Introducción a la Astrofísica 2025

El zoológico astronómico: ¿Qué hay allá afuera?

Clase 7: Naturaleza de la luz

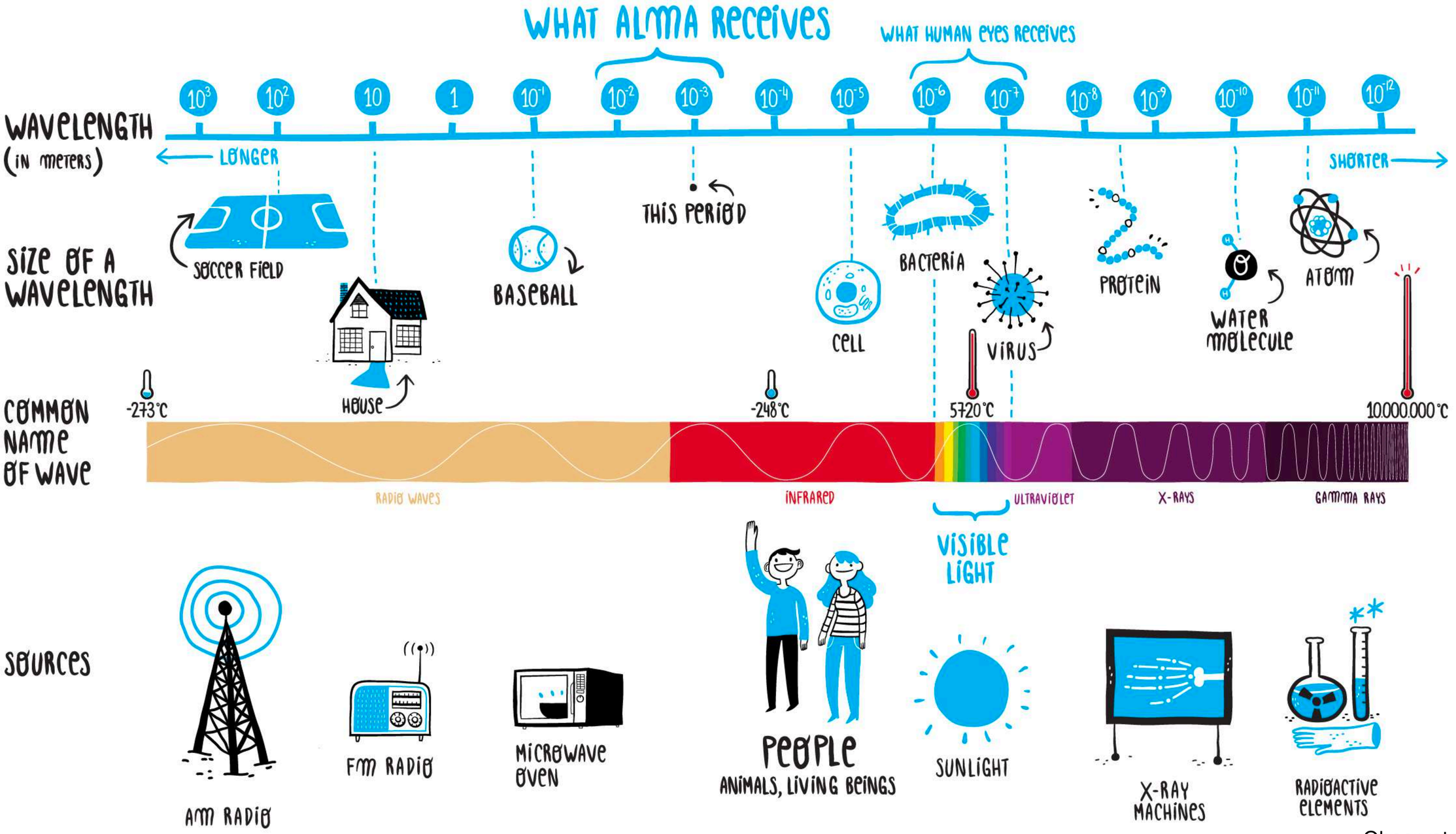
Departamento de Física USACH

Cosas que necesitamos saber:

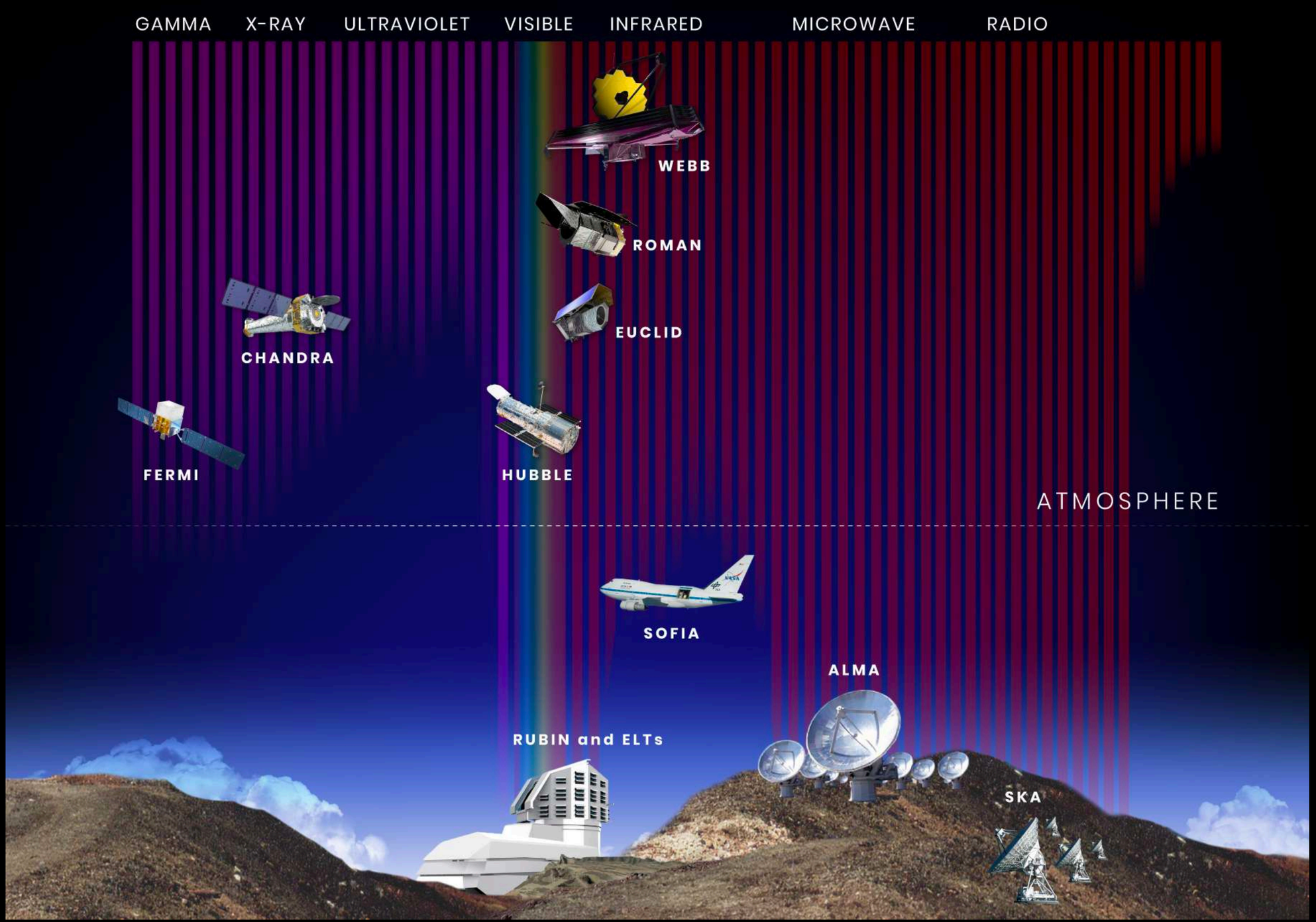
Naturaleza de la luz, cómo la estudiamos (espectros), qué nos dice sobre la composición de las estrellas, cómo clasificamos las estrellas, de dónde sale la luz que emiten las estrellas?

Si bien hoy conocemos otros “mensajeros, casi toda la información que recogemos del Universo viene en forma de “luz”.

Luz = radiación electromagnética (un manojo de campos eléctricos y magnéticos vibrando a ciertas frecuencias/longitud de ondas). La energía que acarrea la luz es directamente relacionada con su longitud de onda.



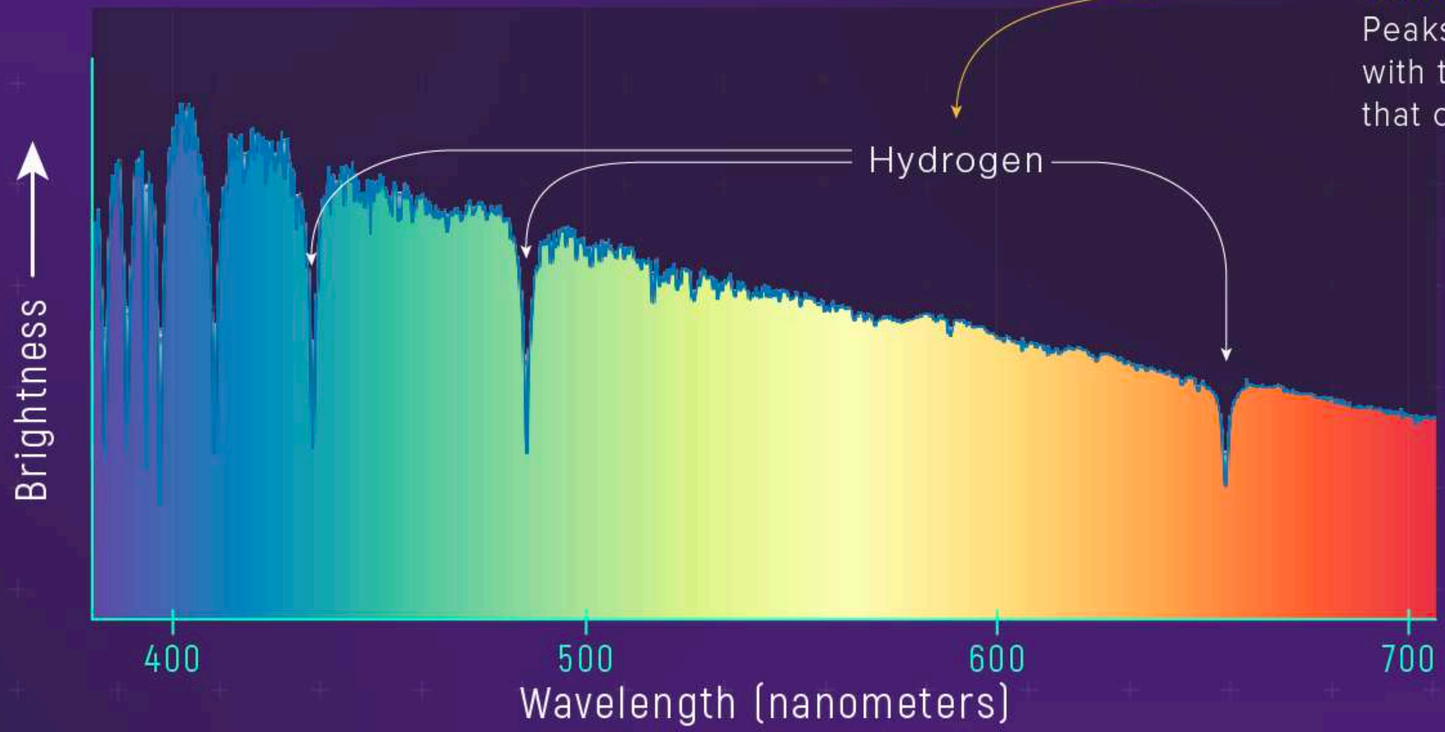
Observatorio ALMA


GAMMA
X-RAY
ULTRAVIOLET
VISIBLE
INFRARED
MICROWAVE
RADIO
WEBB
ROMAN
EUCLID
CHANDRA
FERMI
HUBBLE
ATMOSPHERE
SOFIA
ALMA
RUBIN and ELTs
SKA

NASA, STScI

PICTURE OF A SPECTRUM

GRAPH OF A SPECTRUM



Brightness
(might be labeled as intensity, counts, flux, power, absorbance, transmittance, or reflectance)

Color
(often labeled as wavelength, but can also be labeled as energy or frequency)

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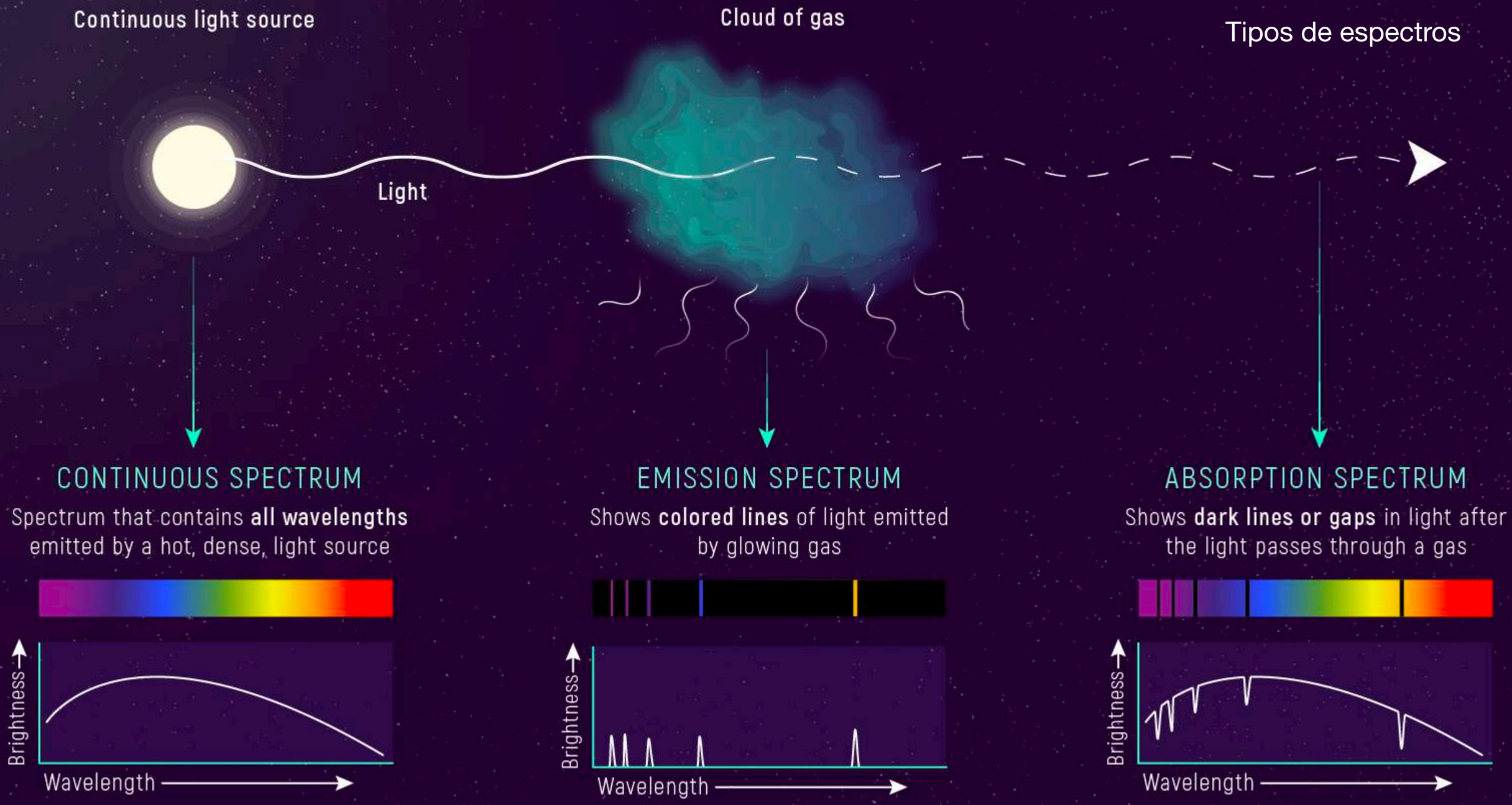
Tipos de espectros



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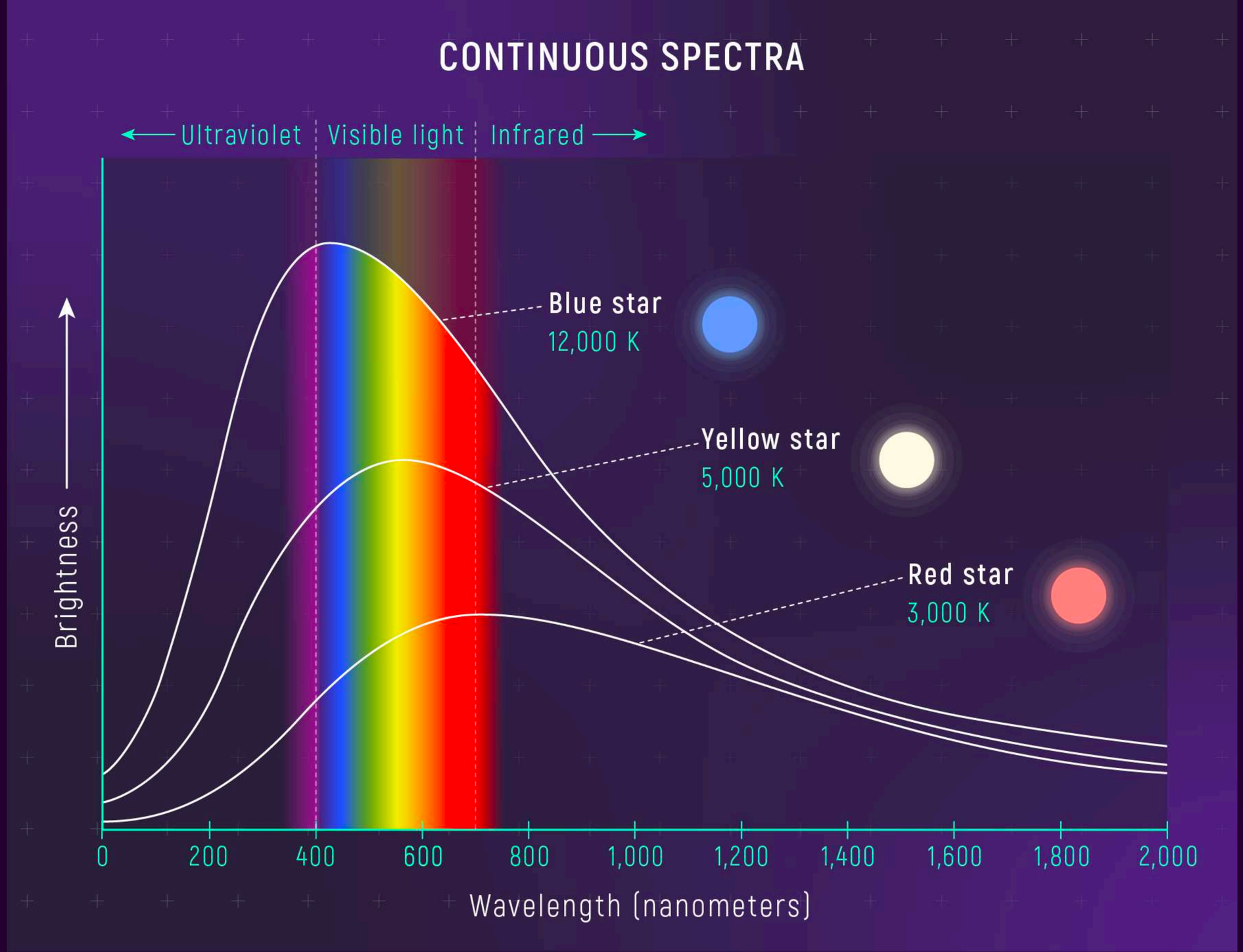

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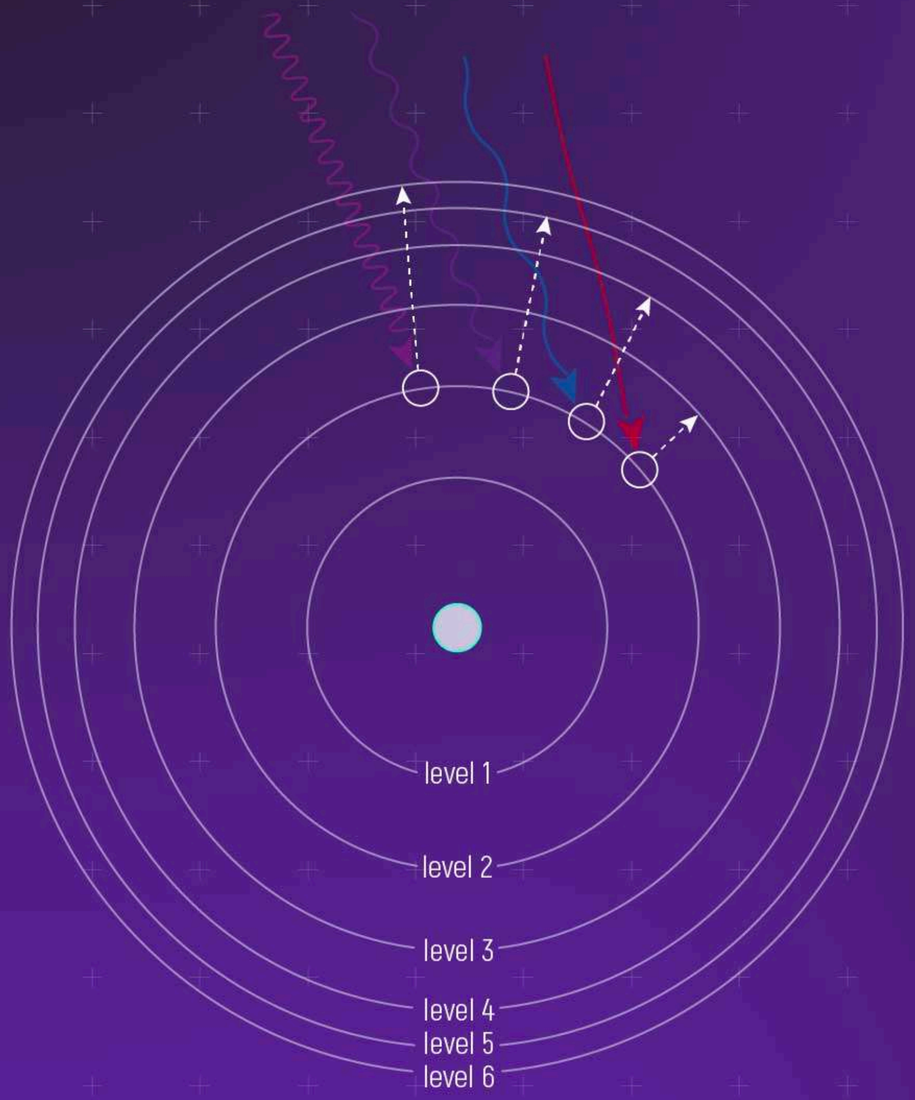
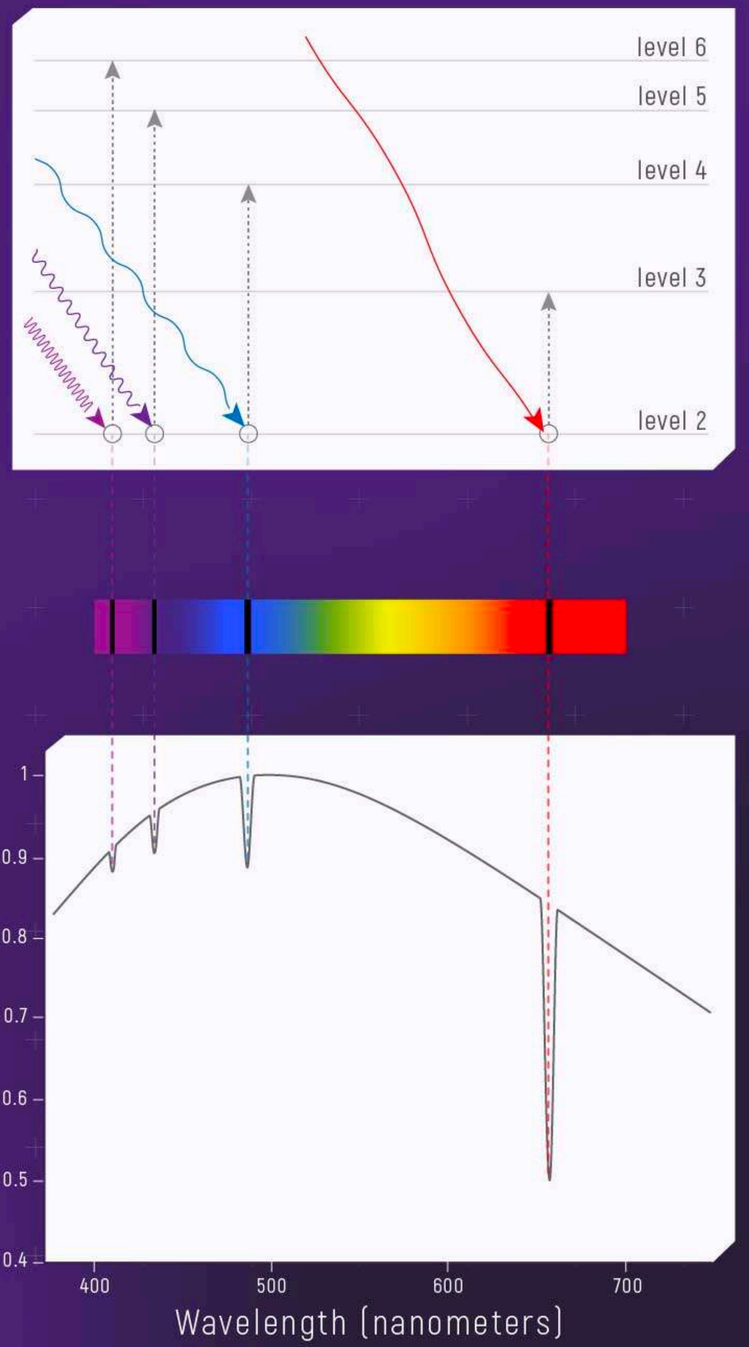
ABSORPTION OF LIGHT BY HYDROGEN





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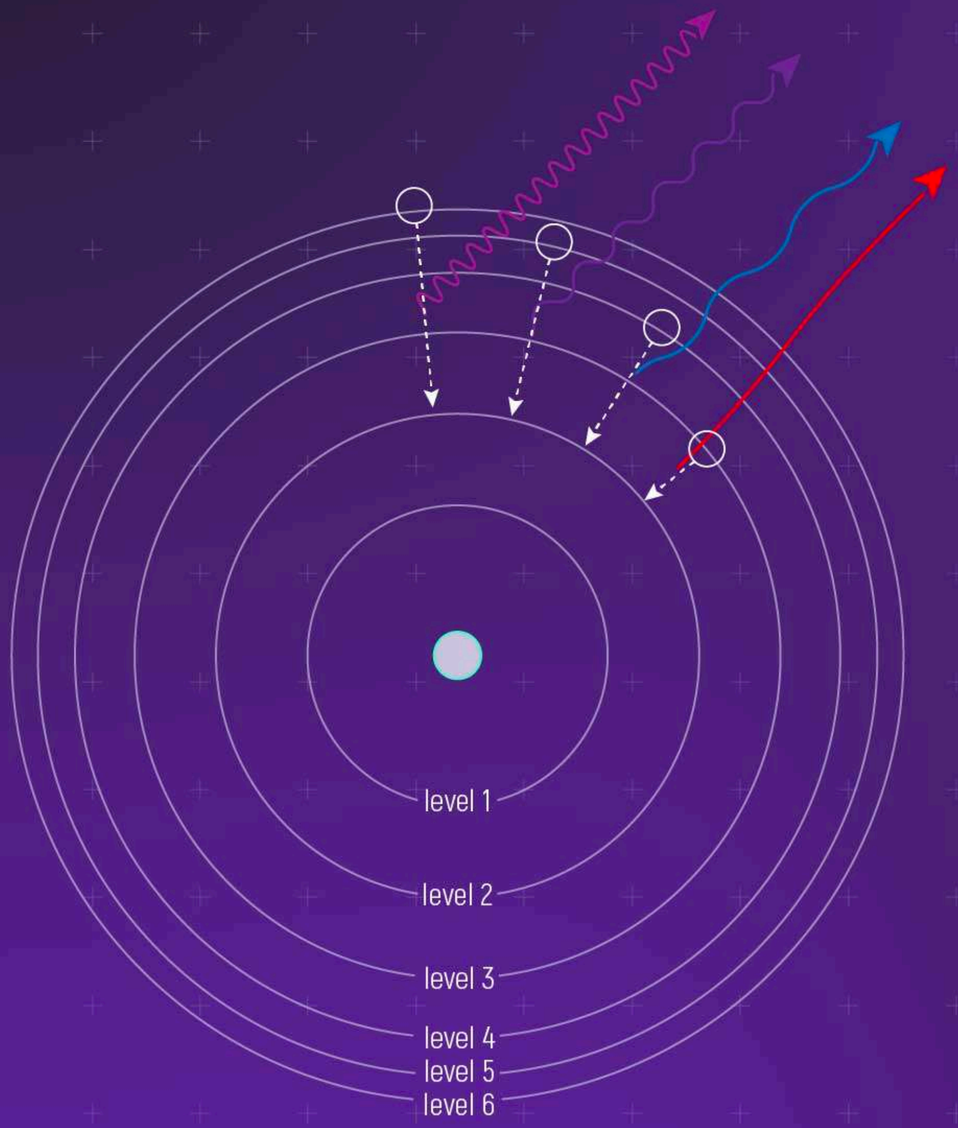
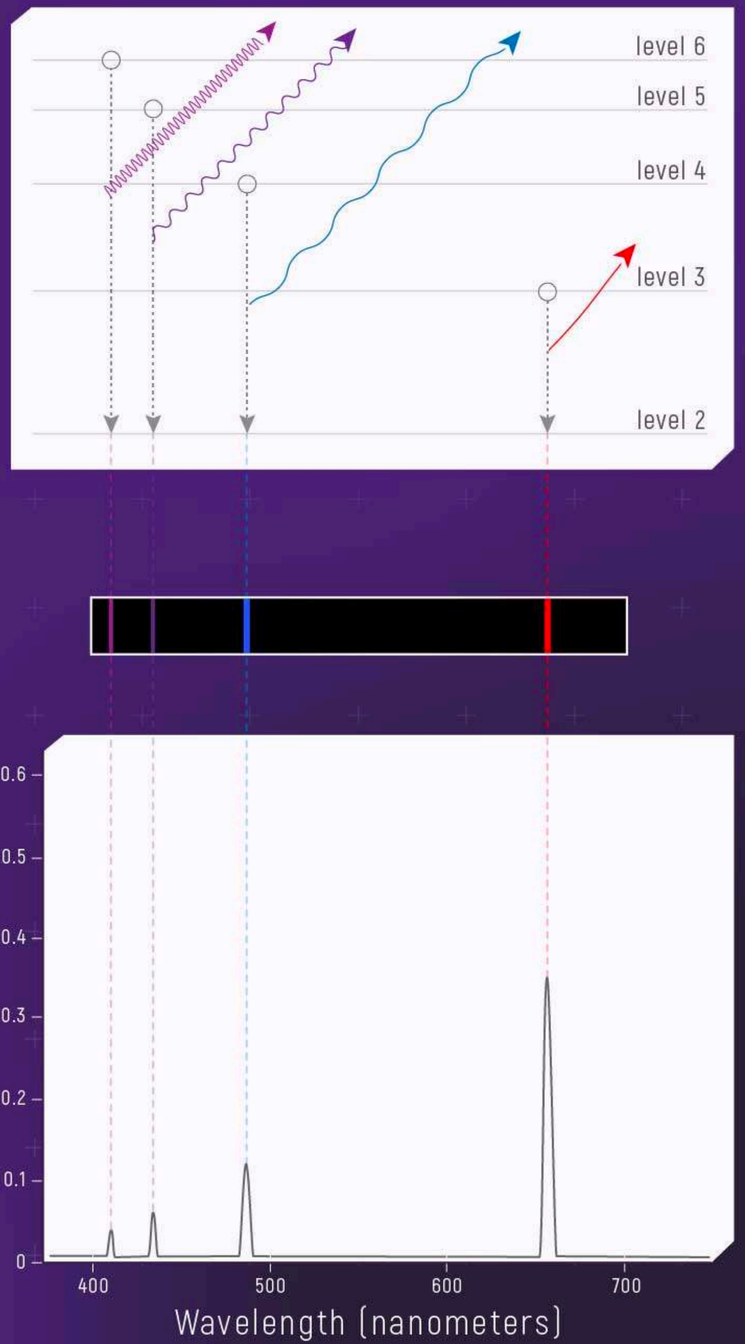
EMISSION OF LIGHT BY HYDROGEN





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ABSORPTION AND EMISSION SPECTRA

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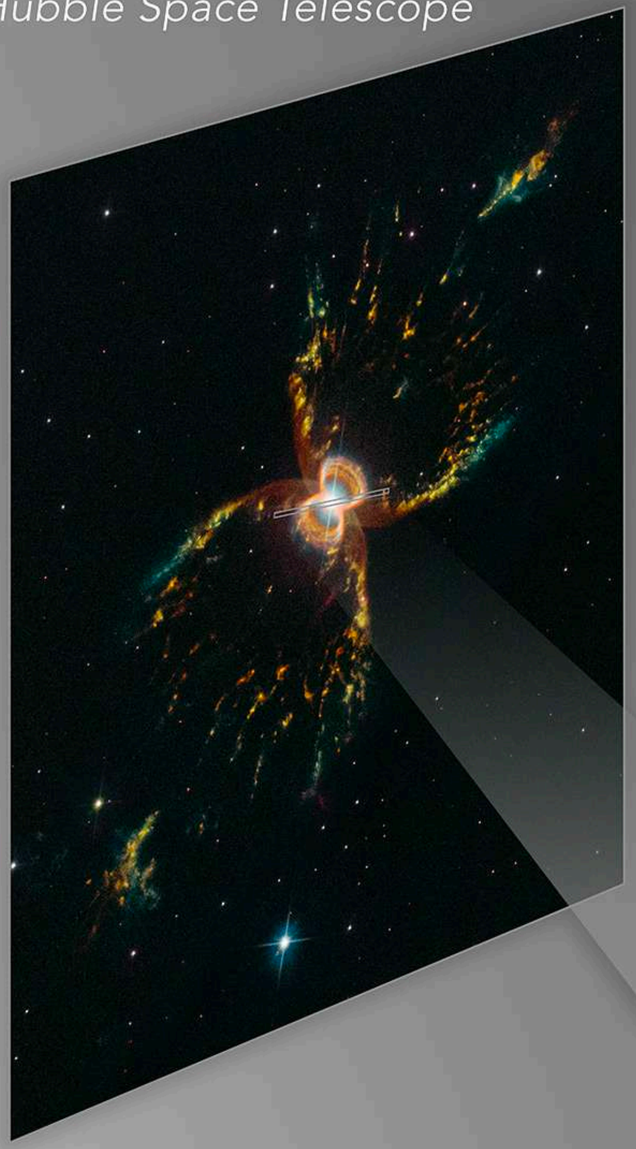
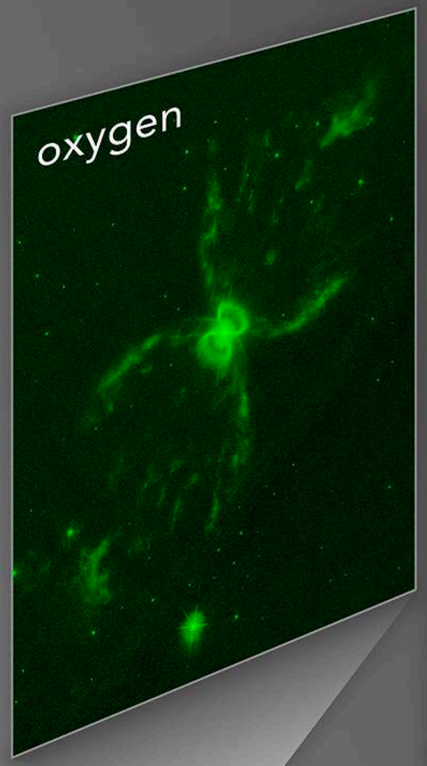
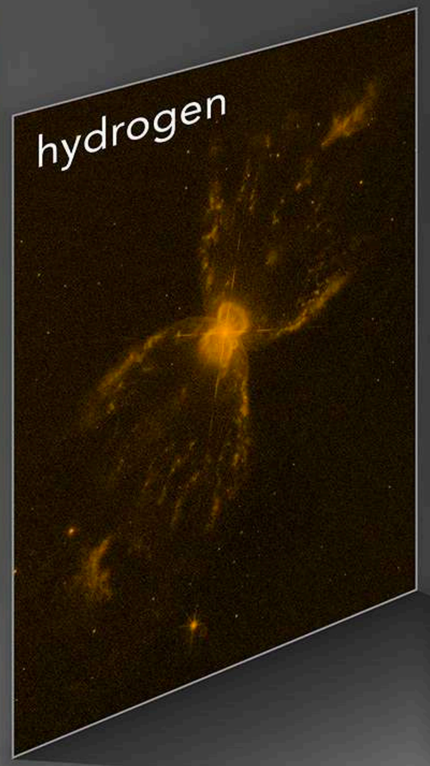
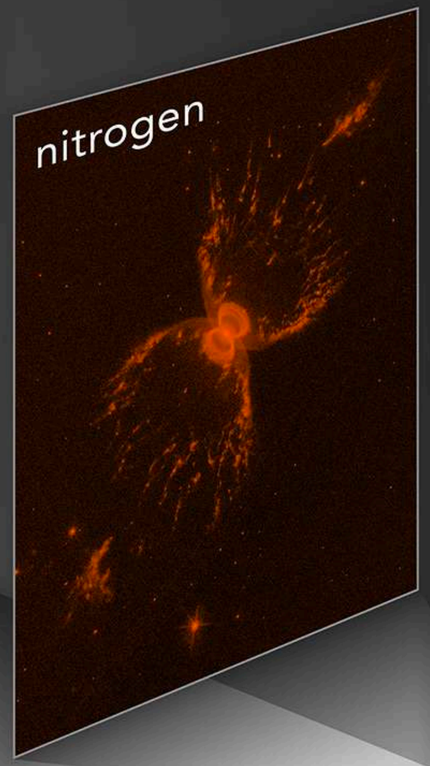
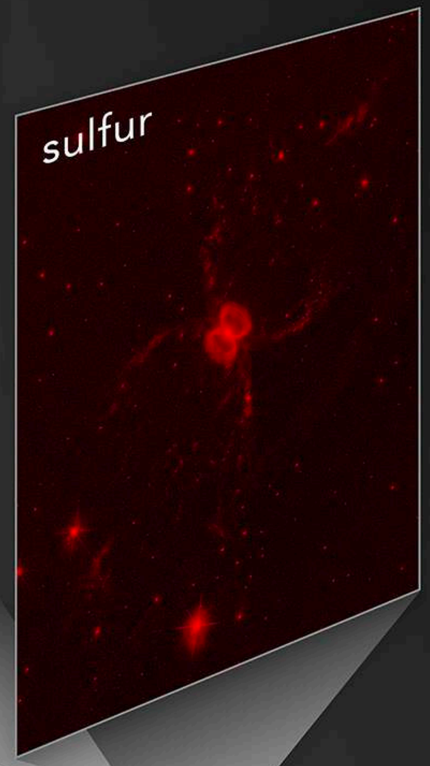
Colors of the Southern Crab Nebula
Hubble Space Telescope

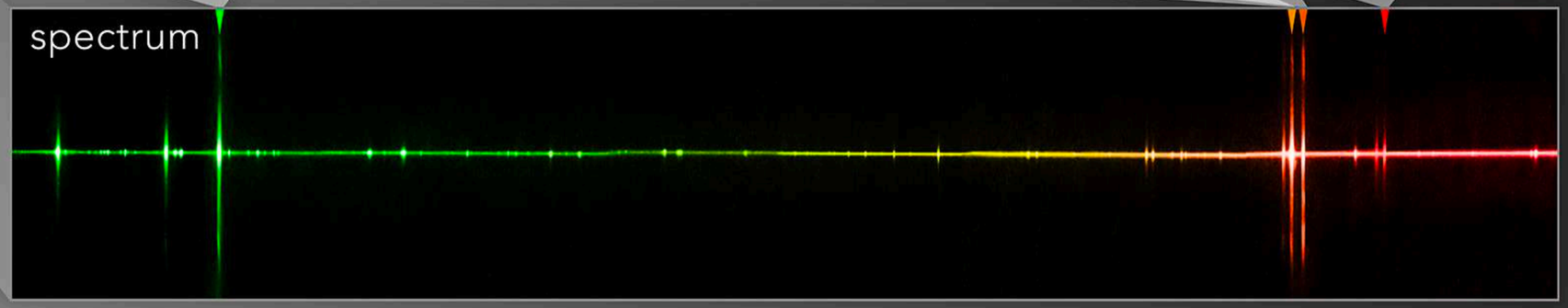












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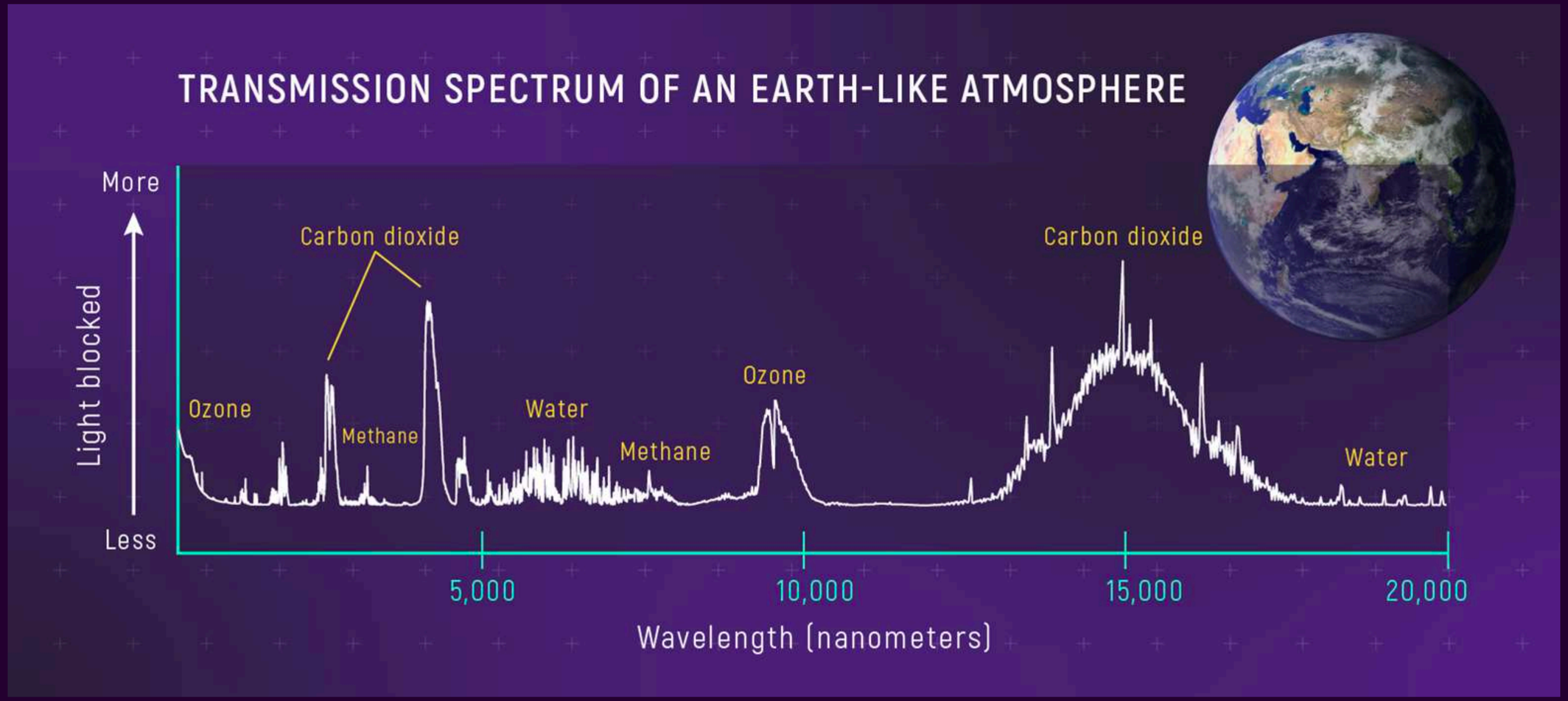

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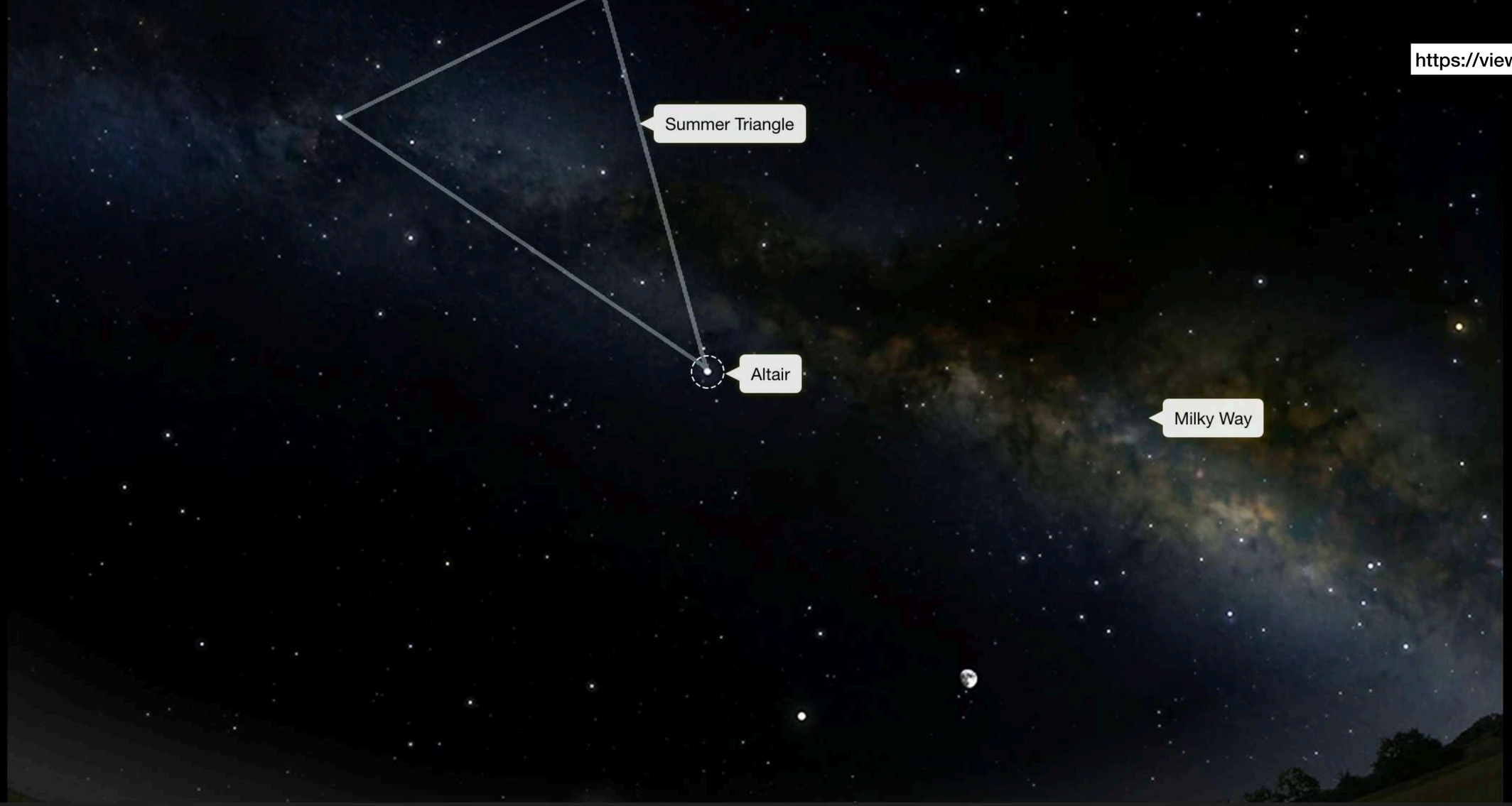
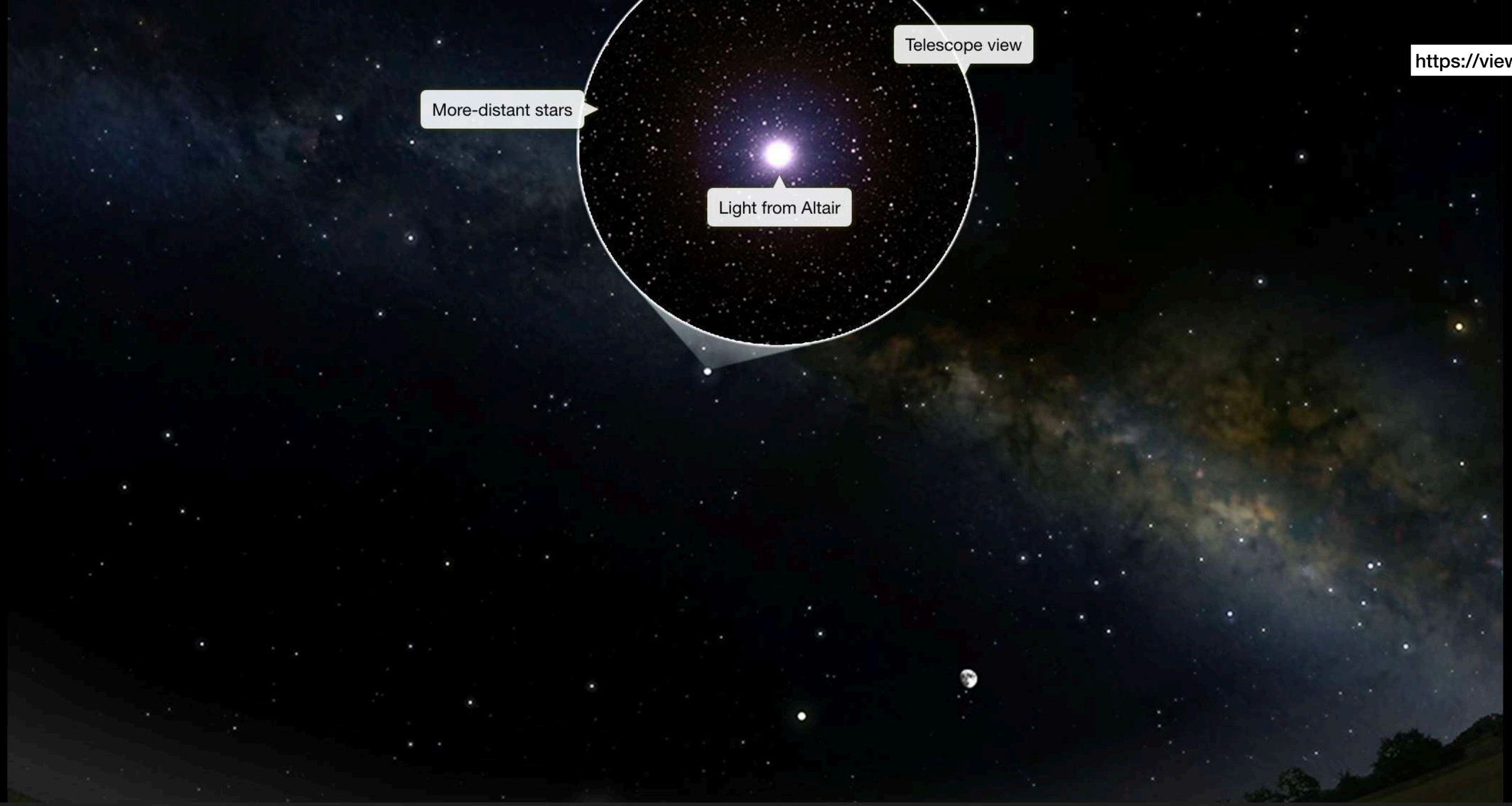
NASA, ESA, Leah Hustak (STScI)

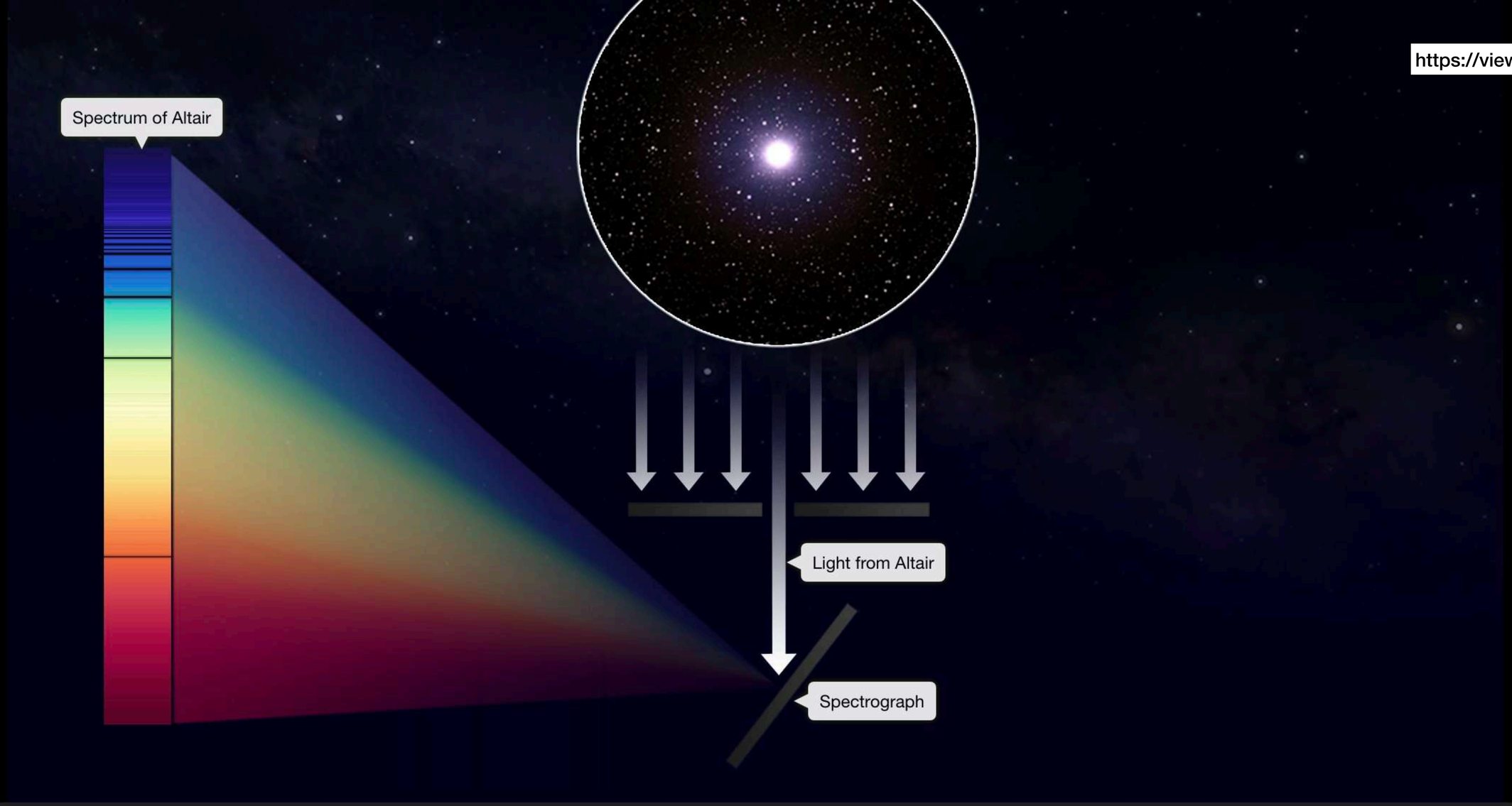


Altair is a bright star visible in the summer night sky in the northern hemisphere.

NAKED-EYE VIEW | TELESCOPE VIEW | SPECTROGRAPH | SPECTRUM | GRAPH | INTERPRETATION

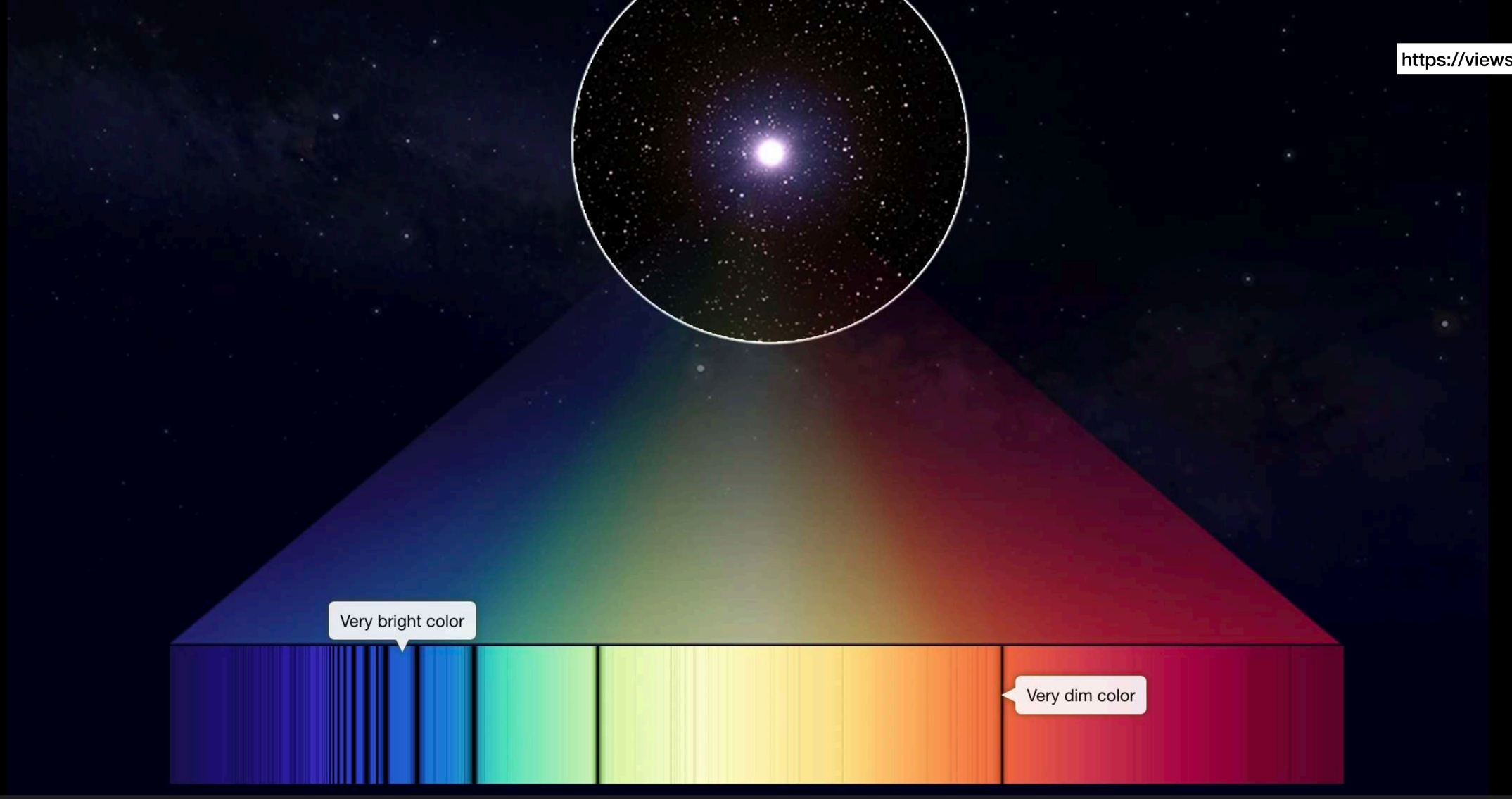


A backyard telescope shows Altair, a relatively close star with a blueish-white color.

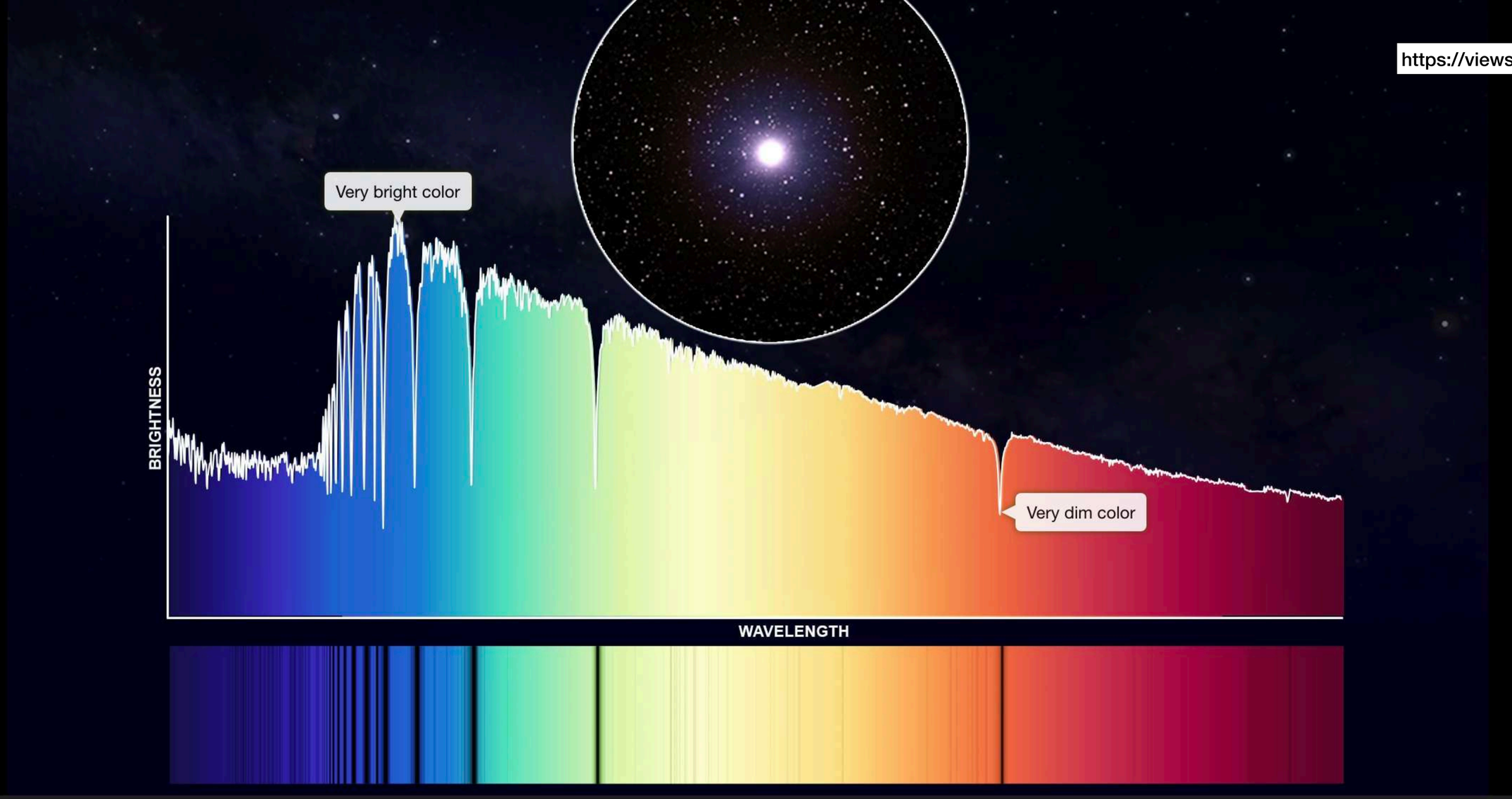


A tool called a spectrograph, which is attached to the telescope, spreads Altair's light out into a spectrum.

NAKED-EYE VIEW | TELESCOPE VIEW | SPECTROGRAPH | SPECTRUM | GRAPH | INTERPRETATION

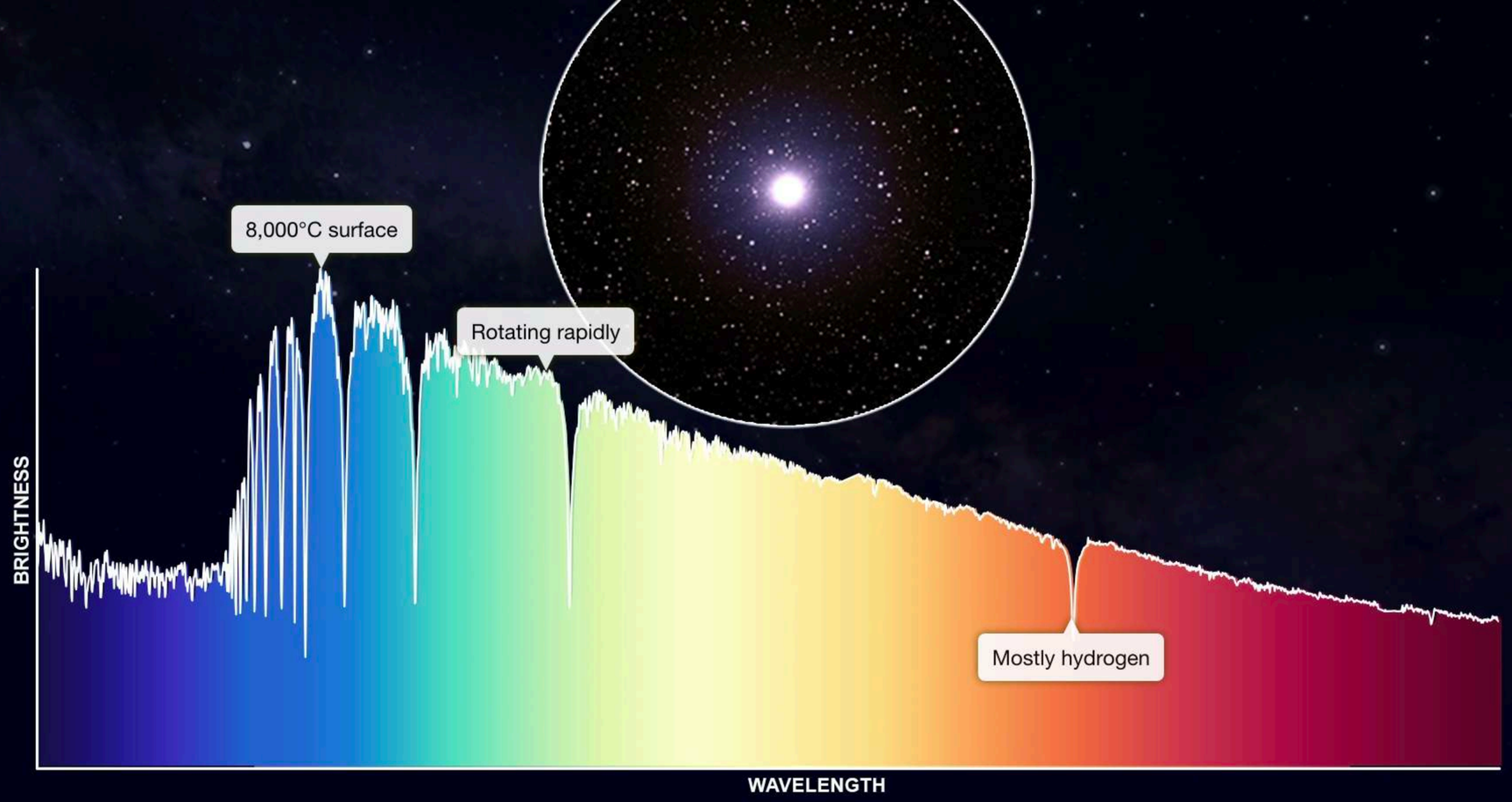


Altair’s spectrum shows that its blueish-white light is actually a mixture of colors of different brightness.



A graph of the spectrum shows exactly how bright each color is.

NAKED-EYE VIEW | TELESCOPE VIEW | SPECTROGRAPH | SPECTRUM | GRAPH | INTERPRETATION

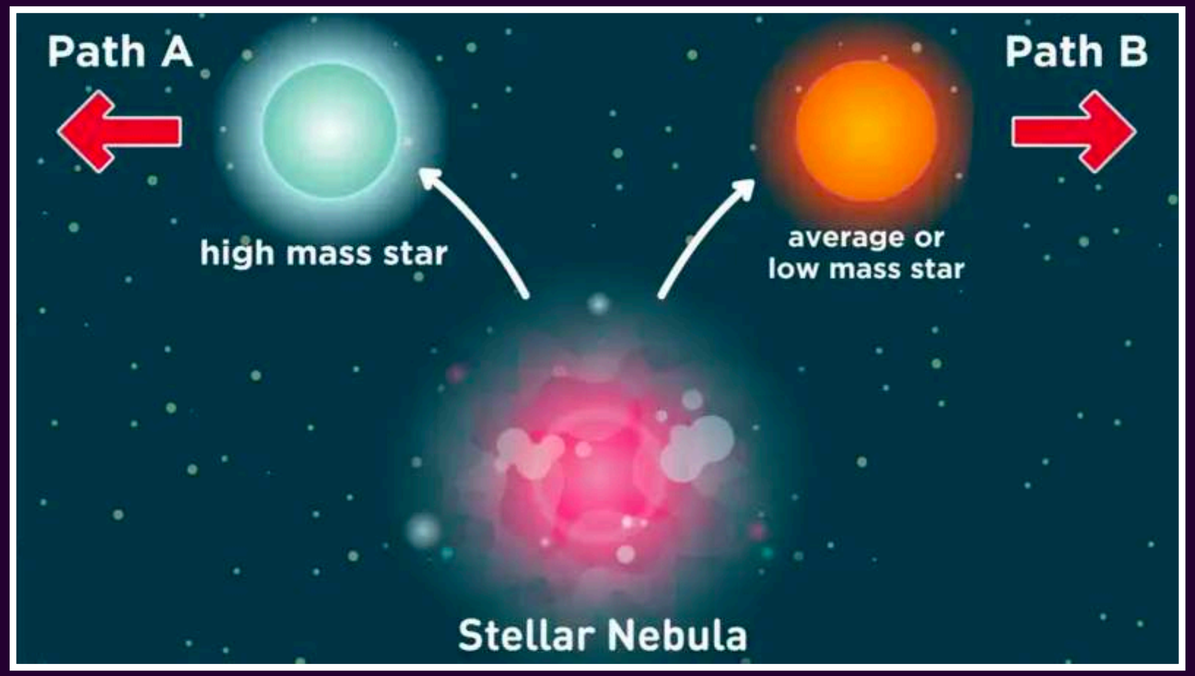


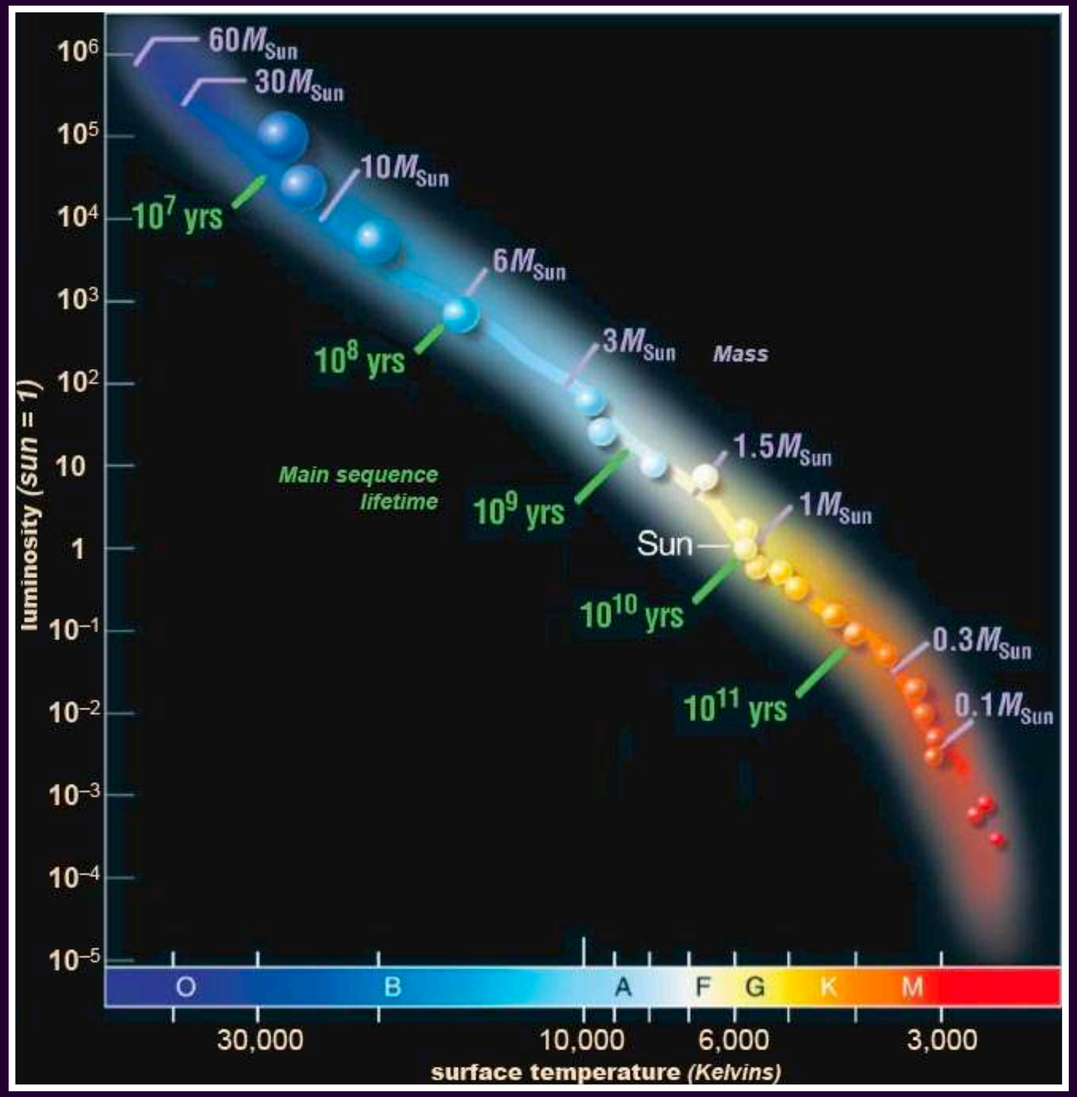
The brightness pattern gives us information about Altair's temperature, composition, and motion.

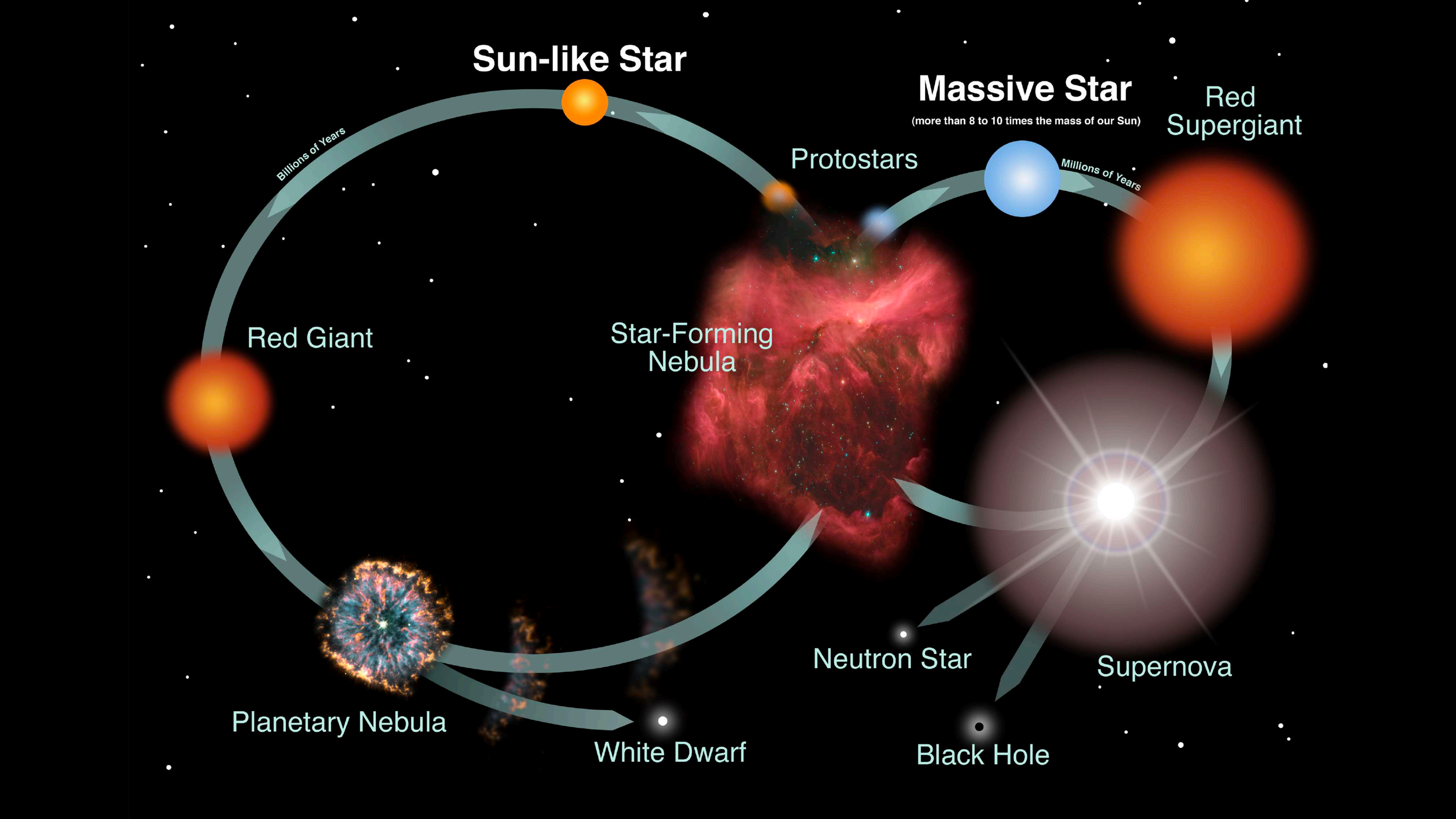
Se puede dividir a las estrellas en dos tipos:

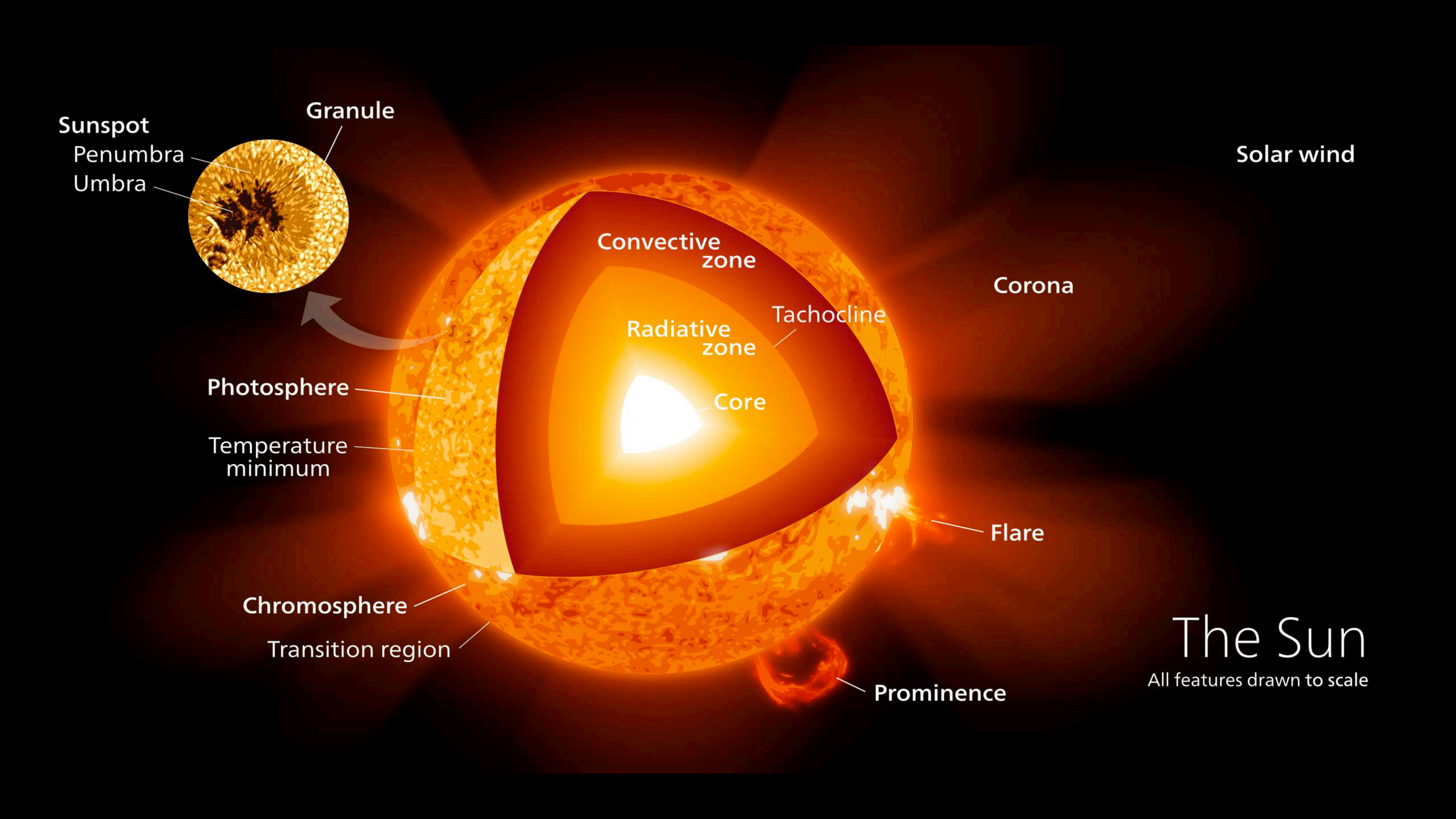
Estrellas de alta masa Estrellas de baja masa

$$M_{\star}^{\text{high mass}} > 8M_{\odot} > M_{\star}^{\text{low mass}}$$






Sun-like Star
Billions of Years
Red Giant
Planetary Nebula
White Dwarf
Star-Forming Nebula
Protostars
Massive Star
(more than 8 to 10 times the mass of our Sun)
Millions of Years
Red Supergiant
Supernova
Neutron Star
Black Hole

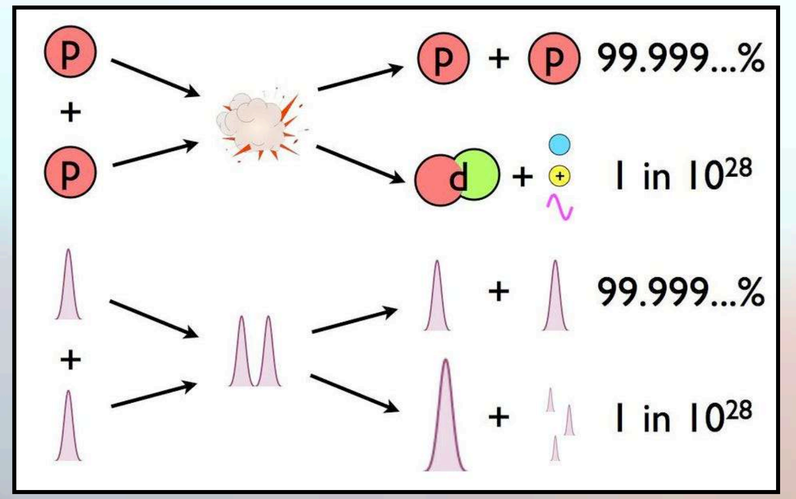

Sunspot
Penumbra
Umbra
Granule
Solar wind
Convective zone
Corona
Tachocline
Radiative zone
Photosphere
Core
Temperature minimum
Flare
Chromosphere
Transition region
Prominence
The Sun
All features drawn to scale

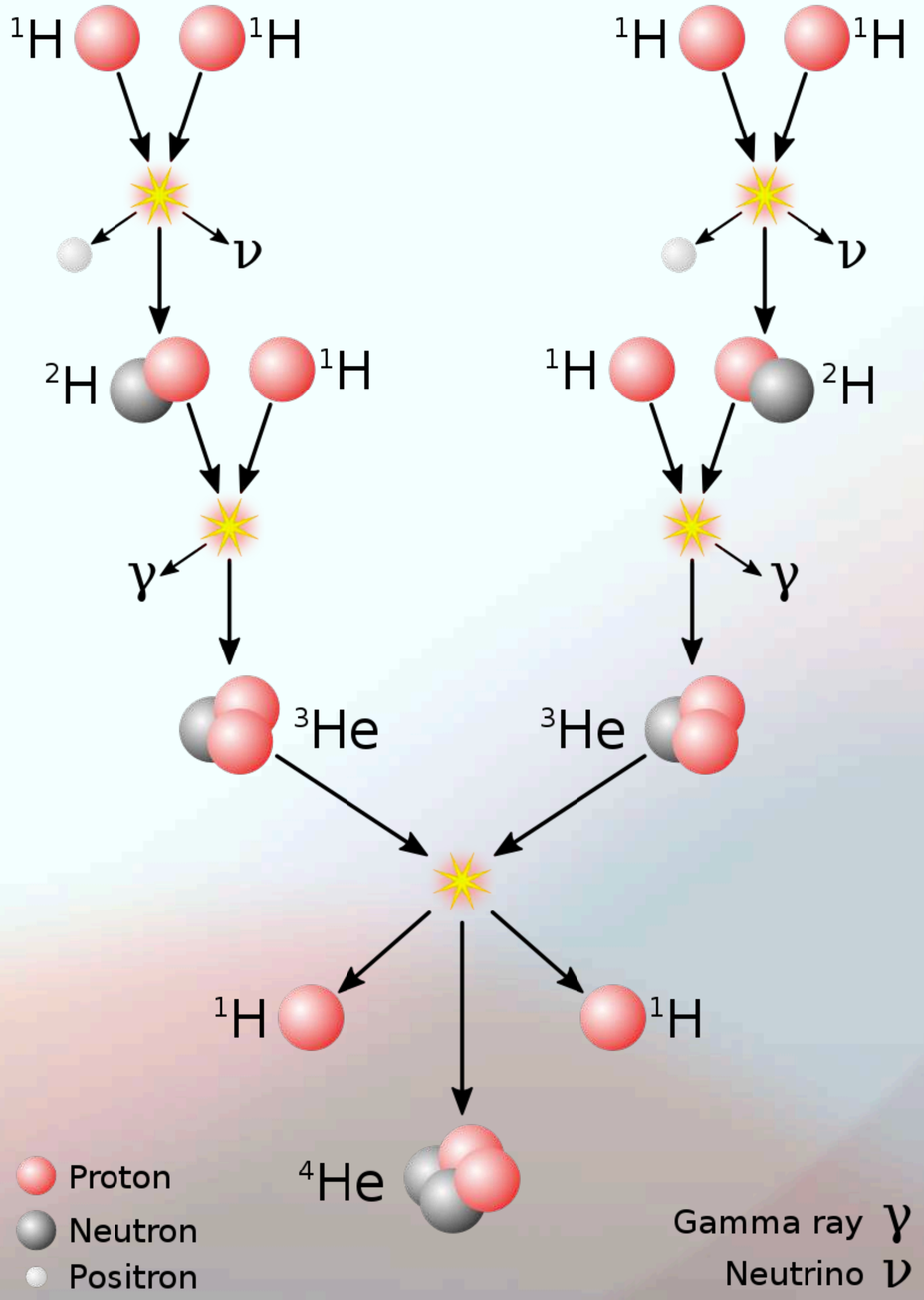
$$4\,{}_{1}^{1}\mathrm{H} \;\rightarrow\; {}_{2}^{4}\mathrm{He} + 2e^{+} + 2\nu_e + 2\gamma$$

Estrellas = reactores de fusión nuclear.

Las estrellas obtienen su energía de la fusión de hidrógeno a helio. Es un proceso complejo pero se puede resumir en que cuatro protones se transforman en un núcleo de helio.

El proceso se llama cadena protón-protón. Pero ¿Qué fuerzas están involucradas? ¿Cúal es el paso más difícil?

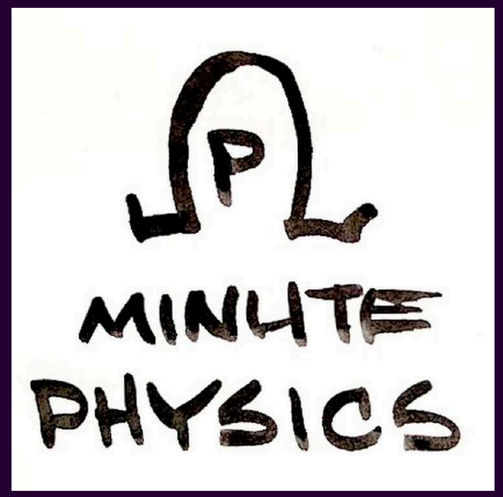




Convección: qué es y por qué es importante en las estrellas?

Recursos web educacionales

Crash Course Astronomy by Phil Plait



YouTube: Minute Physics

WEBB
SPACE TELESCOPE

https://webbtelescope.org/resource-gallery

Recursos web para investigación

https://ui.adsabs.harvard.edu/

http://simbad.u-strasbg.fr/simbad/

https://skyview.gsfc.nasa.gov/current/cgi/query.pl