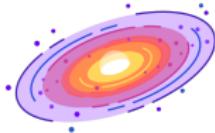


A Celestial Quest

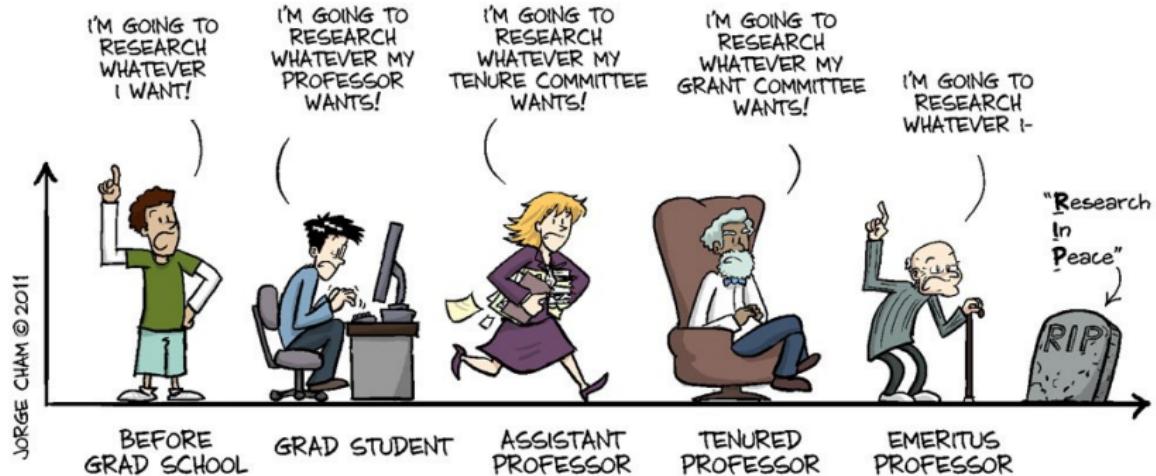
QM: Susnata Chattopadhyay

Singularity club
(IISER Kolkata)

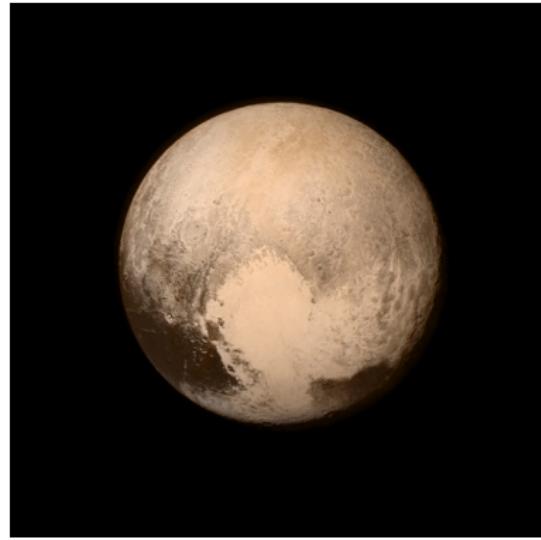
January 19, 2024



THE EVOLUTION OF INTELLECTUAL FREEDOM



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How many moons does this guy have?

Quiz Format

The Quiz consists of $n - 3$ rounds, where n is the total number of natural satellites of Pluto.

In the 1st round Standard **Bounce and Pounce** rules follow:
+10/0 on Bounce and +10/-5 on Pounce.

However in the Final Round **dark matter** prevails.
Remember the **Quiz-master's** decision is the final.

Round 1

Question 1

During the First World War, **X** served in the army and was knocked unconscious by the blast of an exploding shell whilst in an observation balloon. As a consequence of the explosion, he could never fully straighten his right elbow. Later in his life he showed that farther the objects are, the faster they are receding away from us. Who is **X**?

- A. James Webb
- B. Christian Doppler
- C. Edwin Hubble
- D. Arthur Eddington

Question 1

$$h_0 \simeq 72 \text{ km/s/Mpc}$$

Question 2

When an European astronomer **X** discovered **Y**, initially, **X** wanted to name **Y** as *Georgium Sidus* or George's Star in honor of his patron. Name **X**, **Y** ?

- A. Galileo Galilei, Sirius
- B. Tycho Brahe, Uranus
- C. Tycho Brahe, Betelguese
- D. William Herschel, Uranus
- E. Christiaan Huygens, Betelguese

Question 3

I look like wisps of cloud in night sky. Long long time ago, a sailor from western Europe stumbled upon me in the Southern Hemisphere. The Tupi-Guarani peoples of Brazil, compared me to fountains, with either a tapir or a pig drinking from it. While the Mapuche people in Chile compared me to ponds of water. Who am I?

- A. Orion Nebula
- B. The Magellanic galaxies
- C. Andromeda Galaxy
- D. Pleiades Cluster



Question 4

In waves I dance, a cosmic ballet,
As I approach, my hue starts to sway.
Shifted in pitch, or color so bright,
I'm the outcome of the expanding night.

What am I?

- A. Twinkling of stars
- B. Doppler Effect
- C. Reddening
- D. Pulsars
- E. Variable Stars

Question 5

In the night sky, what would the **apparent size** of Andromeda galaxy approximately be?

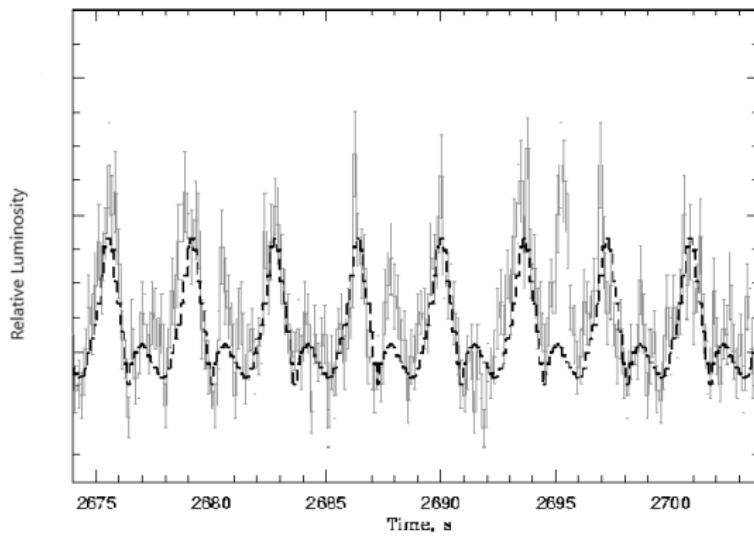
- A. $0.5 \times$ full Moon
- B. $5 \times$ Moon
- C. $8 \times$ Moon
- D. $0.25 \times$ Moon
- E. About the size of Moon



598

Question 6

Professor Dhoomketu constructed a special kind of telescope which can detect the luminosity of any bright source in the sky. Being very impatient, he set out with his new gadget on the very next night (although it was windy) at his village *Dholakpur*. He recorded a very peculiar type of light curve which is shown below:



Question 6

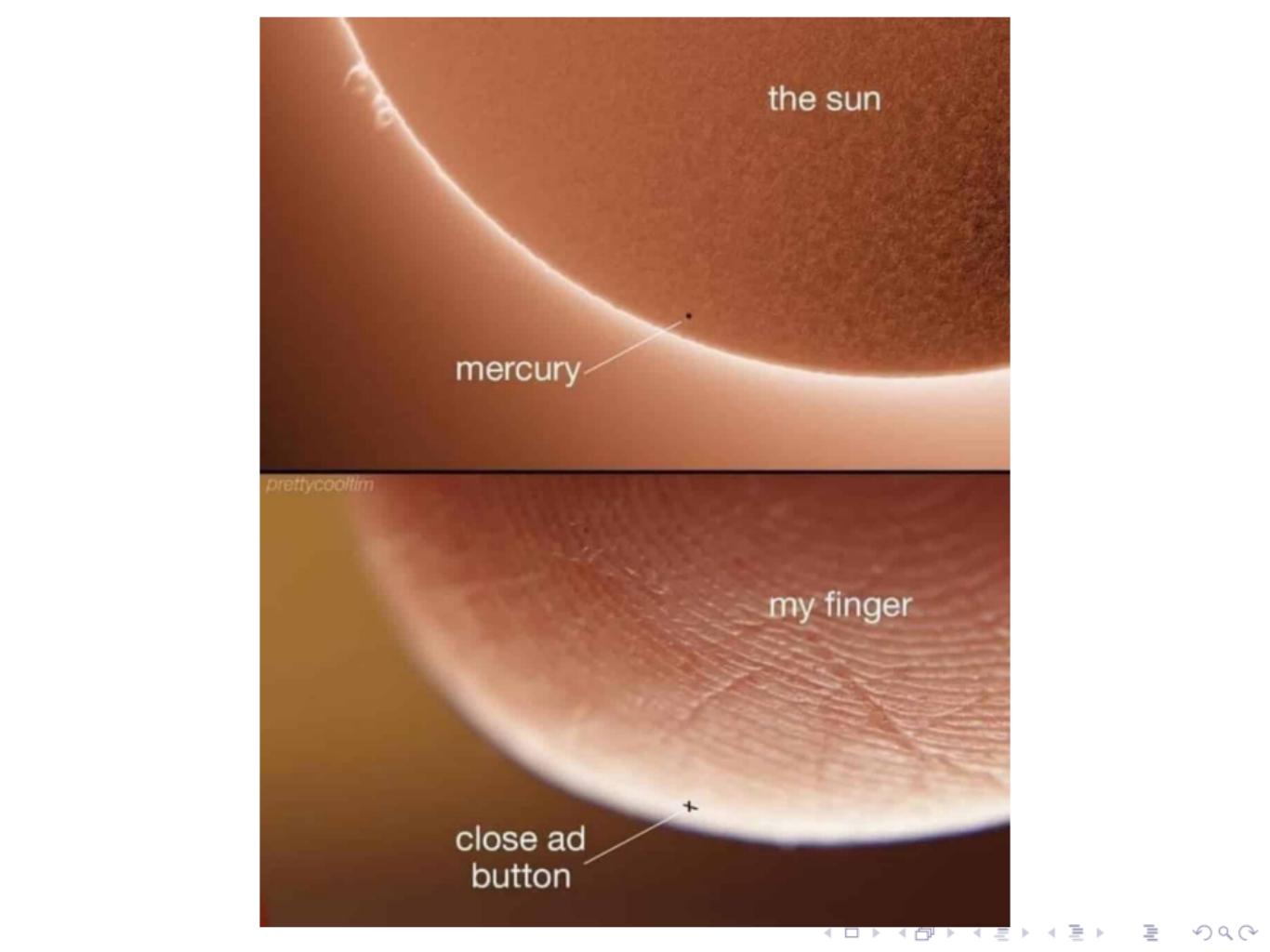
What can be the possible object/phenomena?

- A. twinkling of a star due to the wind.
- B. due to rotation of the Earth.
- C. the object is a Pulsar.
- D. due to rotation of a planet around the star.

Question 7

Consider we try to fit the remaining planets in our solar system between the orbit of Earth and moon. Approximately how many do you think will fit?

- A. All the 7 planets.
- B. All the gas giants.
- C. All the inner planets (except Earth).
- D. only Jupiter and Saturn.



the sun

mercury

prettycooltim

my finger

close ad
button

Question 8

We know that stars can manufacture elements only up to *Iron* by nuclear fusion. Then how do you think the elements heavier than Iron, such as gold and mercury are produced?

- A. Nuclear fission inside stars
- B. Black Dwarf explosions
- C. Supernova remnants
- D. Planetary Nebulae

Question 9



Who is this personality?

Question 9 (*Real*)

If you have identified the person from the previous slide, What is the name of the person who was chosen as a *backup* of him for his mission?

- A. Squadron Leader Avani Chaturvedi
- B. Wing Commander Ravish Malhotra
- C. Flight Lieutenant Aizad Baksh Awan
- D. Air Marshall Harish Chandra Sircar

Question 10

Observe this mesmerizing image of stars captured by JWST. There are 6 major *diffraction spikes* visible as you can see here-



They are caused by?

- A. The shape of you
- B. The shape of the mirror
- C. The shape of the spider holding the secondary mirror
- D. The arrangement of the lenses in the telescope

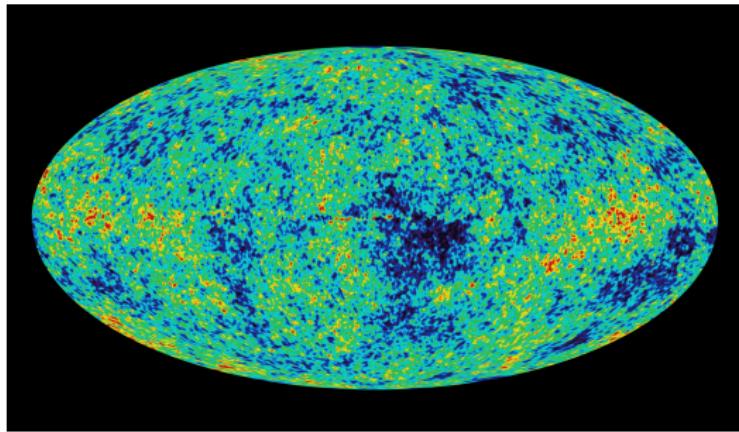
No one:
History channel at 3am:



10 Things NASA Doesn't Want You To Know

Question 11

Observe this image of the universe. This is known as the Cosmic Microwave Background (CMB). What could be the possible source of this radiation?



- A. Thermal noise from telescope
- B. radiation from distant stars
- C. afterglow of the Big Bang
- D. None of the above

Question 12

In the Kiowa story, **seven little girls** were chased by bears. They did their best to escape by climbing on a low rock and pleading with the rock to save them from the *bear*. That rock grew higher and higher until it stretched up into the sky. Those girls became the **X**. And the grooves on Devil's Tower (located in the Black Hills of Wyoming) are the *marks of the bear's claws* as it tried to get them.



Figure: Devil's Tower, Wyoming

Question 12

Identify X?

- A. Ursa Major
- B. Orion
- C. Virgo
- D. Pleiades



Question 13

Titan is the only moon in the Solar System, which is known to have an atmosphere and liquid lakes on it's surface.

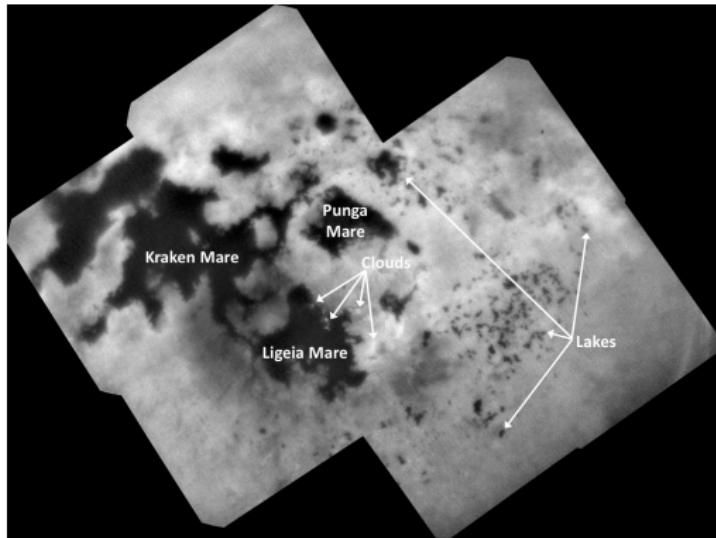
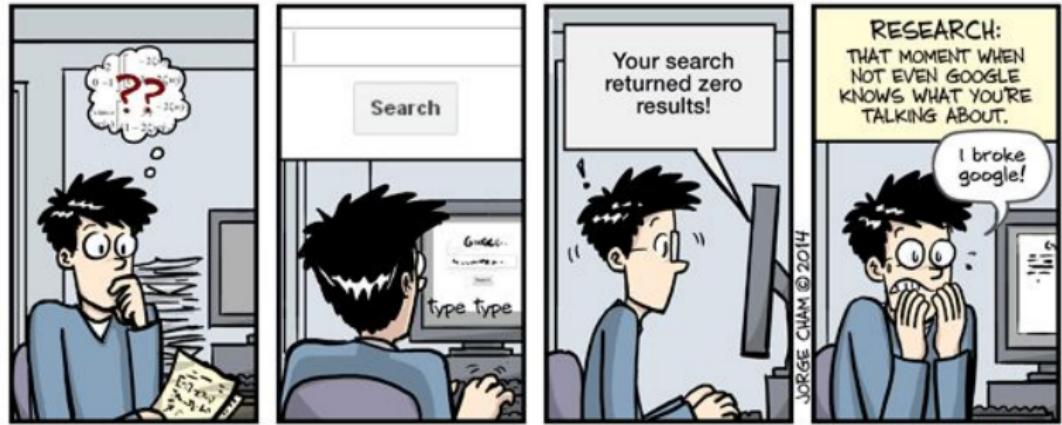


Figure: From Cassini-Huygens Mission (Sept 11, 2017)

Question 13

What is the major composition of these lakes?

- A. Ethane
- B. Ammonia
- C. Water
- D. Lead



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Question 14

Name the planet which is on **average** the closest planet to Uranus.

- A. Neptune
- B. Saturn
- C. Earth
- D. Mercury

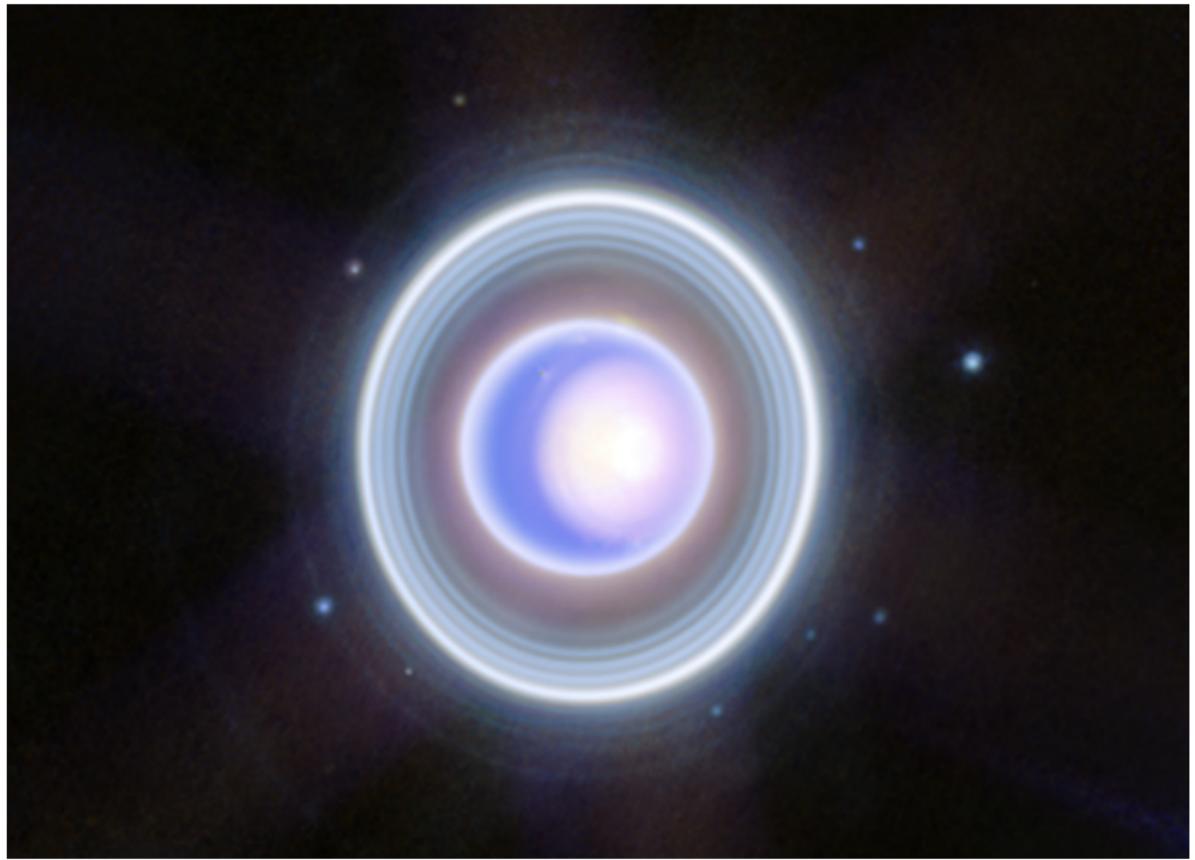


Figure: Image of Uranus from NIRCam on NASA's JWST

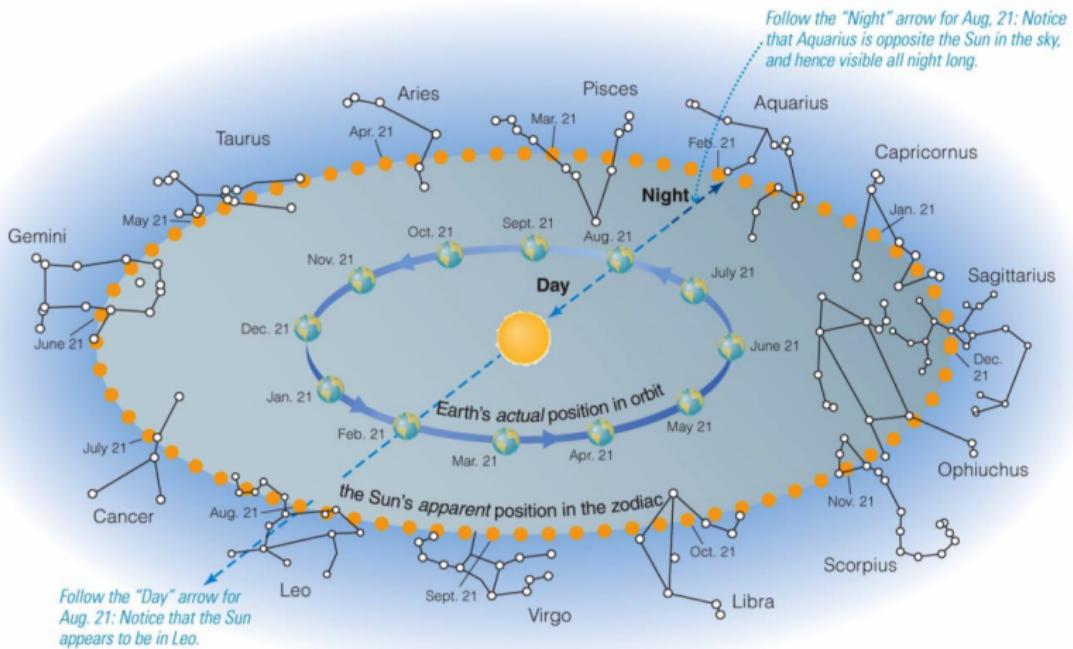
Question 14

Useful link: <https://www.youtube.com/watch?v=SumDHcnCRuU>

Question 15

Throughout the year, the Sun's path (*ecliptic*) passes through 13 constellations in the sky. Out of them, 12 constitute the Zodiac Constellation. Which is the other one?

- A. Orion
- B. Hydra
- C. Leo
- D. Ophiuchus



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Final Round

Questions 16

I'm a cosmic map, a stellar guide,
Where stars in their glory, side by side.
Temperature and brightness, secrets unfold,
In my diagram, their stories are told.
Main sequence march, where life begins,
Giants and dwarfs, in celestial hymns.
Colors and classes, to all I hold the key,
Explosions, core collapses set me free

What am I?

Question 17

Consider the integral where,

$$\Gamma = \int_{-\pi}^{\pi} \frac{\sin x}{x} dx$$

Find $\Gamma/7 = ?$

Hint: $\Gamma + 5$ is the number of exoplanets in the system of TFAR B420-69 L star.

Question 17 (Real)

What is the brightest star in the night sky?

Hint: It shares its name with a character from the Harry Potter series

Question 18

A planet **Y** was observed to have an anomalous orbit. In the 19th century, Le Verrier and other astronomers speculated about the existence of a planet to explain the precession of Y's orbit. However, this anomaly was resolved in the early 20th century, which provided a more accurate explanation for the observed discrepancies. Name **Planet Y**:

Mars: Hey, bae! Come over

NASA: I can't! I ain't got enough money

Mars: I'm wet

NASA:



Question 19

B established the Physical Research Laboratory in 1947 and later founded INCOSPAR in 1962. He played a pivotal role in laying the foundation for India's space program. Who is **B**?

Question 20

Suppose you and your friend went on an expedition for the sake of humanity to the black hole 'Wordygurdyboom' to uncover it's secrets. At the last moment your friend hesitates, and so you decide to play *stone-paper-scissor*, where fortunately your friend loses, and she bids goodbye to you... You stand on your spaceship and watch her (as she faces you) slowly drift into the **Singularity**. What would you observe?

What Your Friends Will See

At this point, it's interesting to think about what your friends might make of all of this. You know, the friends who thought jumping into a black hole was crazy and stayed behind? We're sure they were very supportive of you, but what do *they* see as you take this glorious leap into the unknown?

It turns out they never see it happen. Not because it gets obscured by the darkness of the black hole, but because it literally never happens *for them*.

Remember that gravity doesn't just distort space; it also distorts *time*. And black holes have so much gravity that they distort time in a really extreme way.

A lot of people know that time slows down at very high speeds. For example, if you climb onto a spaceship and zoom off at nearly the speed of light and come back, time will have moved slower for you and everyone you know will have aged more than you. But it's not just speed that can have this effect on time; being near a really massive object (like a black hole) does this, too. It bends space, but it also slows down time.

As you dive near the black hole, your friends will see time slow down for you. To them, you'll start to look like you are traveling in suuuuper... sloooooow... moooootion. They'll see you get closer and closer to the black hole, but you'll be doing it slower and slower.



And the closer you get to the black hole, the slower your clock will go. At some point, your clock will slow down so much that, to them, you will almost look like you are frozen in time. We're sure they're great friends, but eventually they'll probably give up and go live the rest of their lives. The last image they'll have of you will be faint and red, because the gravity also stretches the wavelength of the photons into the infrared spectrum.

In fact, it won't just be a long time to the rest of the universe before you fall in. It will literally never happen. From an outside perspective, time for you will freeze, and your image will get spread across the surface of the black hole and be forever etched there. It would take an infinite amount of time before an observer sees you fully enter the black hole. Solar systems and galaxies would form and perish. Trillions of years would pass, and they would never see you cross the boundary.

If you were hoping to impress your friends with a dramatic move, jumping into a black hole was not a wise choice.



Entering the Black Hole

Of course, that's just what your friends see. To you, it's still a wild roller coaster ride.

Remember that time still moves normally for *you*, so from your perspective the trip into the black hole will happen at normal speed.

Acknowledgements

Singularity club extends their thanks to the **Quiz Club** for co-hosting this eventful event. The following persons were involved in the question designing committee:

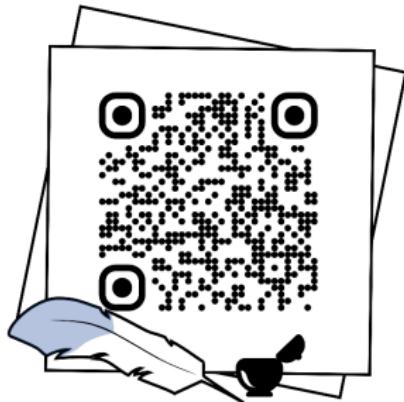
Susnata Chattopadhyay (Meh!)

Shantonu Dutta

Surjo Ghosh

Harsh Kanu

Das Ende



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