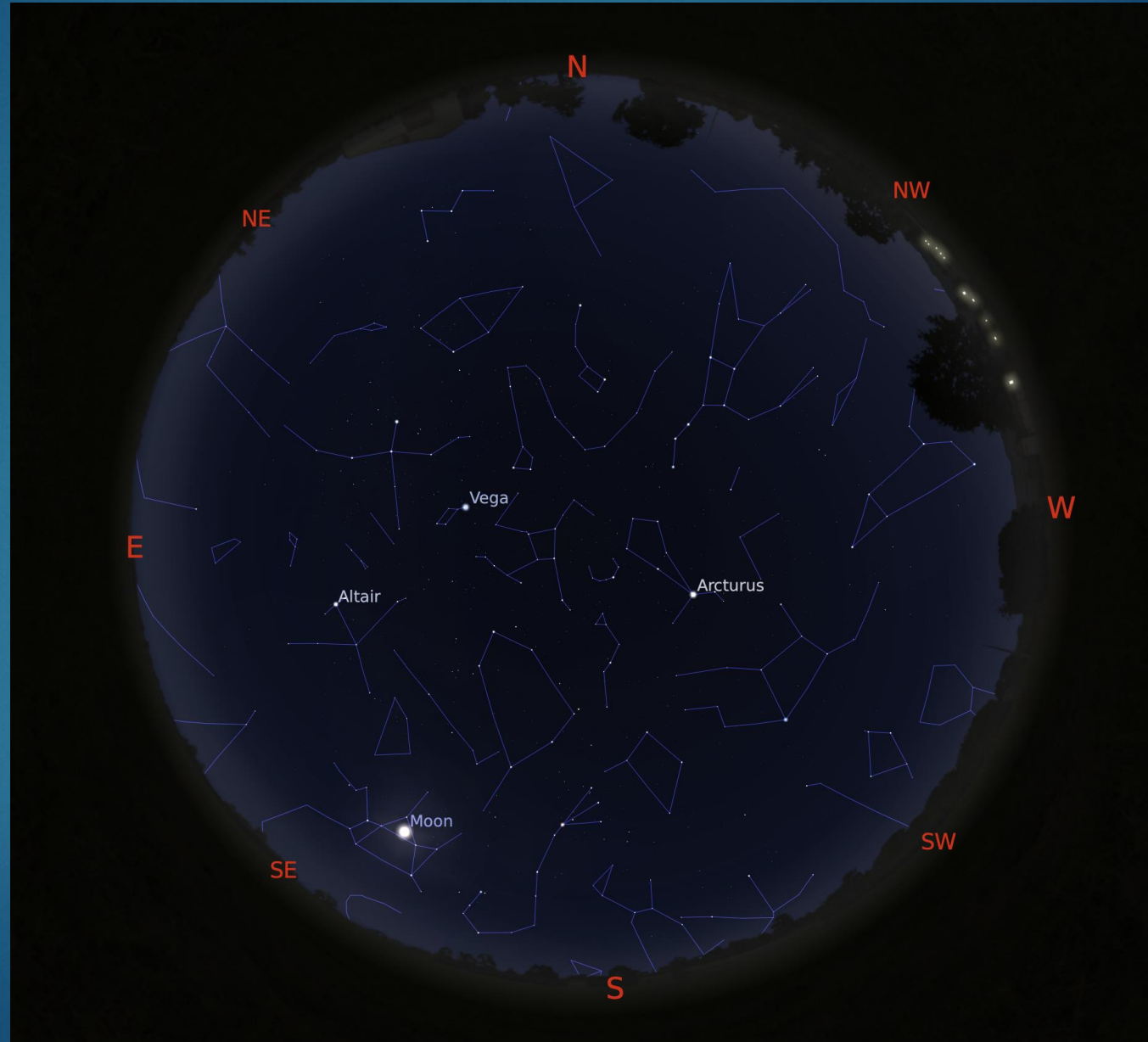
# Practical Activity TONIGHT!!!

Evaluate the limiting magnitude of this location

## CAVEATS

- Direct artificial light incidence
- Not enough time to adapt to the dark
- Moon
- Clouds
- Constellation not near the zenith

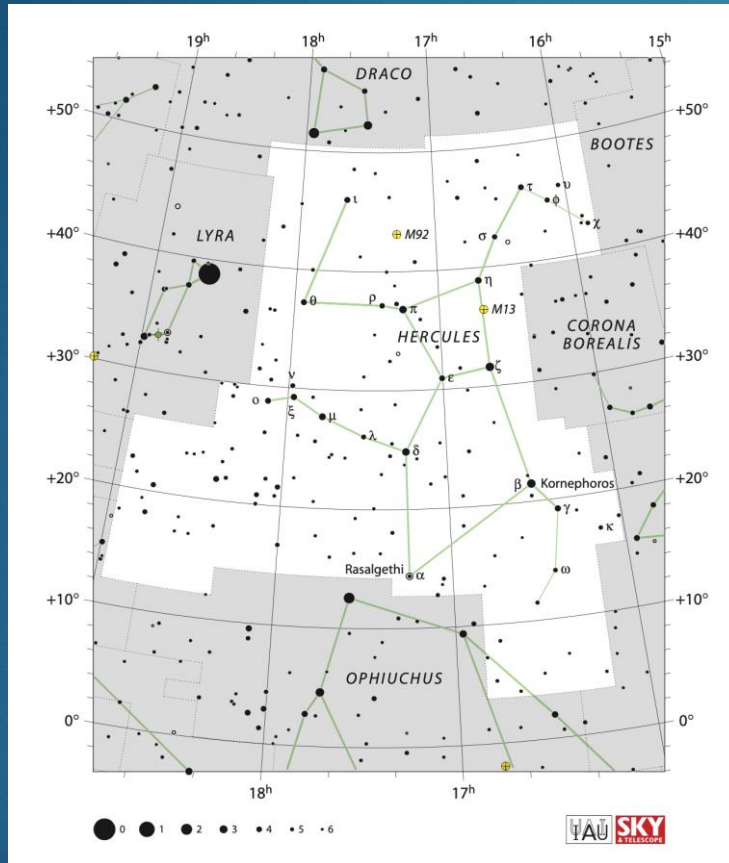
# The sky tonight at 22:00



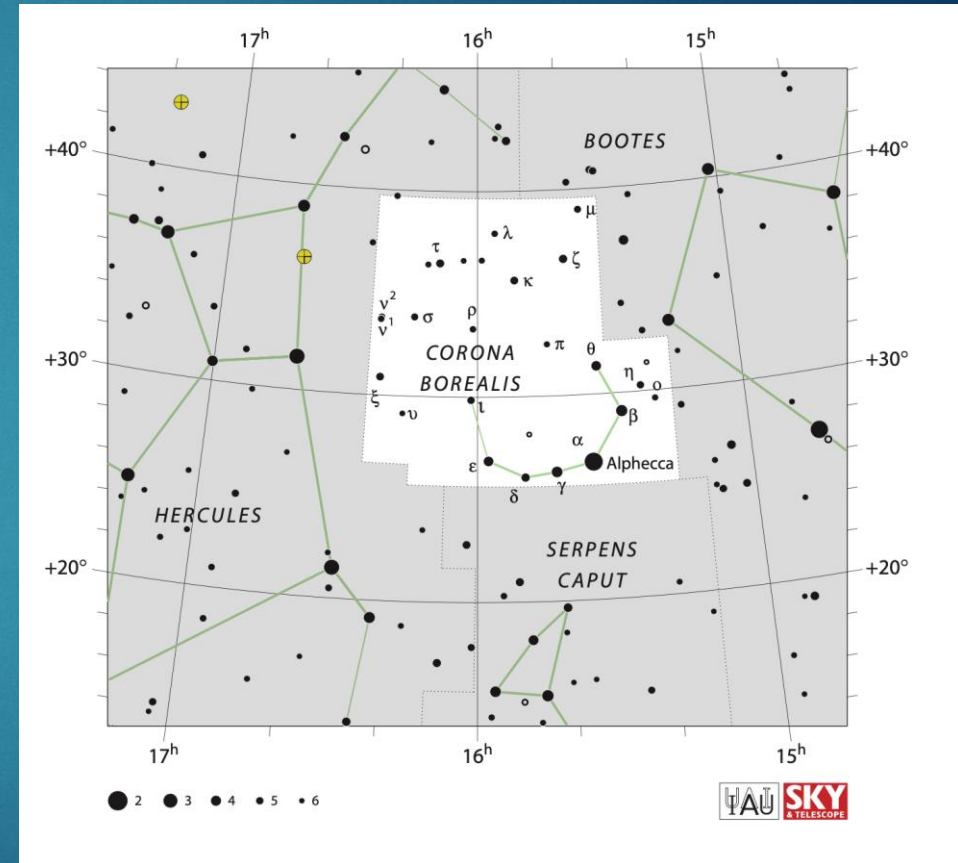
# Practical Activity TONIGHT!!!



2 regions

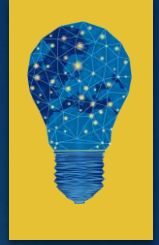


Hercules

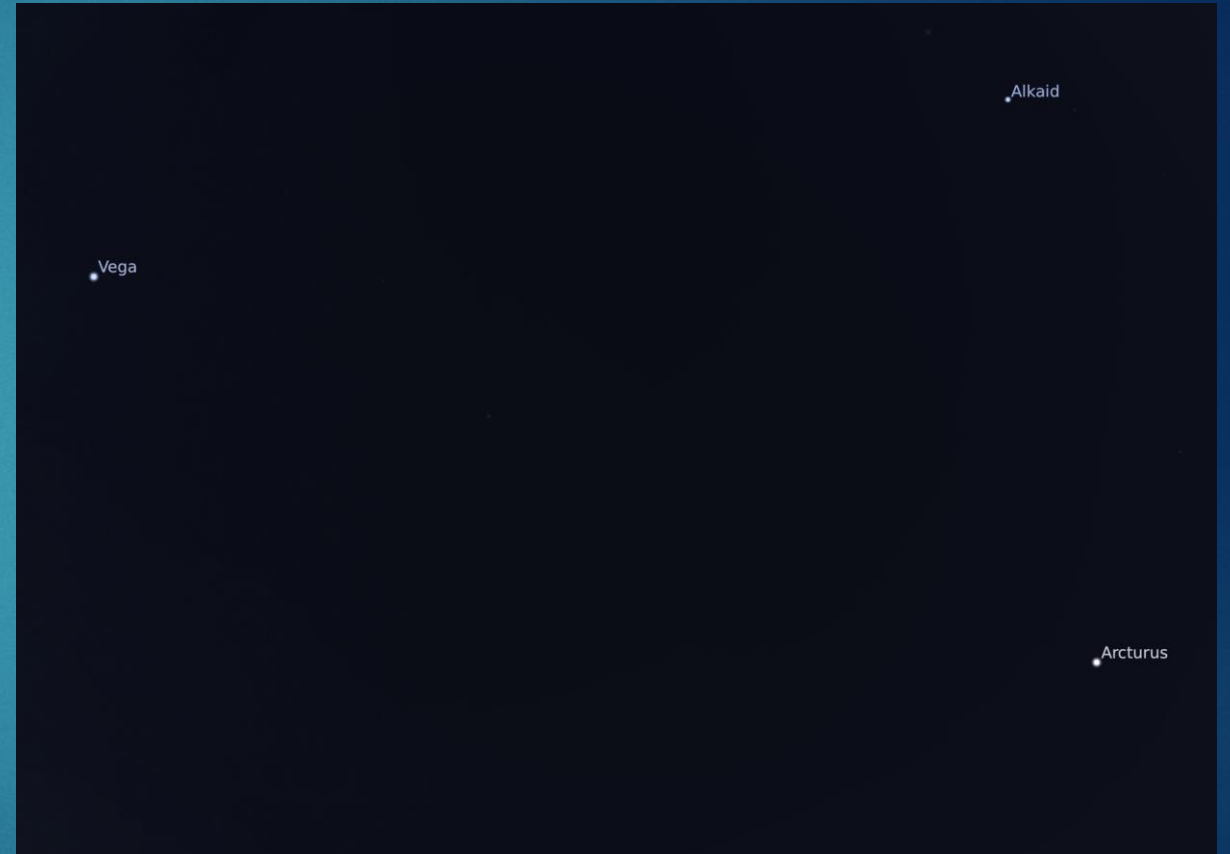


Corona Borealis

# The impact of light pollution

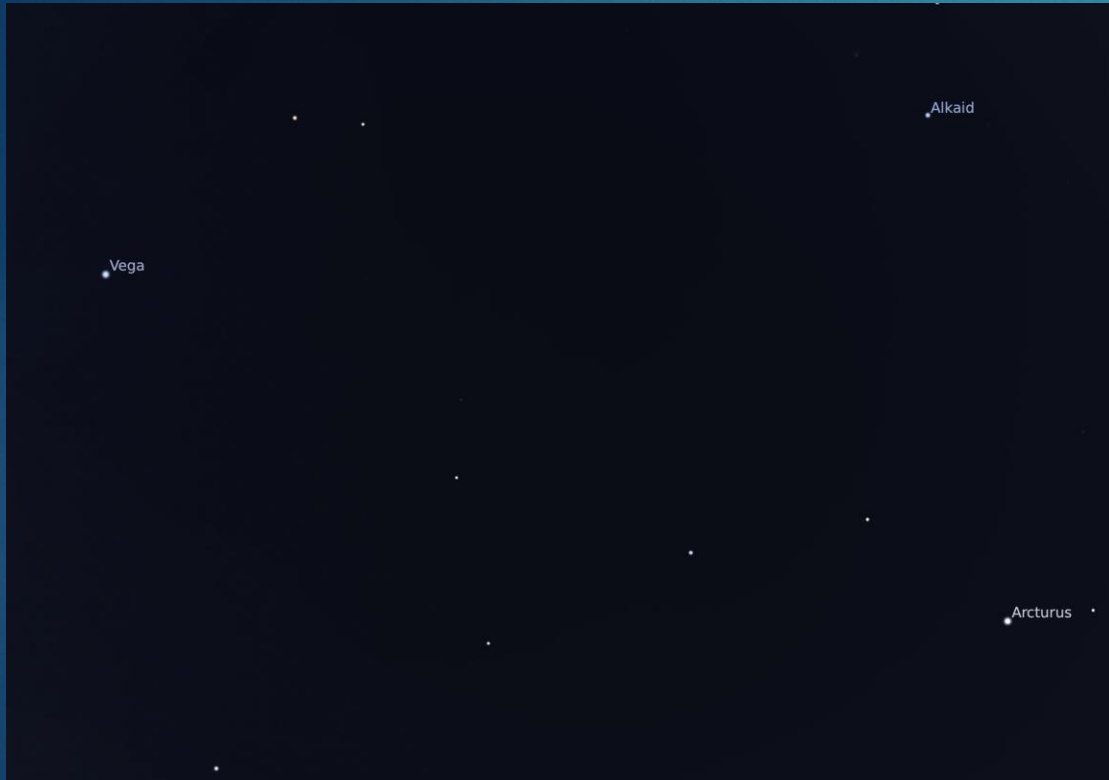


Limiting magnitude 1



Limiting magnitude 2

# The impact of light pollution

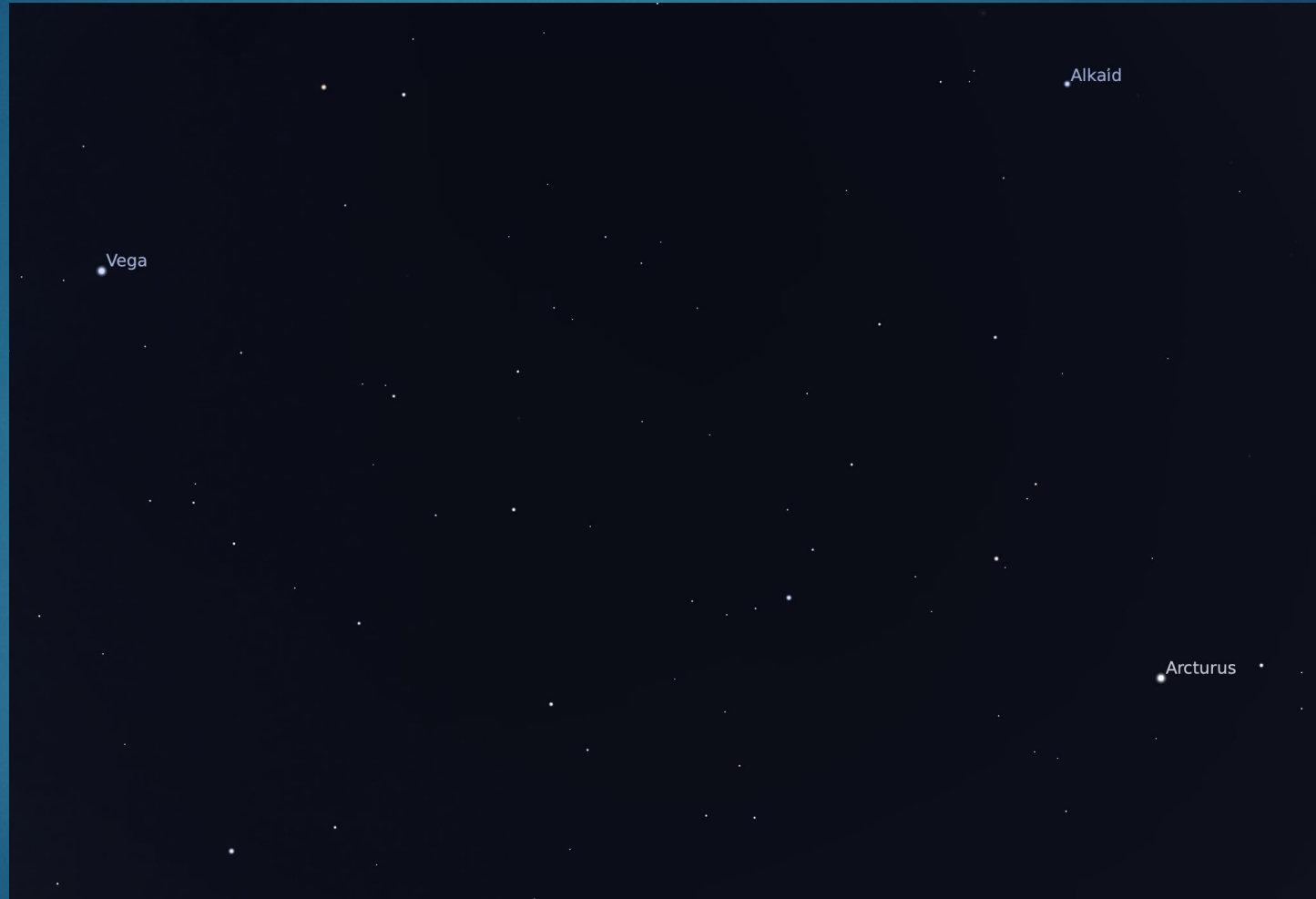


Limiting magnitude 3



Limiting magnitude 4

# The impact of light pollution



Limiting magnitude 5





# How many stars can you see by naked eye?

Limiting magnitude	Number of stars
1	6
2	45
3	150
4	540
5	1700
6	4900
7	14000

# Simulating Light Pollution on Stellarium



The screenshot shows the 'View' window in Stellarium, which is used to configure the simulation. The window is divided into several sections:

- Navigation:** A top bar with icons for Sky, SSO, DSO, Markings, Landscape, Starlore, and Surveys.
- Sky Section:**
  - Milky Way brightness/saturation: 1,00
  - Zodiacal Light brightness: 1,00
  - Dynamic eye adaptation
  - Atmosphere visualization (with a button for 'Refraction/Extinction settings...')
  - Light pollution: 9 or  take from locations database
  - Shooting stars: 10 (Normal rate)
- Stars Section:**
  - Stars
  - Absolute scale: 1,00
  - Relative scale: 1,00
  - Twinkle: 0,20
  - Limit magnitude: 6,50
  - Spiky stars
  - Labels and Markers
  - Use additional names of stars
- Projection Section:**
  - A list of projection types: Perspective, **Stereographic**, Fish-eye, Orthographic, Equal Area.
  - Stereographic** is selected, with a description: 'Stereographic projection is known since antiquity and was originally known as the planisphere projection. It preserves the angles at which curves cross each other but it does not preserve area.' and 'Maximum FOV: 235°'.
  - Vertical viewport offset: 0 %

At the bottom of the window, the status bar shows: Earth, Athens, 0 m | FOV 68.7° | 17.8 FPS | 2022-07-12 22:00:33 UTC+03:00

Sky and viewing options window [F4]



# Thank you!

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