

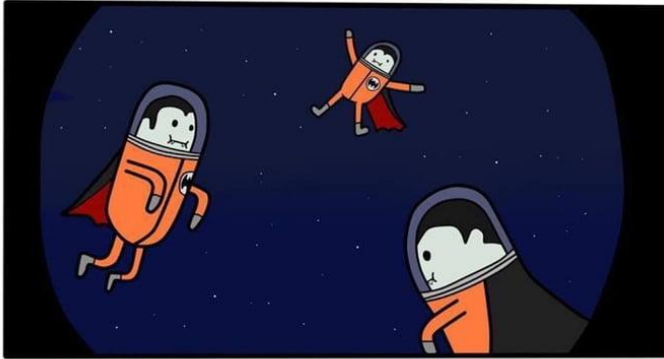
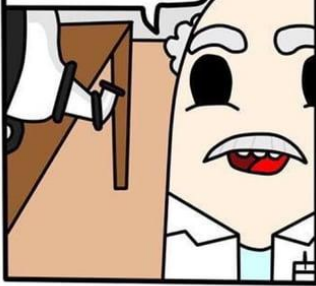


Prospects for Detection of Space Vampires

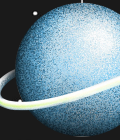
Addy J. Evans
AoT Nov. 24th, 2021

@JUNK COMICS f

Finally, I made
the first telescope
without any mirrors
in it



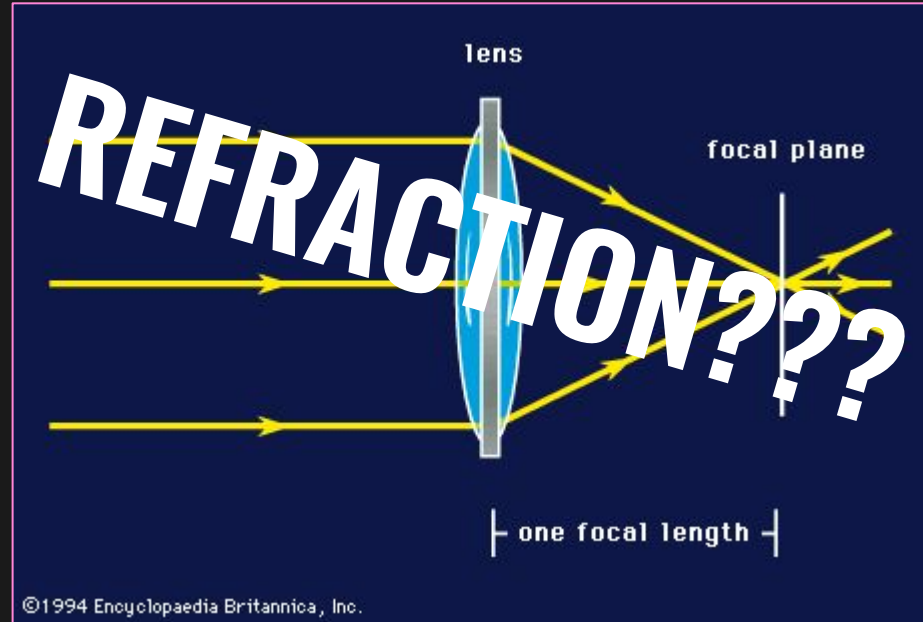
Can we detect
space vampires?



???



???



Reflecting vs. refracting telescopes

REFRACTOR



- MORE EXPENSIVE
- LESS COMPACT
- CHROMATIC ABERRATION
- REDUCED LIGHT-GATHERING

REFLECTOR



- CAN'T SEE SPACE VAMPIRES

xkcd

The Yerkes Observatory: the largest refracting telescope ever made



→ 40 inch aperture!

The Yerkes Observatory: the largest refracting telescope ever made



→ 40 inch aperture!

→ Can we use this to detect space vampires?

What wavelength does vampiric radiation peak at?

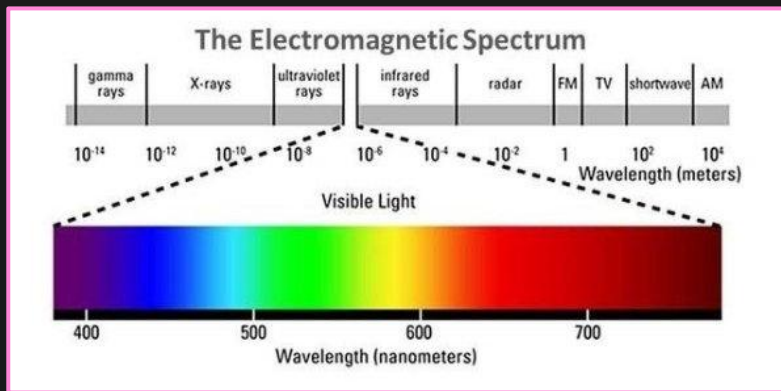


40 inch aperture!

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!



What wavelength does vampiric radiation peak at?



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

We can answer this question using...

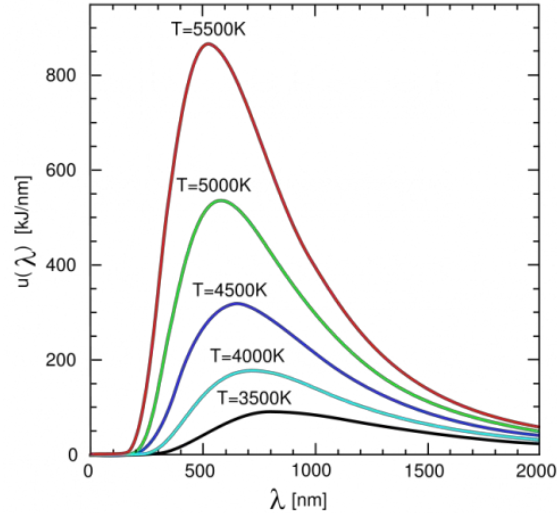


What wavelength does vampiric radiation peak at?



40 inch aperture!
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Can we use this to detect space vampires???

We can answer this question using...



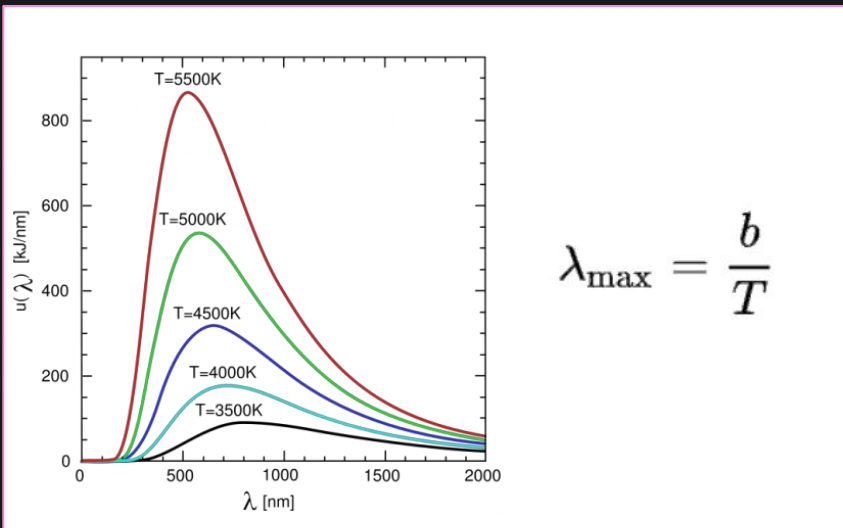
Blackbody radiation!

What wavelength does vampiric radiation peak at?



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

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*?

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

???

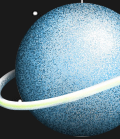


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$$\lambda_{\max} = \frac{b}{T}$$

???

→ Vampires were people once so presumably they have human-ish skin?



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→ Vampires were people once so presumably they have human-ish skin?

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



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

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

???



→ Vampires were people once so presumably they have human-ish skin?

→ 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

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

???

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

b = 2898 microns Kelvin

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



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

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

???

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

$$b = 2898 \text{ microns Kelvin}$$

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

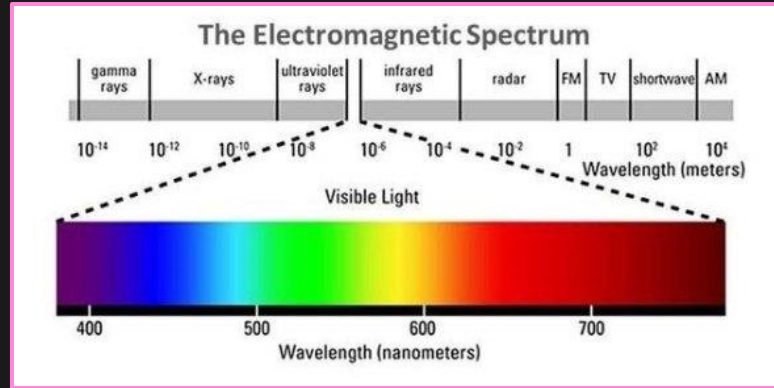
$$\lambda_{\max} = b/T = 9 \text{ microns}$$



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

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

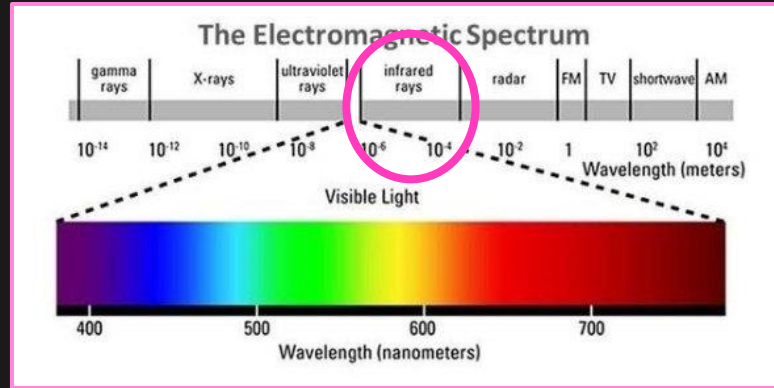
$$\lambda_{\max} = 9 \text{ microns}$$



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

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

$$\lambda_{\max} = 9 \text{ microns}$$



BUT WAIT!!!



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



BUT WAIT!!!



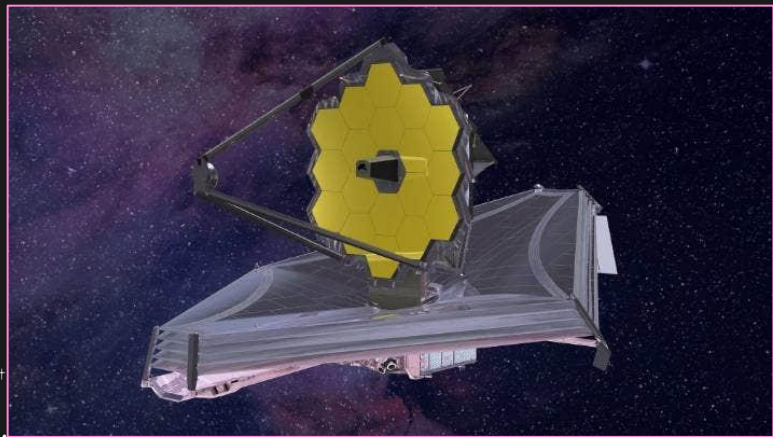
40m aperture!
Has a limiting magnitude of ~ 17
Can we use this to detect space vampires???

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

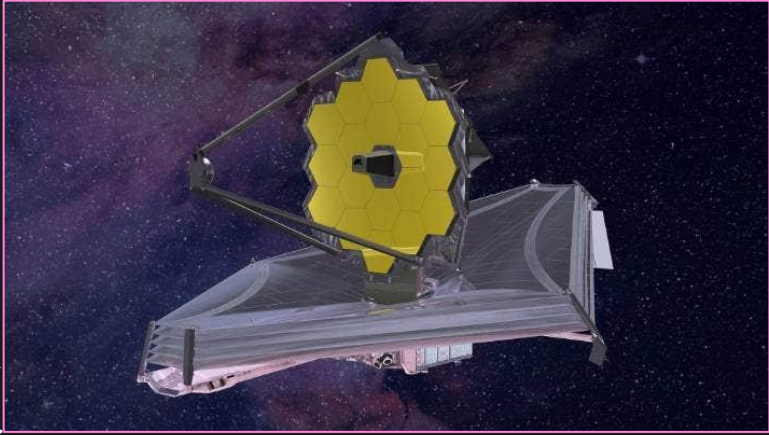
→ Can we see space vampires with other kinds of telescopes?



The NIRCarn on JWST

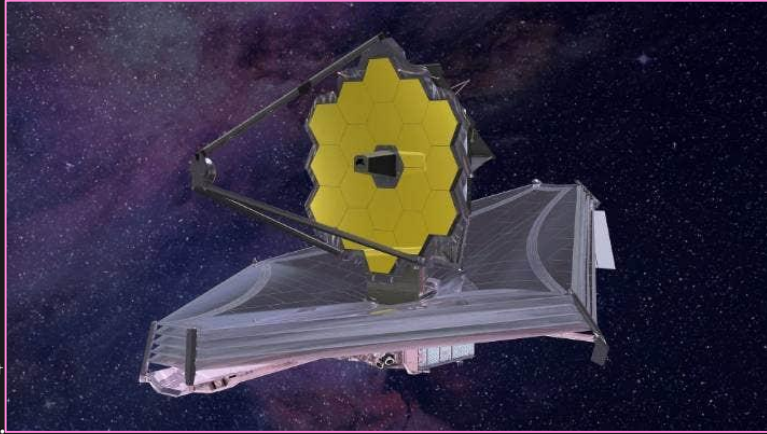


The NIRC*am* on JWST



→ Sensitive to wavelengths of 0.6 to 20 microns

The NIRCcam on JWST



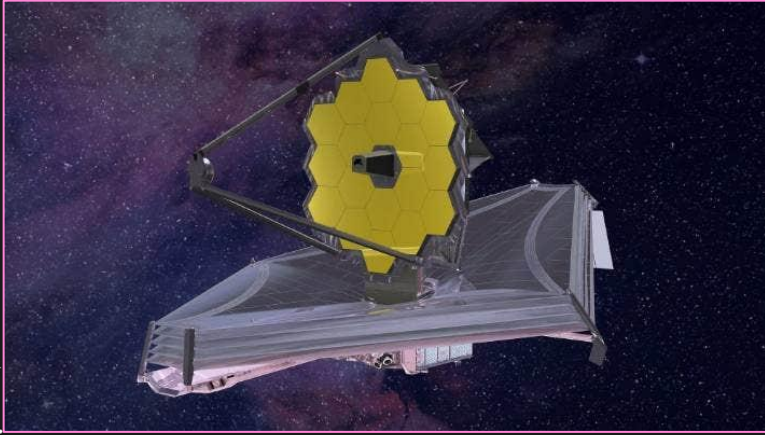
→ Sensitive to wavelengths of 0.6 to 20 microns

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

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

$$T = 144.9 \text{ Kelvin} = -199 \text{ degrees Fahrenheit}$$

The NIRC*a*m on JWST

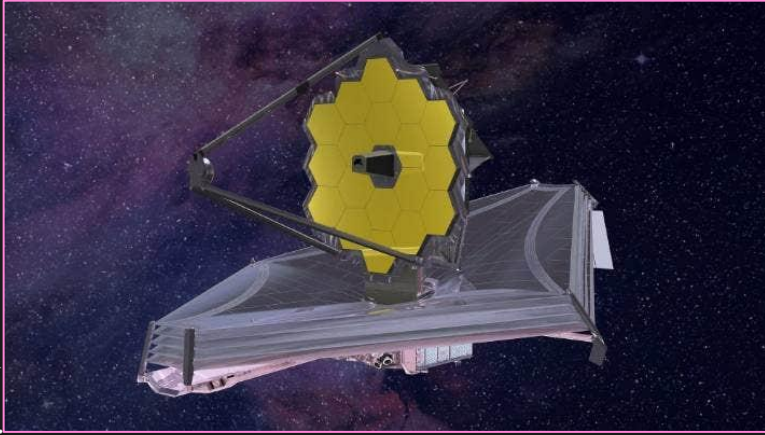


→ Sensitive to wavelengths of 0.6 to 20 microns

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



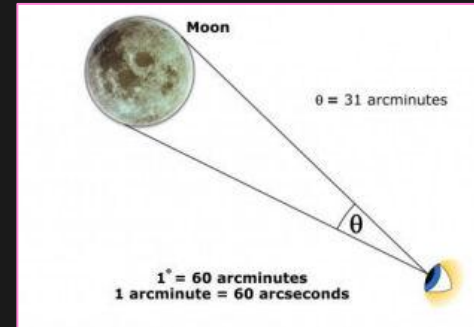
The NIRCcam on JWST



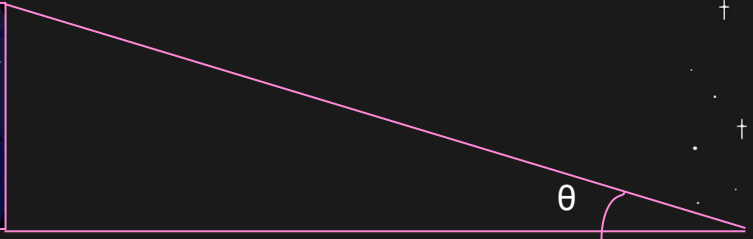
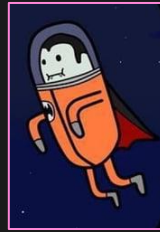
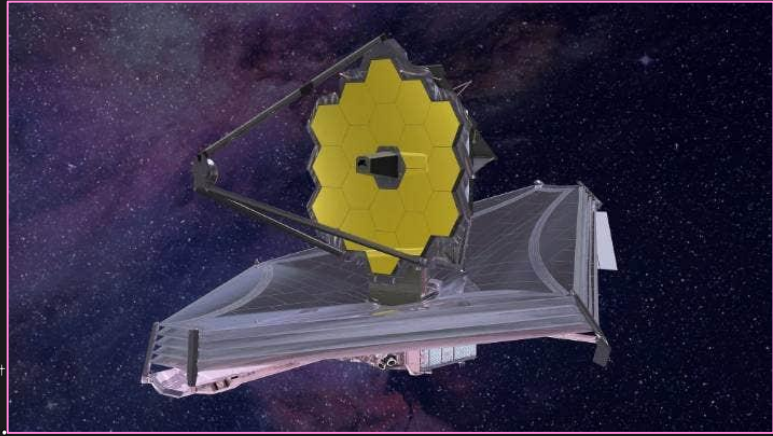
→ Sensitive to wavelengths of 0.6 to 20 microns

→ Has an angular resolution of ~ 0.01 arcseconds

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

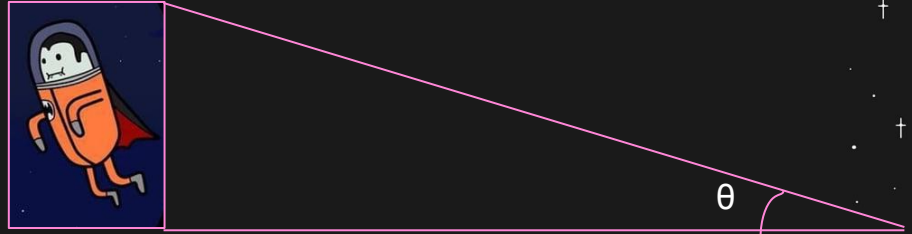
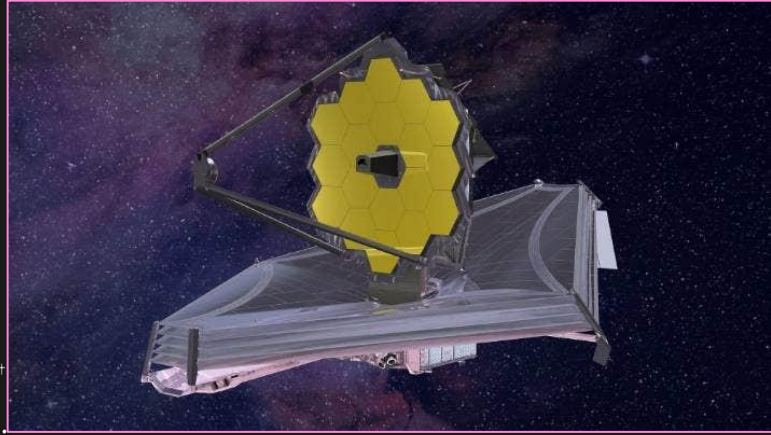


At what distance could JWST see a human-sized space vampire?



distance ~ hypotenuse

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



distance ~ hypotenuse

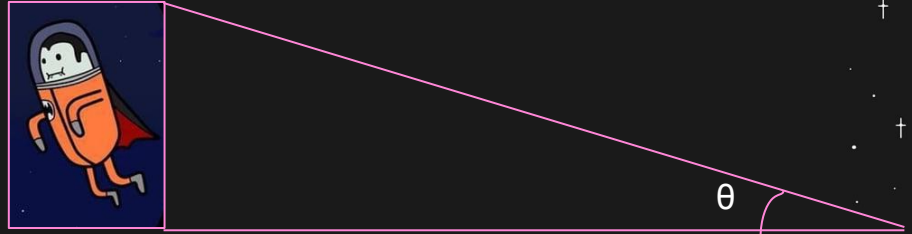
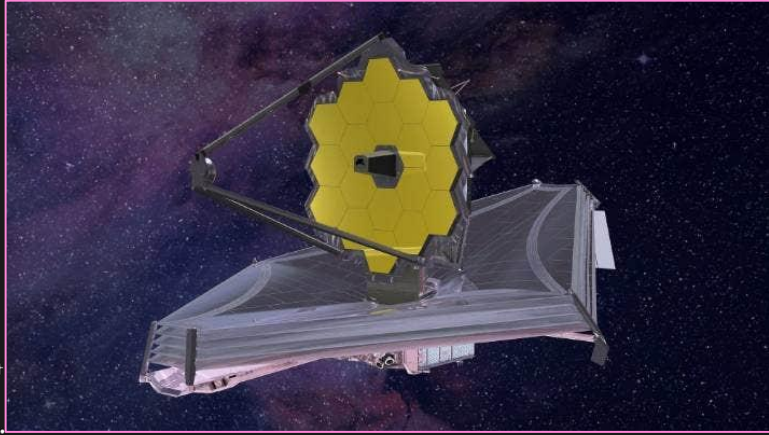
Vampire height ~ 6 ft = 1.8 meters

$\theta = 0.01$ arcseconds

$\sin\theta = 1.8 \text{ meters} / \text{hypotenuse}$

$\rightarrow \theta = 0.01 \text{ arcseconds} = 1.8 \text{ meters} / \text{distance}$

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



distance ~ hypotenuse

Vampire height ~ 6 ft = 1.8 meters

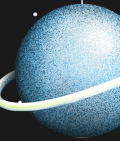
$\theta = 0.01$ arcseconds

distance ~ 23,000 miles

$\sin\theta = 1.8 \text{ meters} / \text{hypotenuse}$

$\rightarrow \theta = 0.01 \text{ arcseconds} = 1.8 \text{ meters} / \text{distance}$

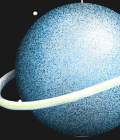
In comparison...



In comparison...



→ The moon is ~230,000 miles away



In comparison...



→ The moon is ~230,000 miles away

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



In comparison...



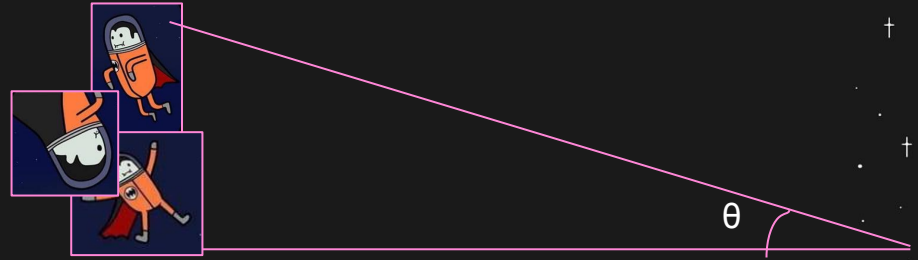
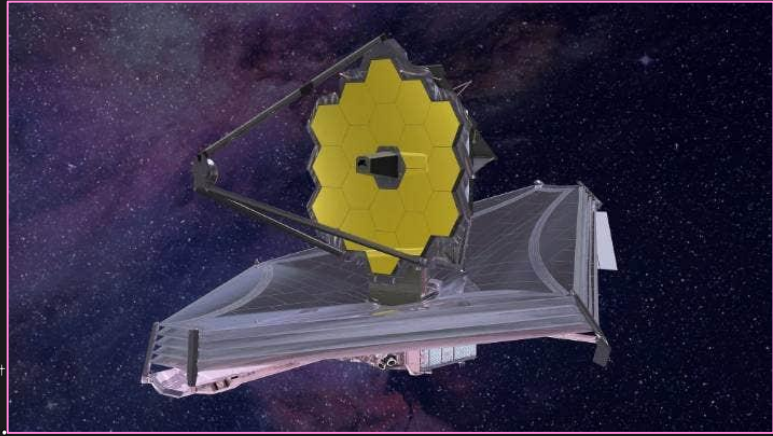
→ The moon is ~230,000 miles away

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

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



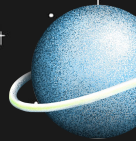

At what distance could JWST see a space vampire conglomerate?





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

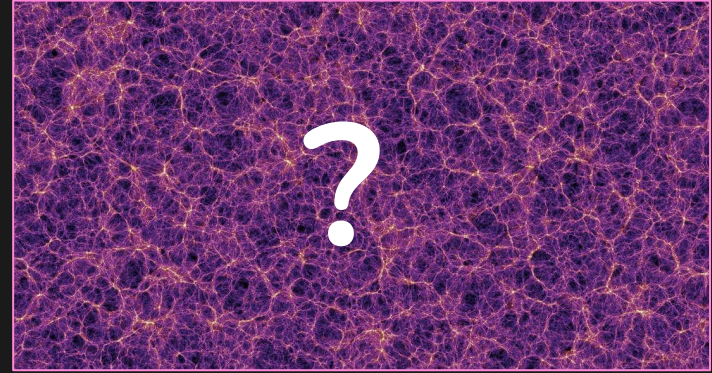
→ Vampires don't like sunlight (starlight).
So maybe...



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

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

→ Cosmic voids?



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

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

→ Cosmic voids?
→ *The Local Void* ?

The Local Void is
my favorite place to
unwind ...



θ

distance ~ 75 million light years

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

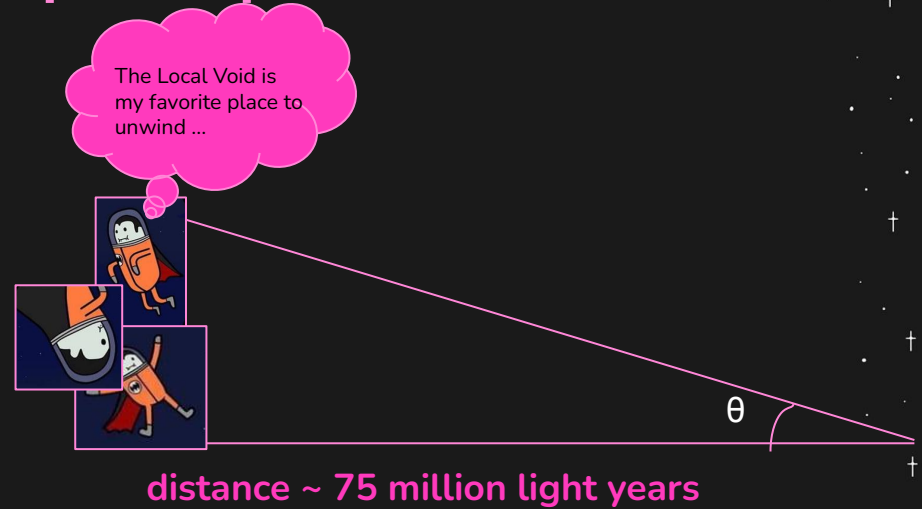
→ Vampires don't like sunlight (starlight).
So maybe...

→ Cosmic voids?
→ *The Local Void* ?

Vampire conglomerate size = ???
 $\theta = 0.01$ arcseconds

$\sin\theta = \text{???} / \text{hypotenuse}$

→ $\theta = \text{???} / \text{distance}$



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

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Vampire conglomerate size = ???
 $\theta = 0.01$ arcseconds

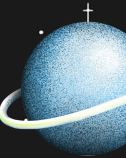
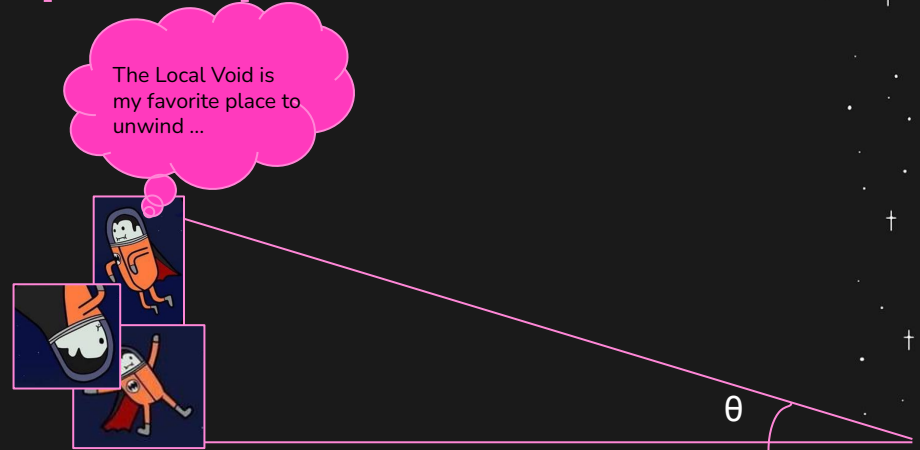
$\sin\theta = \text{???} / \text{hypotenuse}$

→ $\theta = \text{???} / \text{distance}$

The Local Void is
my favorite place to
unwind ...

distance ~ 75 million light years

conglomerate size ~ 3.63 light years

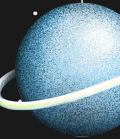


But first: where would we expect to find space vampires based on environment?

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

→ Cosmic voids?

→ Rogue planets?

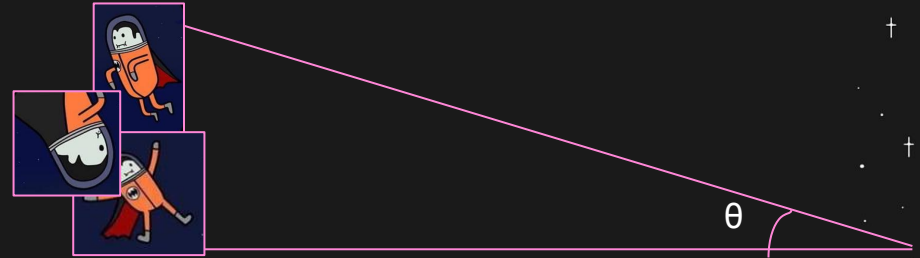


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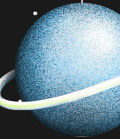
→ Rogue planets?



distance ~ 13 light years

conglomerate size ~ 20 light seconds

~ 3 million miles





Future work

→ What if vampires sparkle?



Future work

→ What if vampires sparkle?



Future work

→ 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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