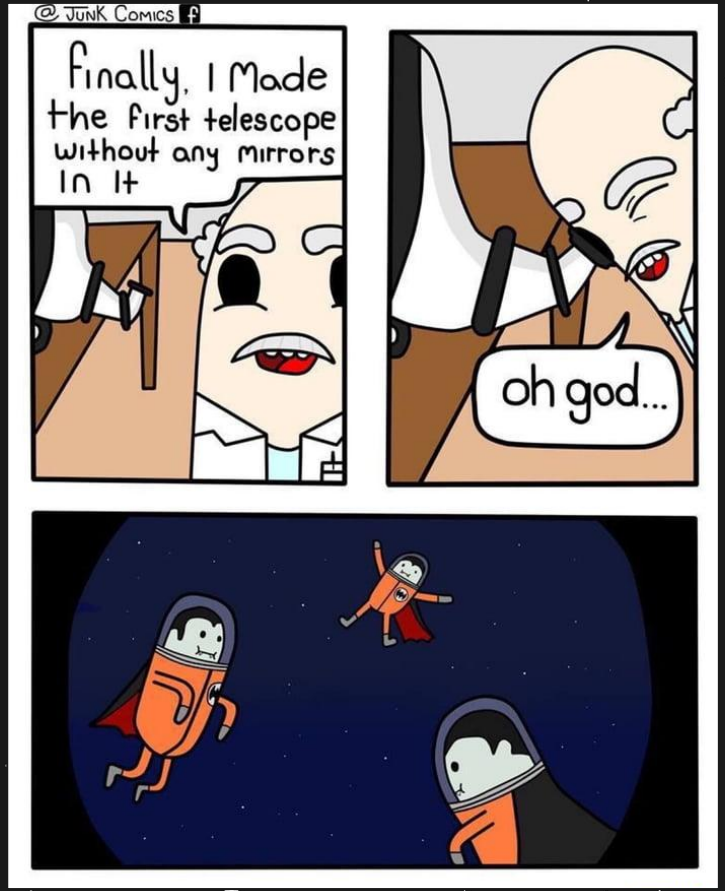
Prospects for Detection of Space Vampires

Addy J. Evans

AoT Nov. 24th, 2021



Can we detect space vampires?


@ JUNK COMICS
Finally, I Made the first telescope without any mirrors In It

???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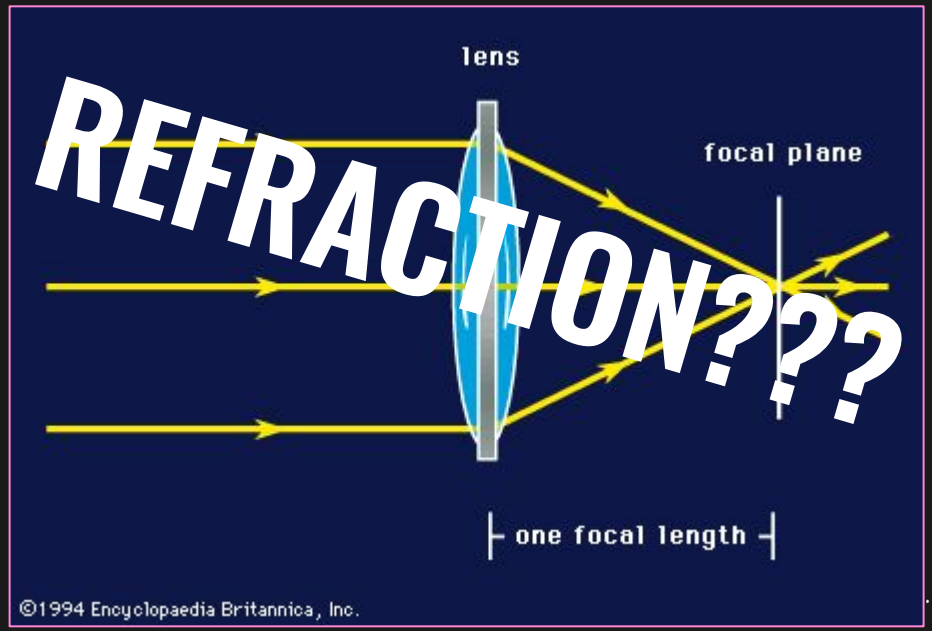
lens
focal plane
REFRACTION???
one focal length
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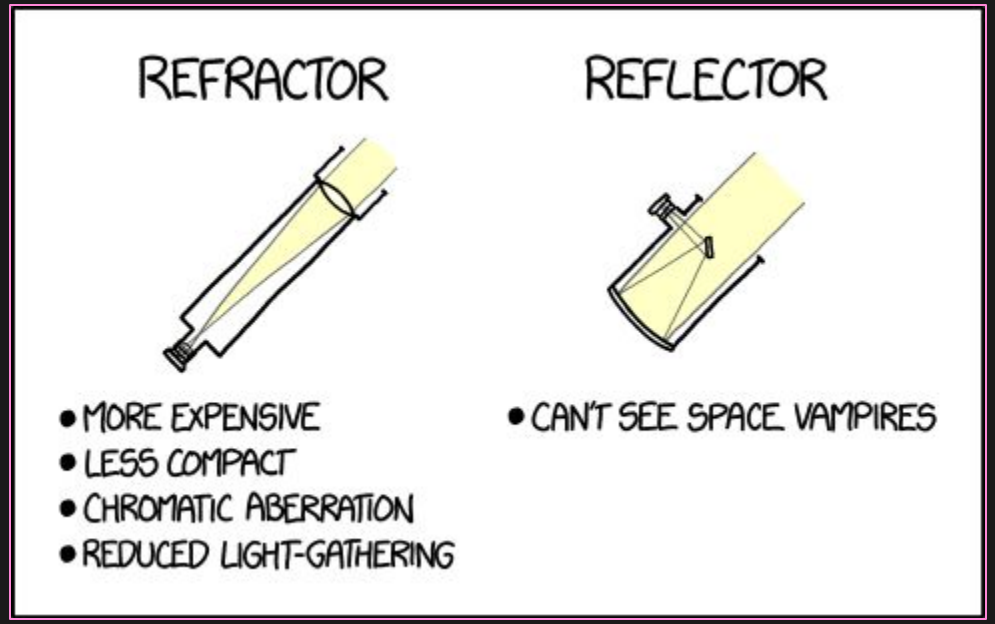
Reflecting vs. refracting telescopes



xkcd

The Yerkes Observatory: the largest refracting telescope ever made

→ 40 inch aperture!

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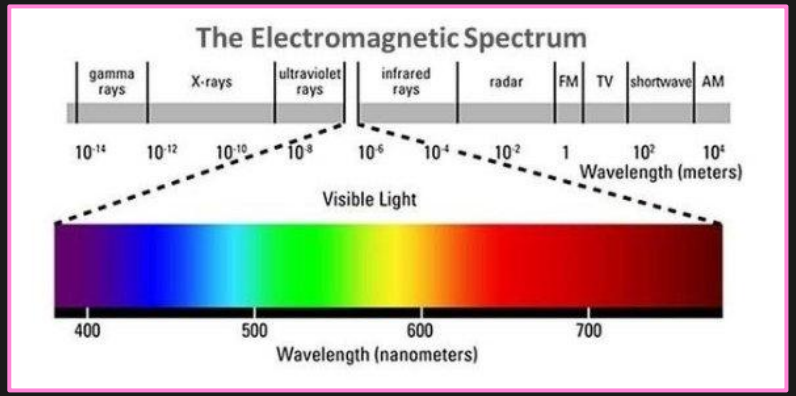
→ Can we use this to detect space vampires?

What wavelength does vampiric radiation peak at?

40 inch aperture!
Has a limiting magnitude of ~ 17
Can we use this to detect space vampires???

→ Ideally, you want to search for an object in the wavelength regime that it's brightest at!



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We can answer this question using...

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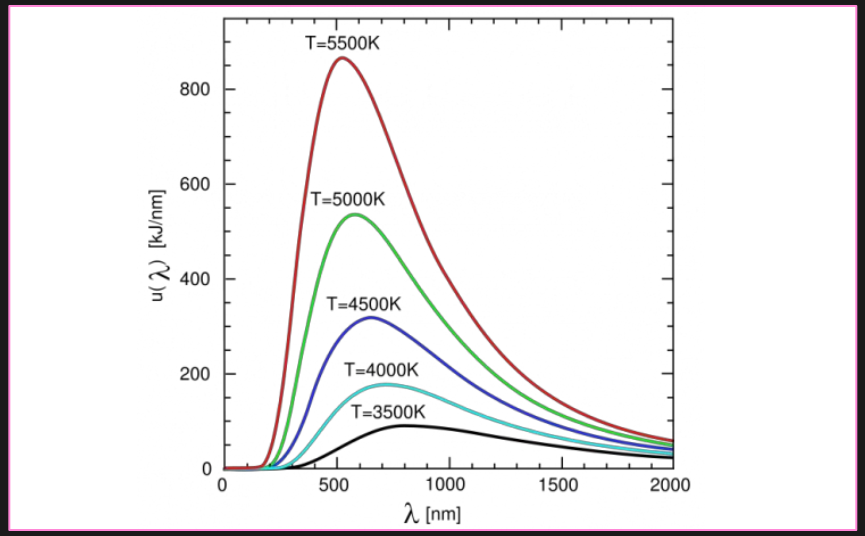

Blackbody radiation!

What wavelength does vampiric radiation peak at?

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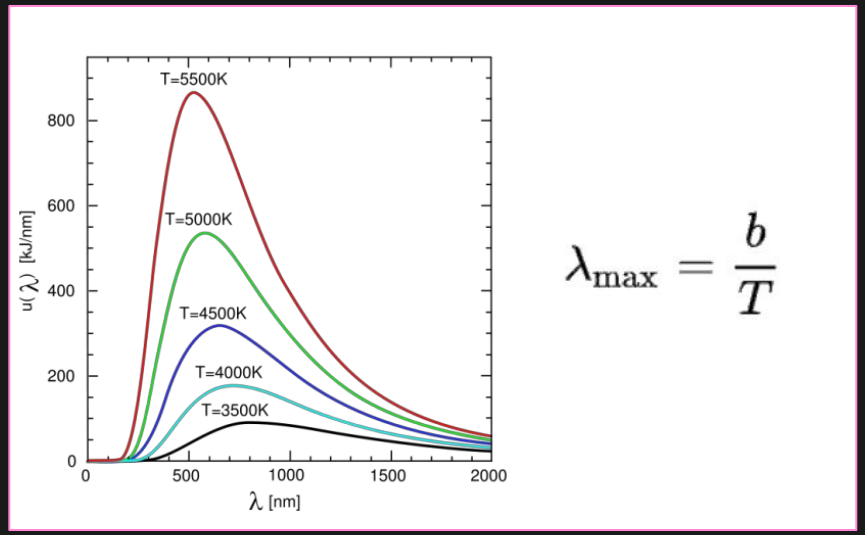
And also...



$$\lambda_{max} = \frac{b}{T}$$

Wien's Displacement Law (a result of assuming blackbody radiation)!

But wait...what is the temperature of a vampire *actually*?

$$\lambda_{\max} = \frac{b}{T}$$

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→ The human body begins to sustain burns around ~ 120 degrees Fahrenheit

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→ The human body begins to sustain burns around ~ 120 degrees Fahrenheit

→ Let's say for funsies that vampires can withstand the temperature of space, -450 degrees Fahrenheit

The peak wavelength of a space vampire at the theoretically well-motivated maximum temperature

$$\lambda_{max} = \frac{b}{T}$$

???

λ_{max} = b / T

b = 2898 microns Kelvin

T = our very scientific temperature,
120 degrees Fahrenheit = 322 Kelvin

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λ_{max} = b/T = 9 microns

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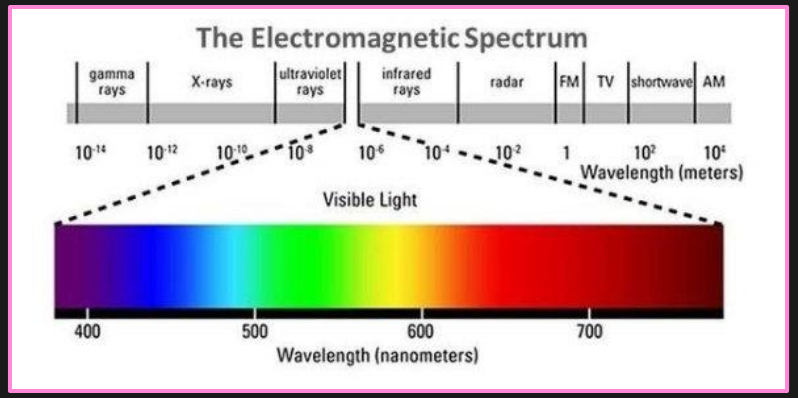

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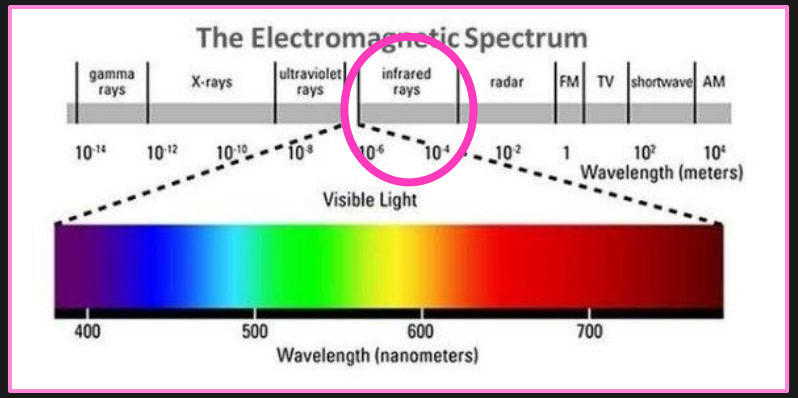

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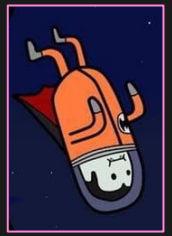
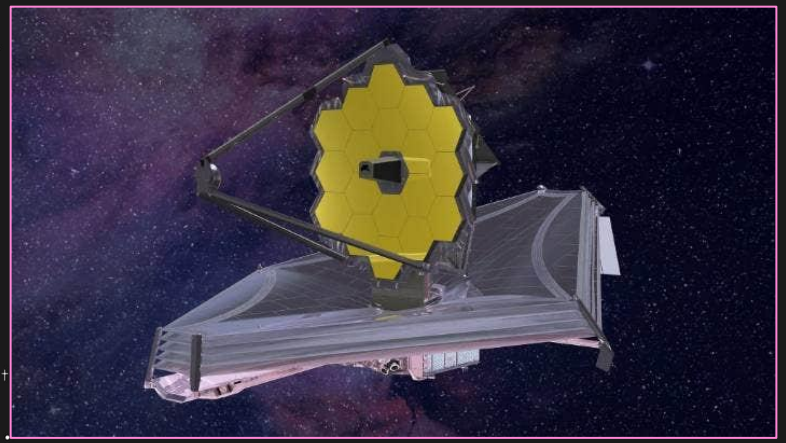
→ Refractors are only good for looking at objects that emit at optical wavelengths

→ Can we see space vampires with other kinds of telescopes?



The NIRCam on JWST



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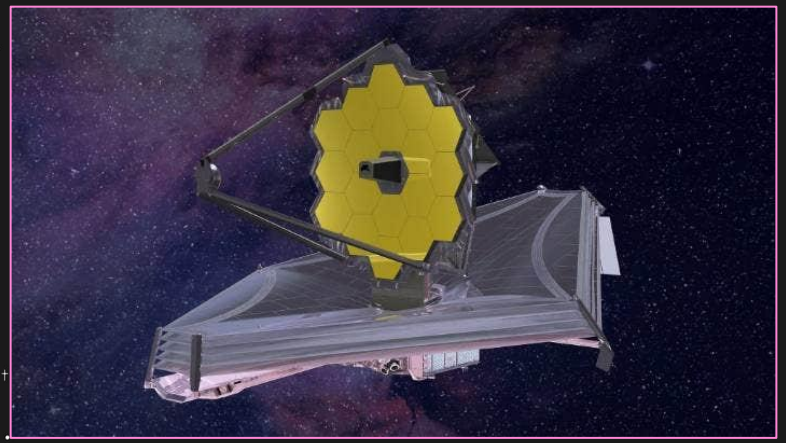

→ Sensitive to wavelengths of 0.6 to 20 microns

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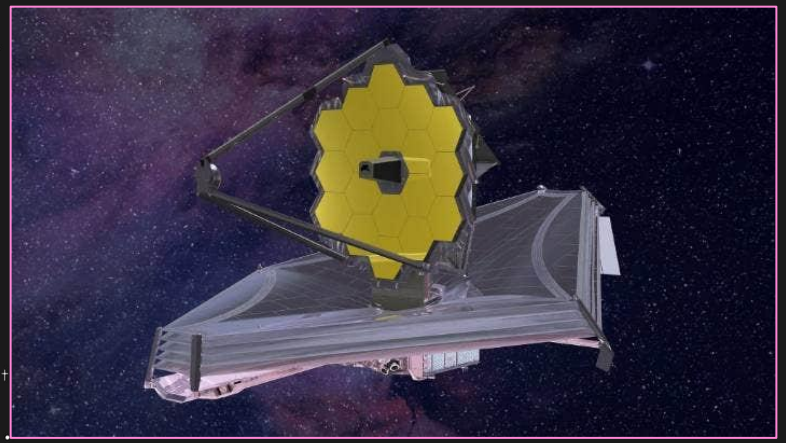


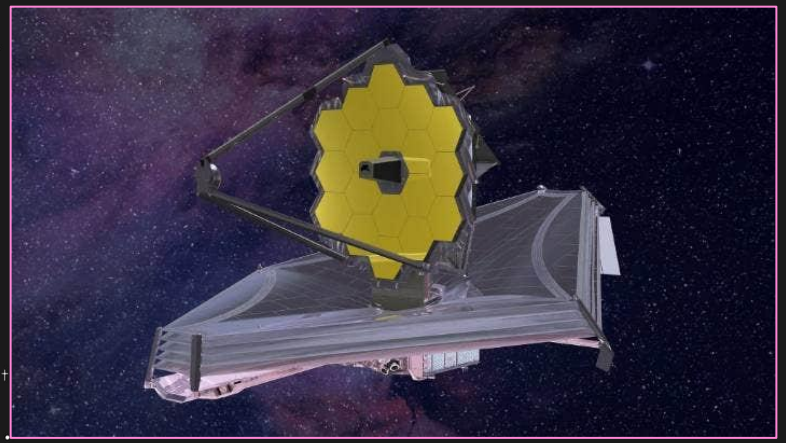
→ Sensitive to wavelengths of 0.6 to 20 microns

We can use the sensitivity of the instrument to define a lower limit on the temperature of the vampire:

$\lambda_{max} = b / T = 20$ microns

T = 144.9 Kelvin = -199 degrees Fahrenheit

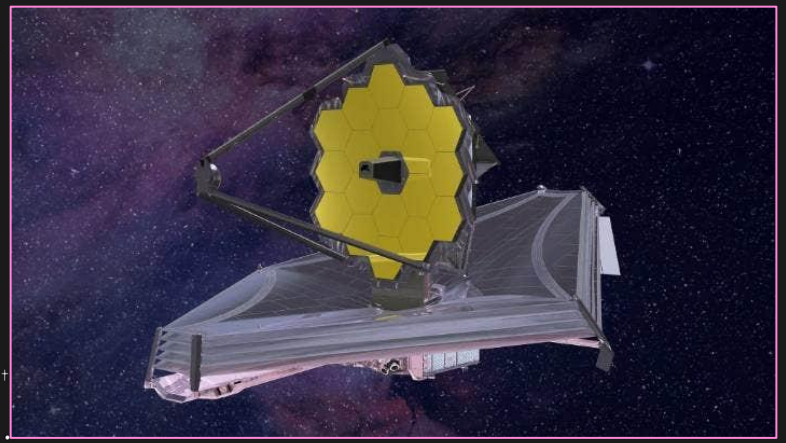
The NIRCam on JWST



→ Sensitive to wavelengths of 0.6 to 20 microns

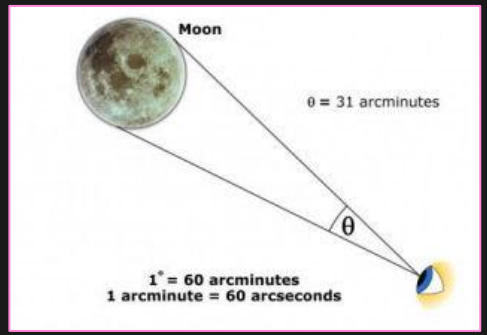
Now we know for detection of space vampires using NIRCam, the vampiric temperature range is -199 to 120 degrees Fahrenheit

The NIRCam on JWST



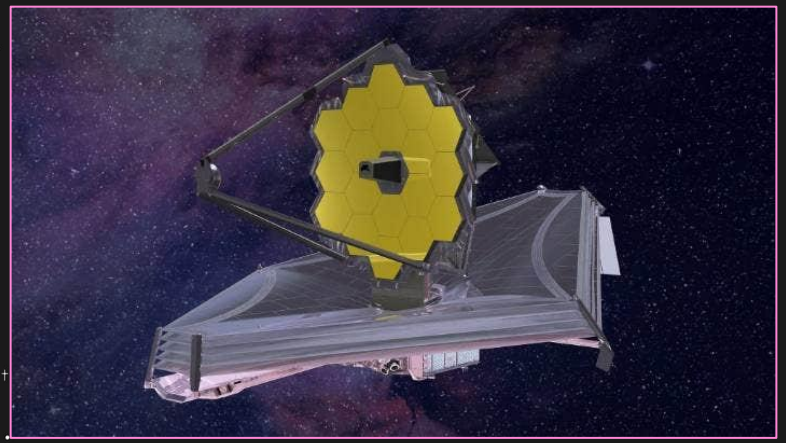
→ Sensitive to wavelengths of 0.6 to 20 microns

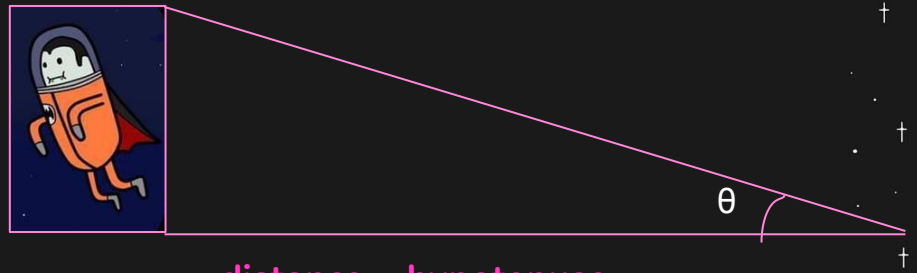
→ Has an angular resolution of ~0.01 arcseconds



Now we know for detection of space vampires using NIRCam, the vampiric temperature range is -199 to 120 degrees Fahrenheit

At what distance could JWST see a human-sized space vampire?





distance ~ hypotenuse

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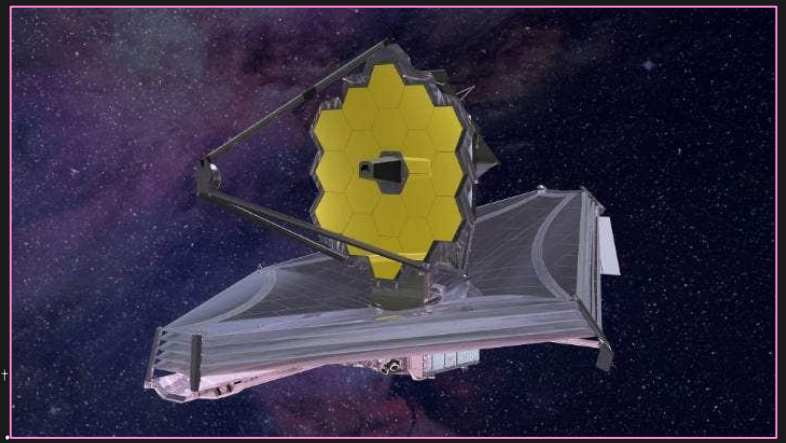

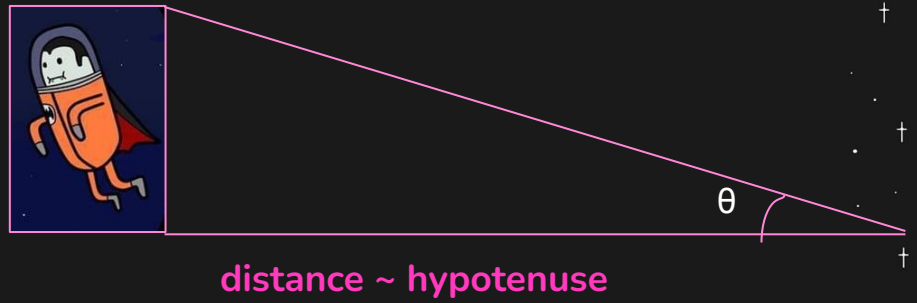

distance ~ hypotenuse

Vampire height ~ 6 ft = 1.8 meters
θ = 0.01 arcseconds

sinθ = 1.8 meters / hypotenuse

→ θ = 0.01 arcseconds = 1.8 meters / distance

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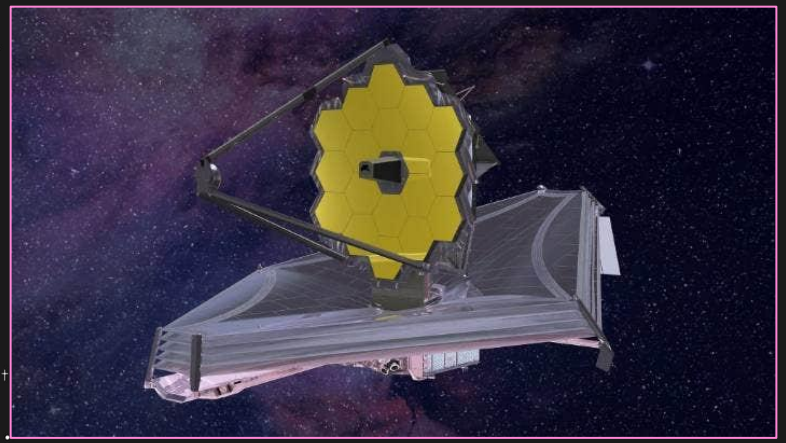

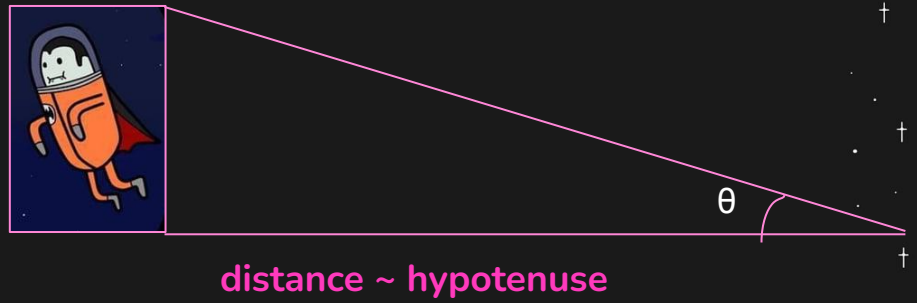

distance ~ hypotenuse

Vampire height ~ 6 ft = 1.8 meters

θ = 0.01 arcseconds

distance ~ 23,000 miles

sinθ = 1.8 meters / hypotenuse

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In comparison...

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→ The moon is ~230,000 miles away

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→ GPS satellites orbit the Earth at ~ 12,000 miles

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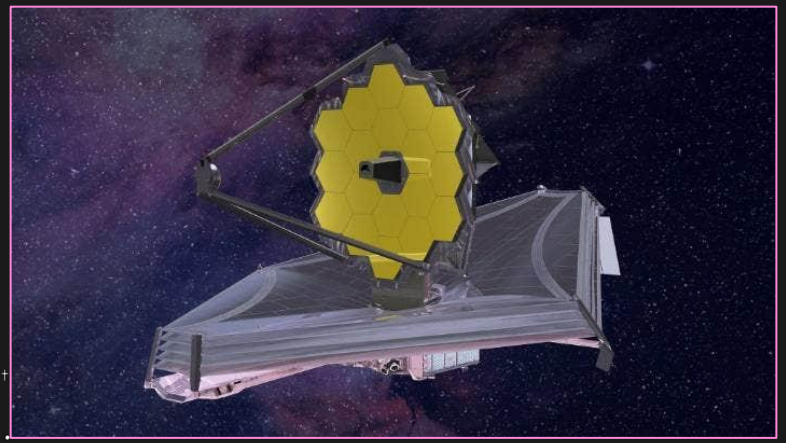
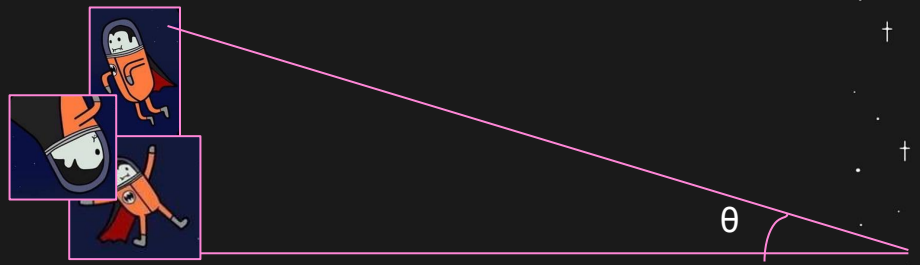
→ The moon is ~230,000 miles away

→ GPS satellites orbit the Earth at ~ 12,000 miles

→ Satellites in geosynchronous orbit are at ~ 22,000 miles

At what distance could JWST see a space vampire conglomerate?





But first: where would we expect to find space vampires based on environment?

→ Vampires don’t like sunlight (starlight).
So maybe...

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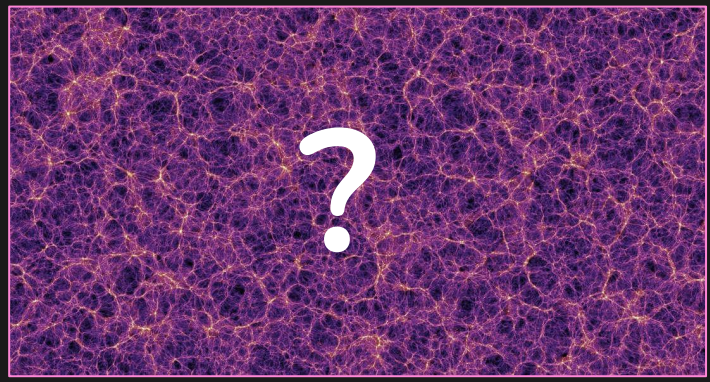

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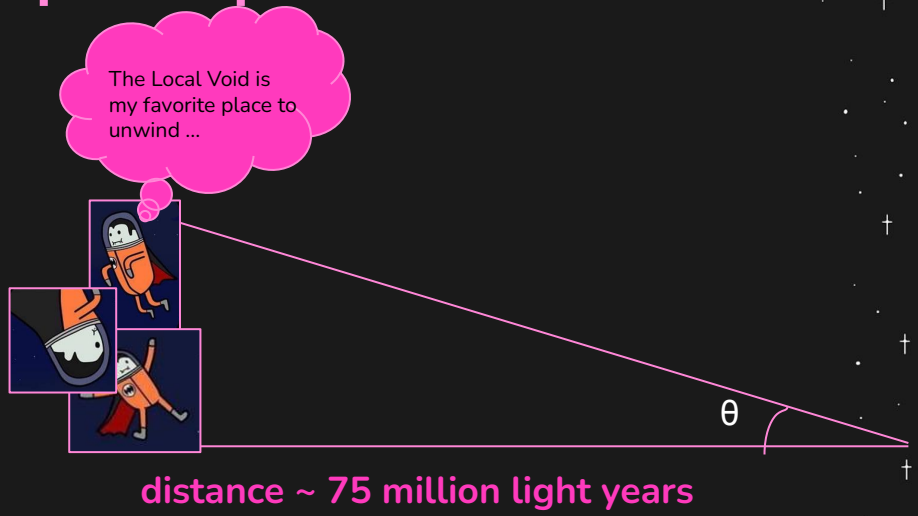
→ *The Local Void* ?



distance ~ 75 million light years

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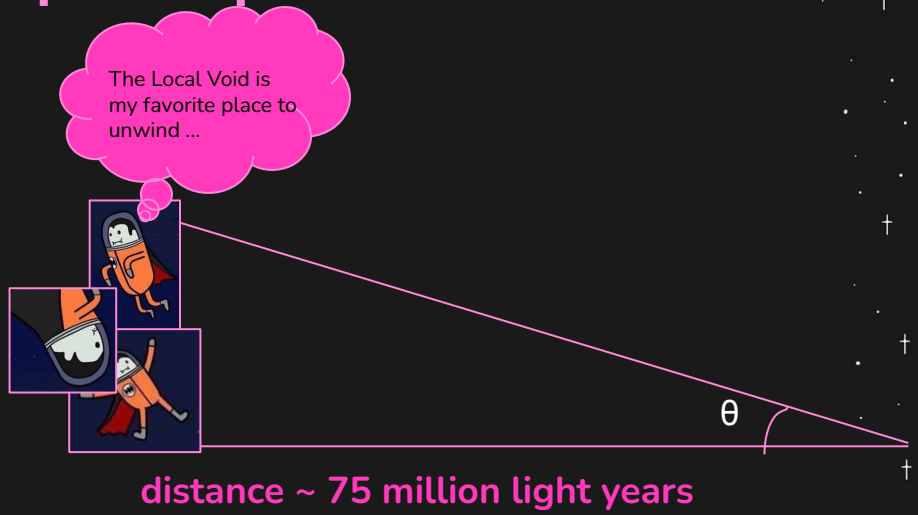

Vampire conglomerate size = ???
θ = 0.01 arcseconds

sinθ = ??? / hypotenuse

→ θ = ??? / distance

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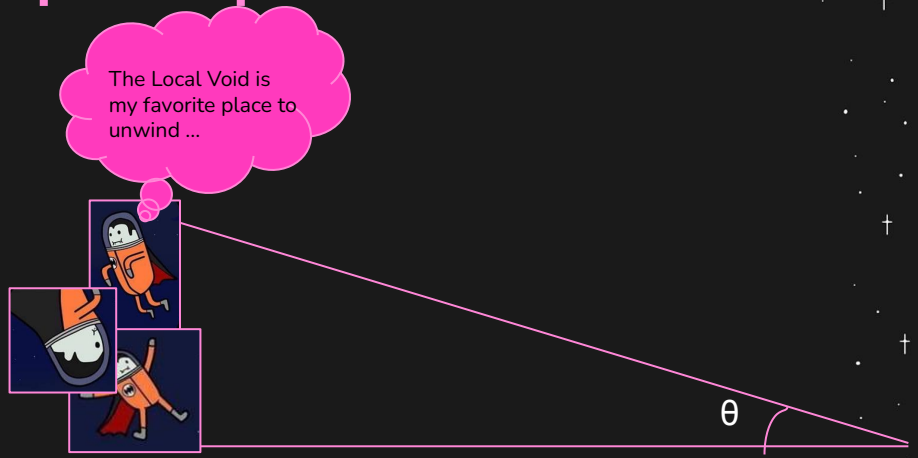

distance ~ 75 million light years

conglomerate size ~ 3.63 light years

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→ Rogue planets?

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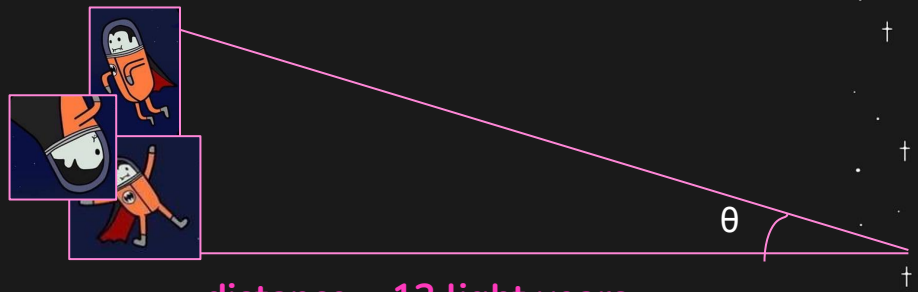

distance ~ 13 light years

conglomerate size ~ 20 light seconds

~ 3 million miles

Future work

→ What if vampires sparkle?

Future work

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→ What if vampires sparkle?

→ Vampires as dark matter?

Future work

→ What if vampires s

→ Vampires as dark m

THANKS FOR LISTENING :-)

THANKS!

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