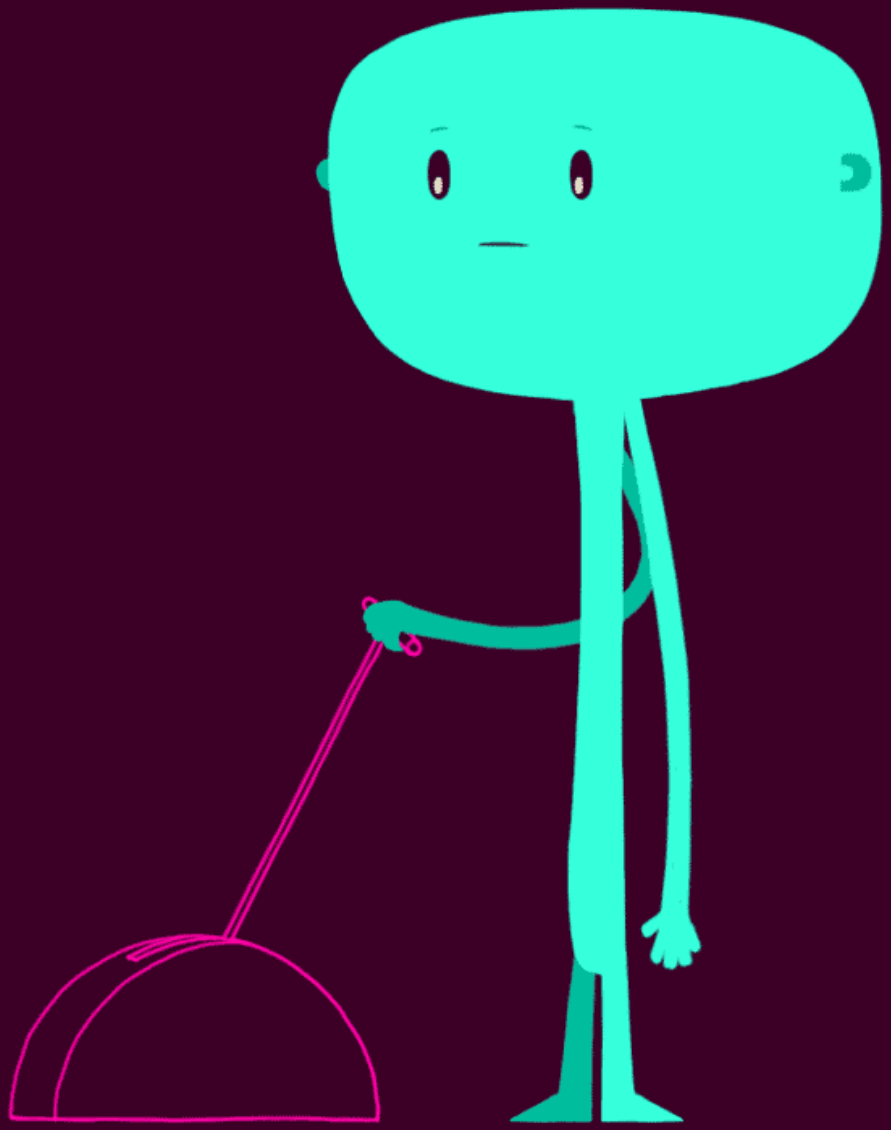

Black Holes



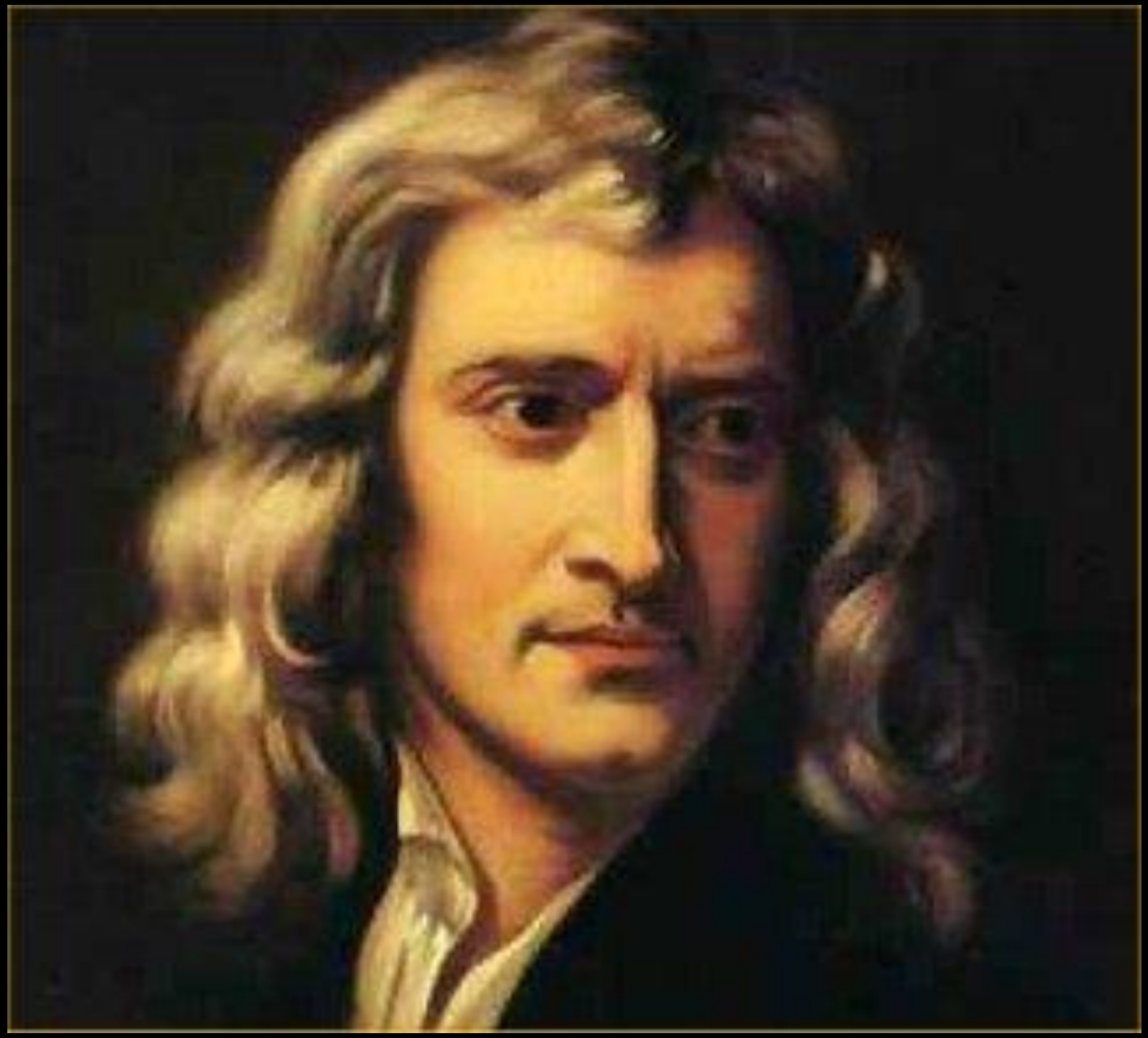


Aristotle

- 384 BC – 322 BC
- Elements move toward their natural place

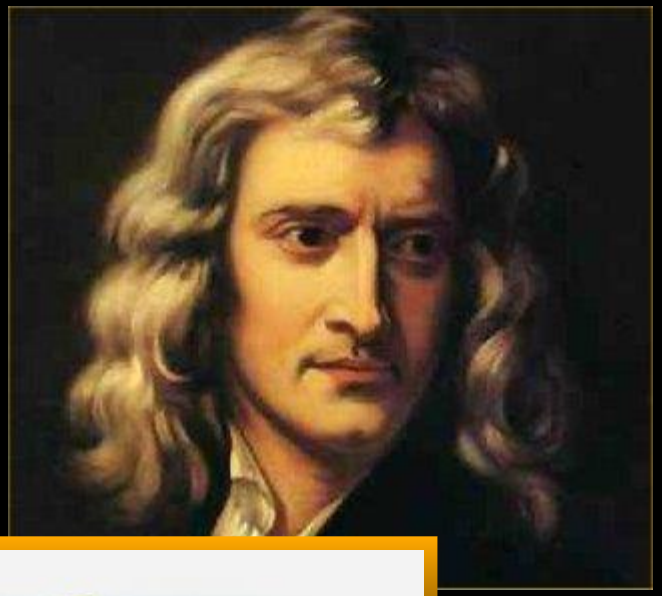








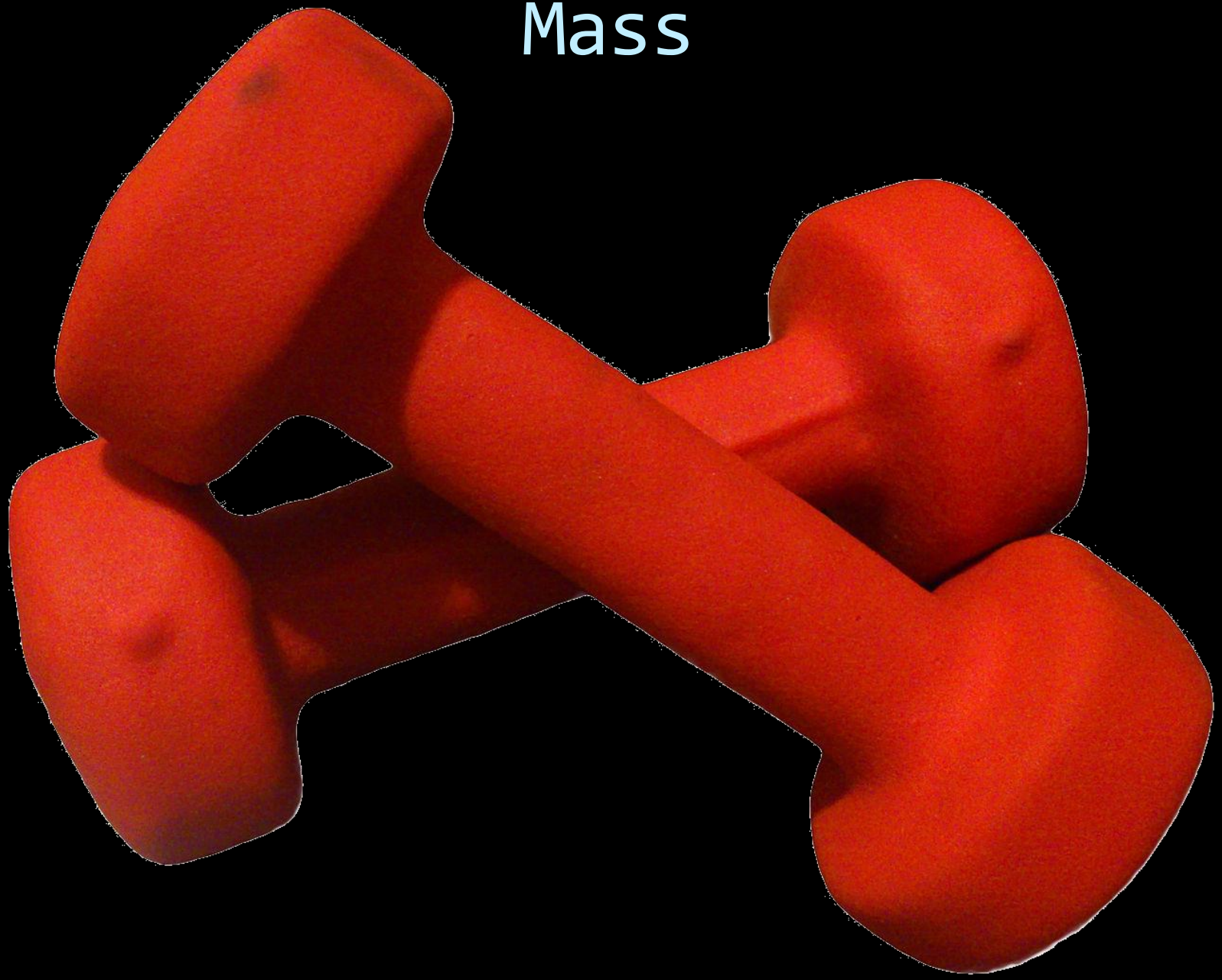
Isaac Newton



- 1642 –1727
- Gravity is a force that acts over a distance



Mass



Concept of Mass

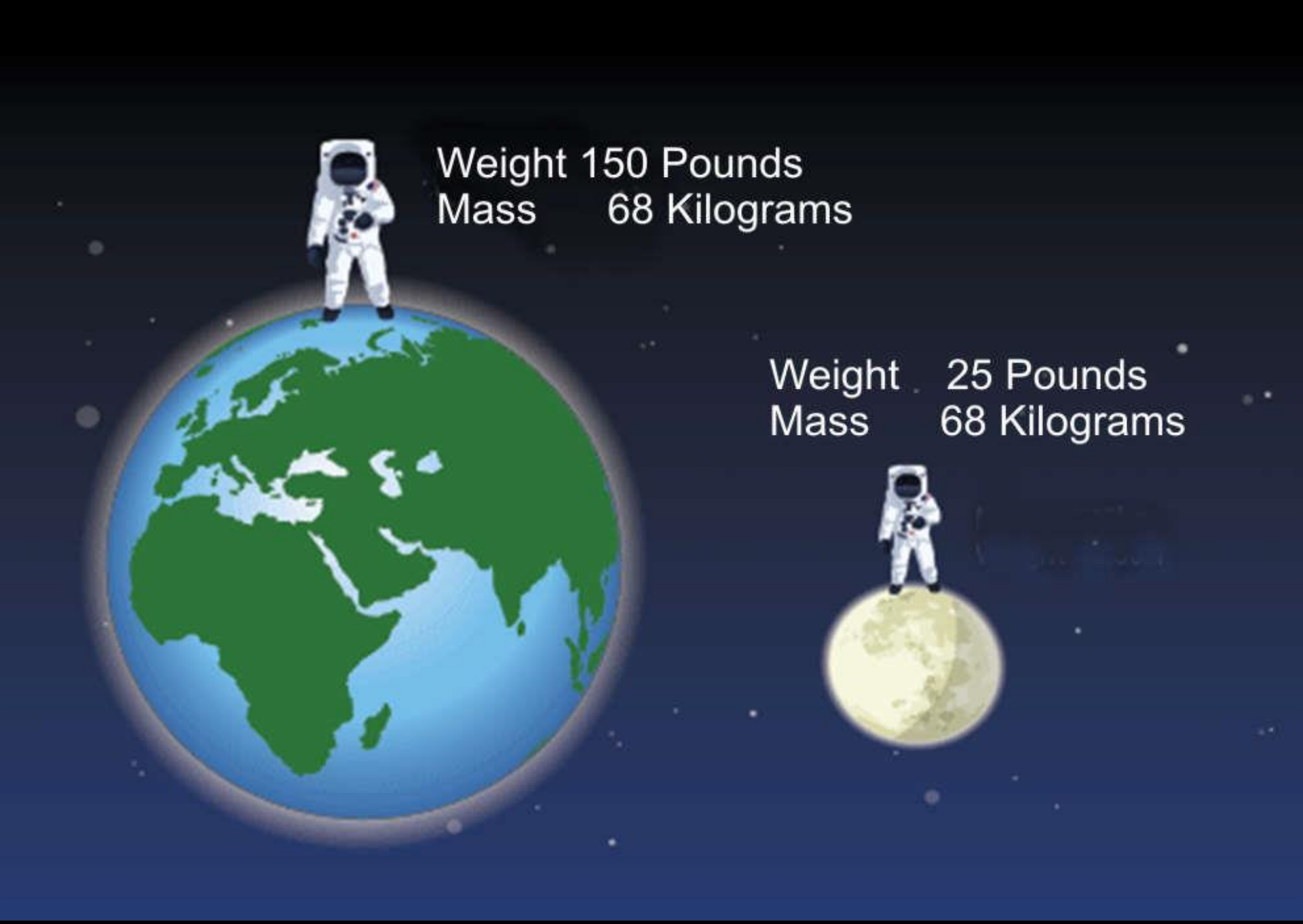
On Earth, let's say you weigh 150 lbs.

On the Moon, you'd weigh 25 lbs.

On Jupiter, you'd weigh 350 lbs.

On the Sun, you'd weigh 4,000 lbs.



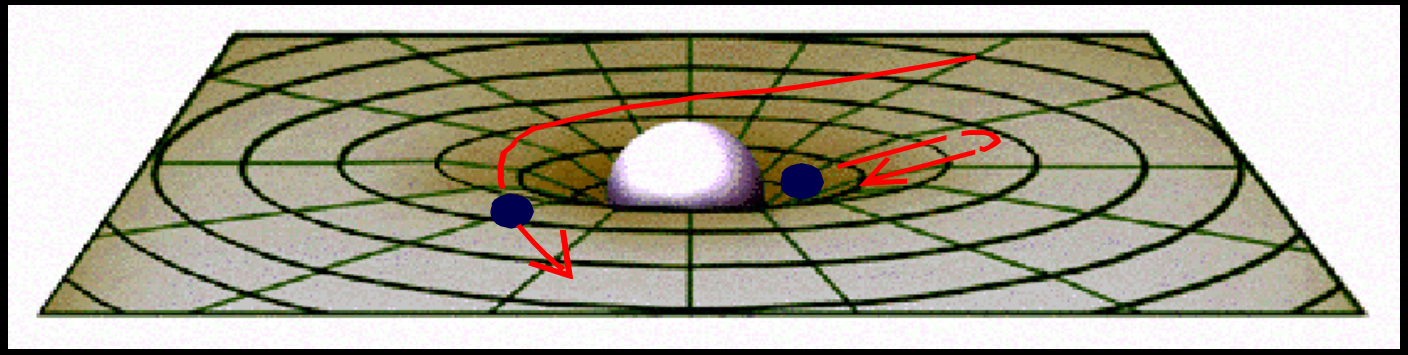

Weight 150 Pounds
Mass 68 Kilograms
Weight 25 Pounds
Mass 68 Kilograms


1912

Albert Einstein

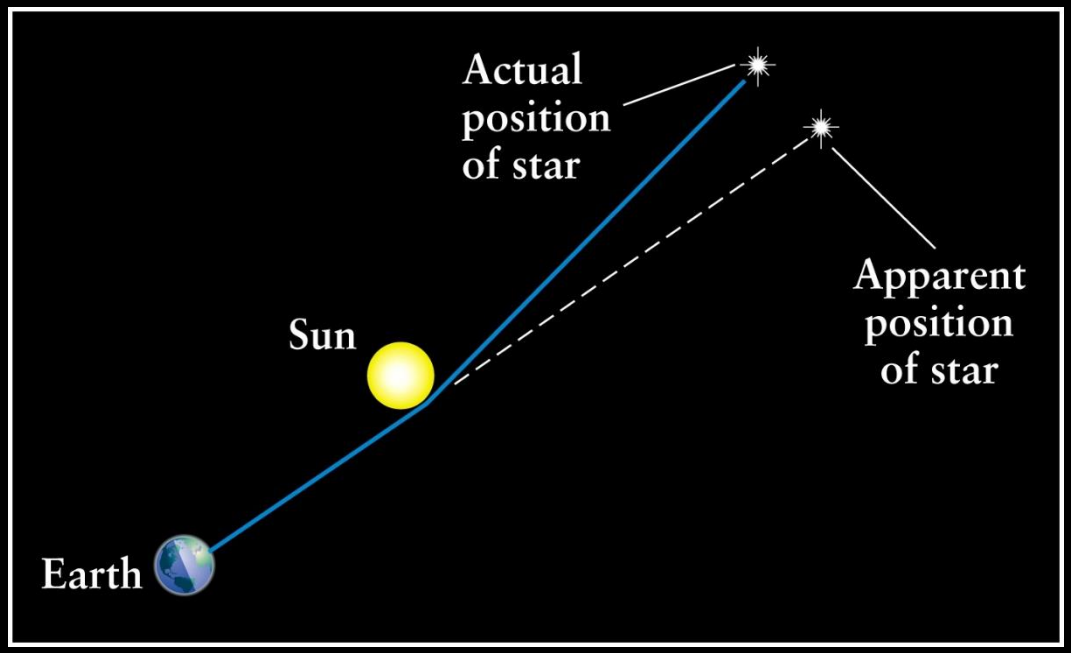
- 1879 – 1955
- Gravity is a distortion of space and time



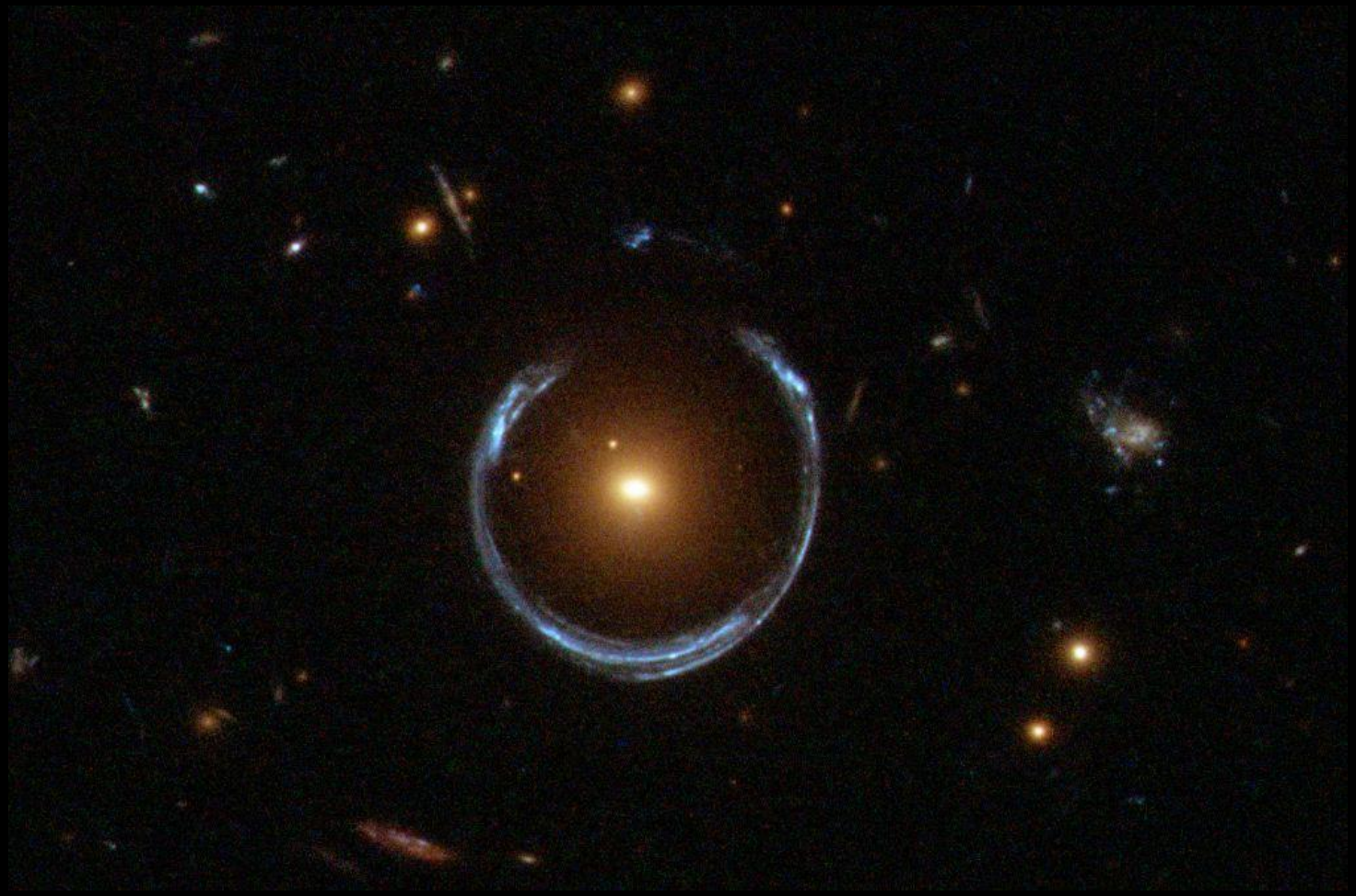


Observations confirming the predictions of general relativity

- gravitational lensing (bending of light by gravity) confirmed during a solar eclipse in 1919



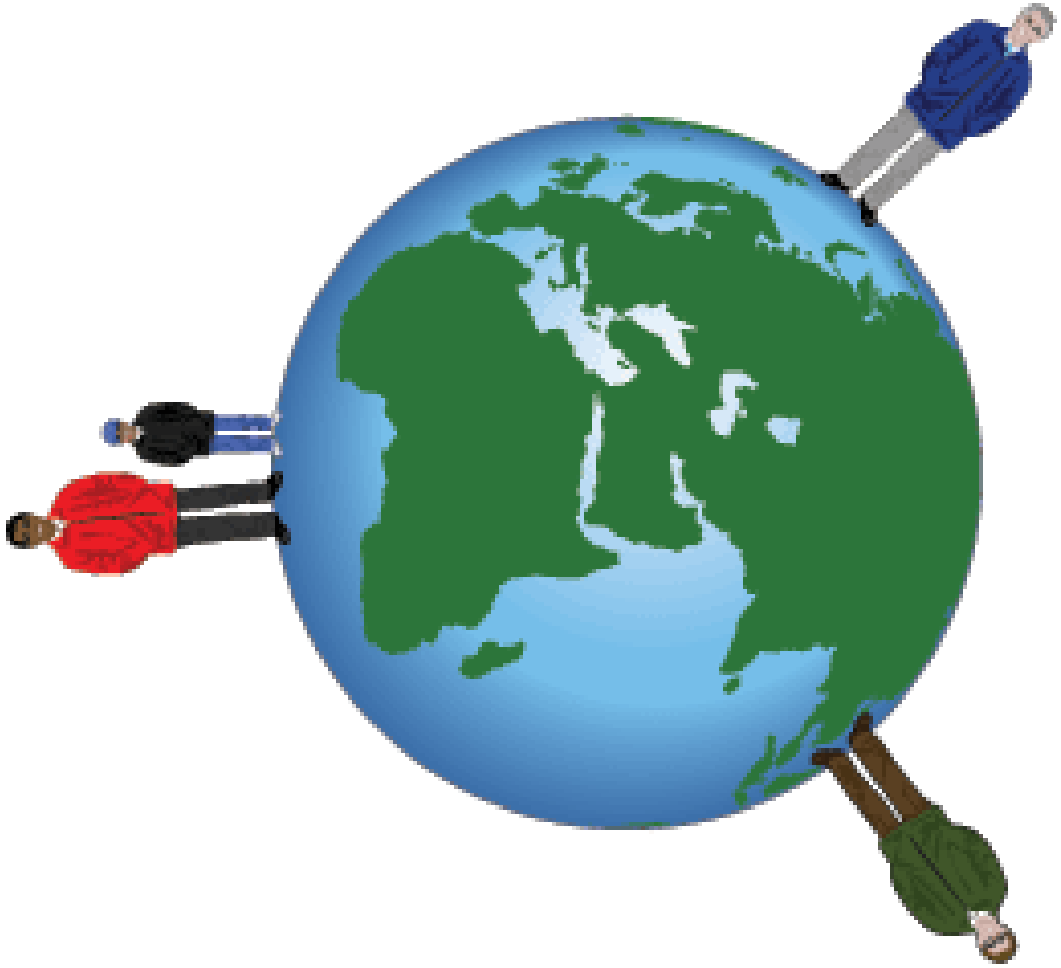
Gravitational Lensing





Gravity Questions

- Point at student living in Cape Town South Africa.



Gravity Questions

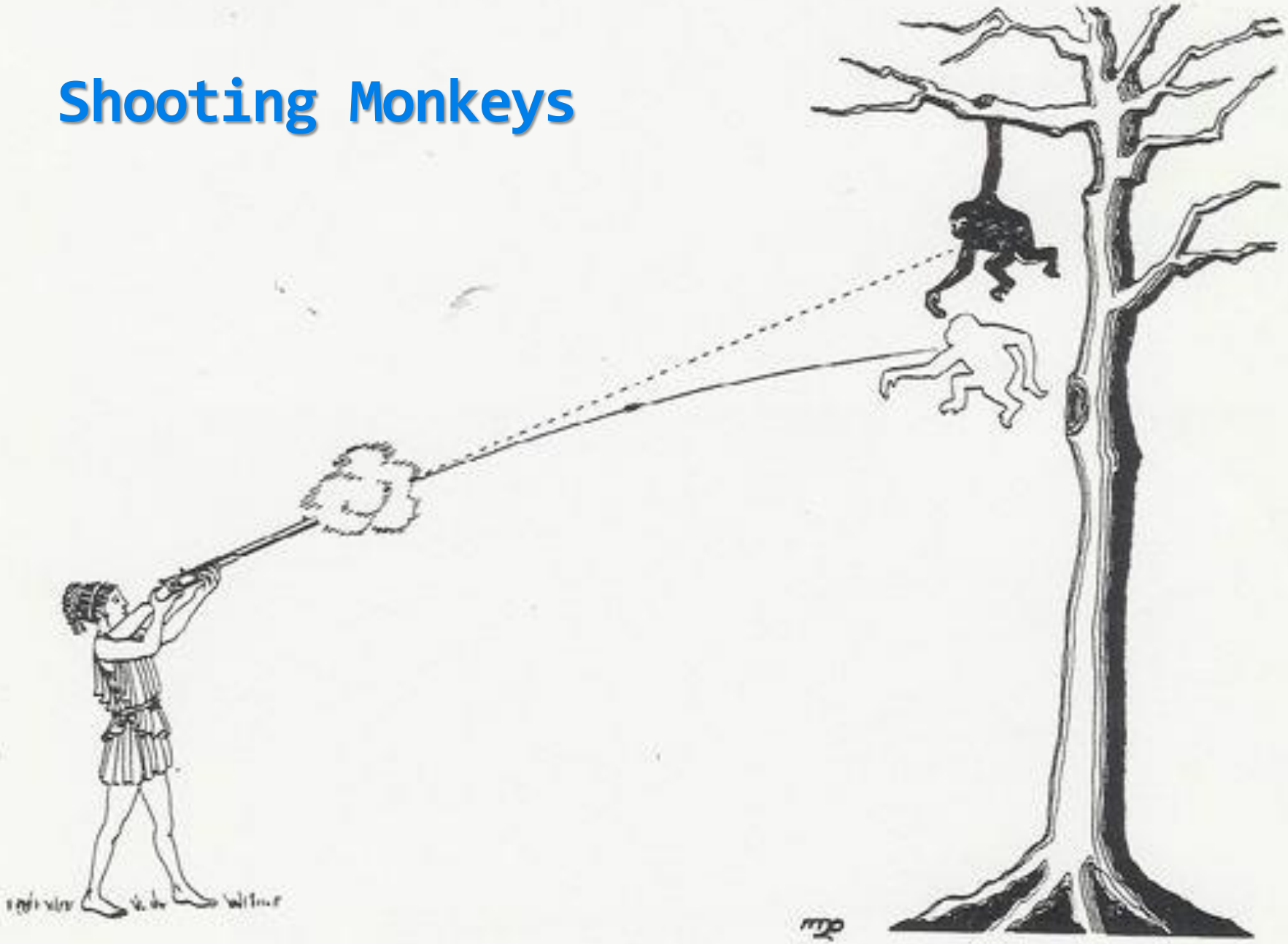
- Point at student living in Cape Town South Africa.
- Do heaver things fall faster than light things?



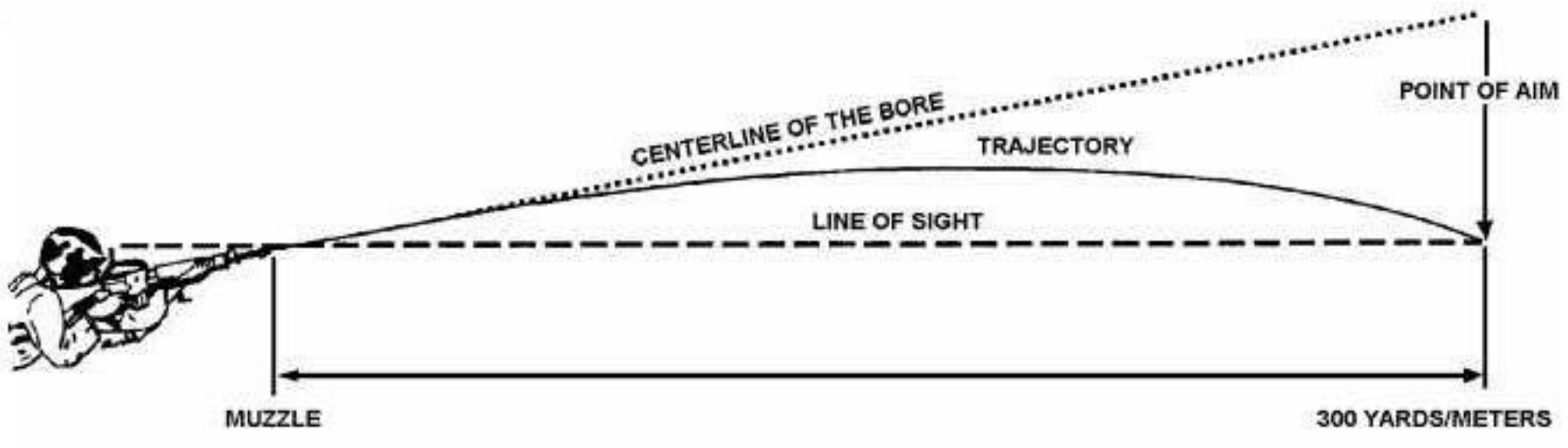
Gravity Questions

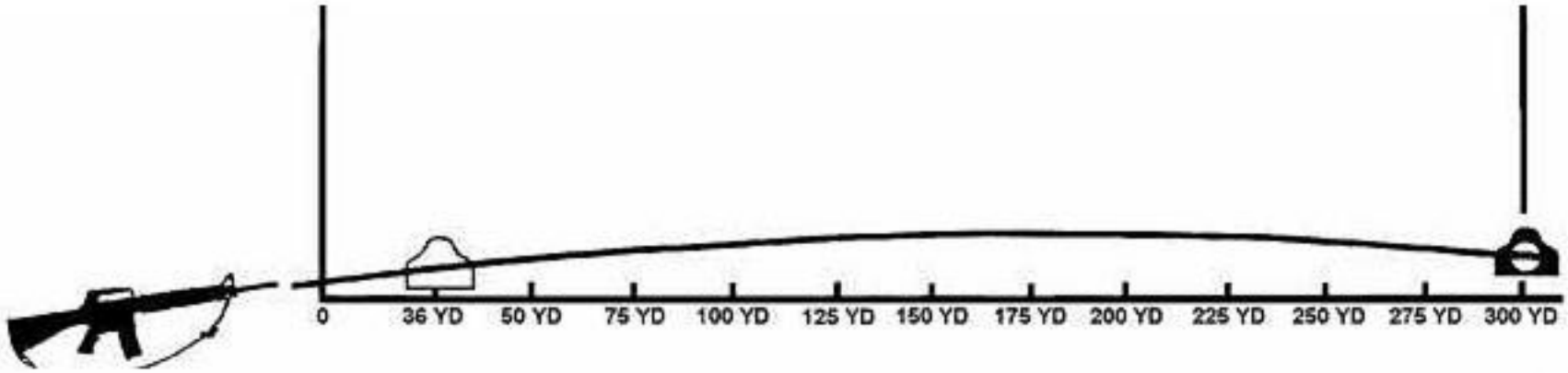
- Point at student living in Cape Town South Africa.
- Do heaver things fall faster than light things?
- Why doesn't a bullet fired from a gun fall?

Shooting Monkeys



Aiming a Rifle



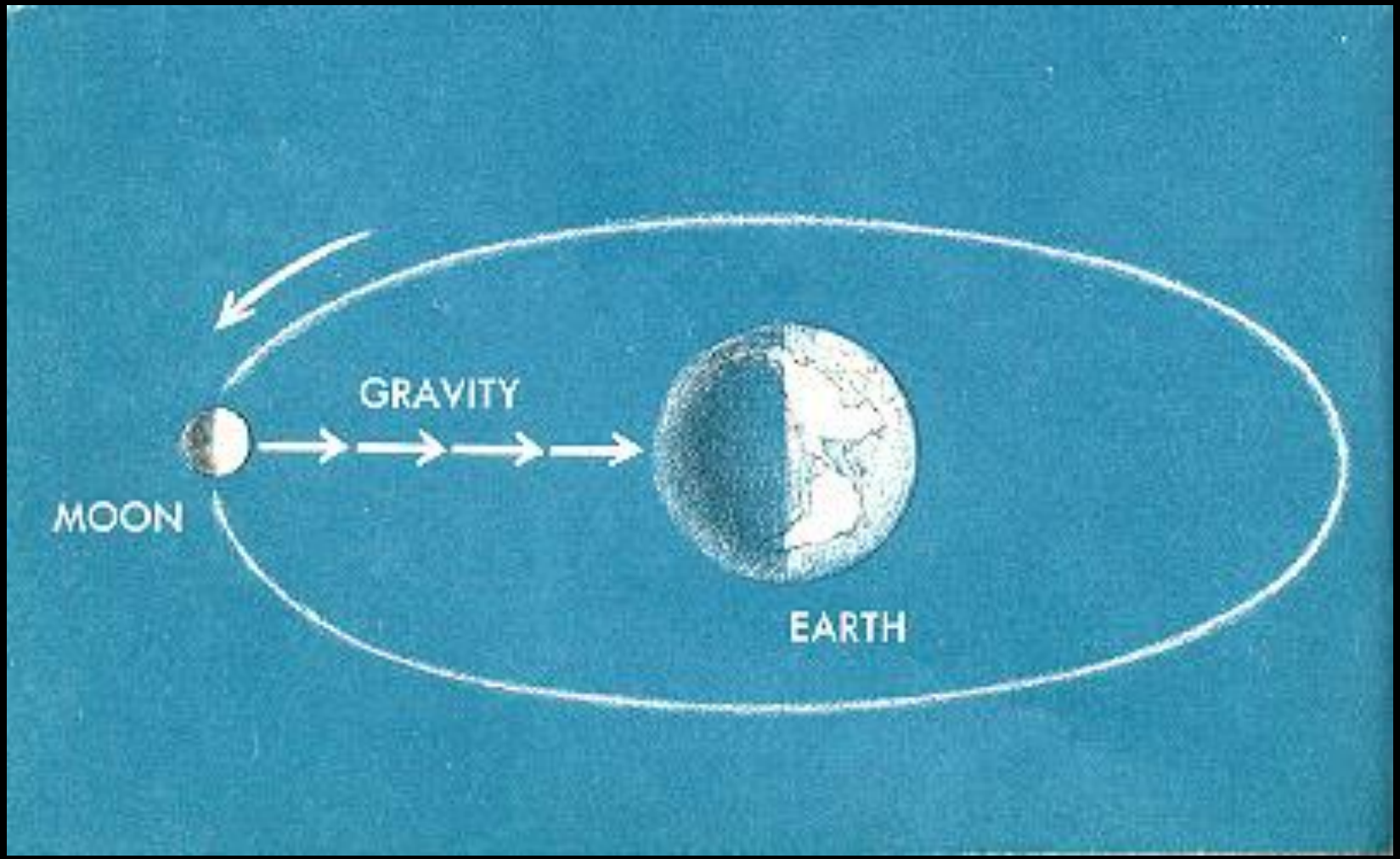




Gravity Questions

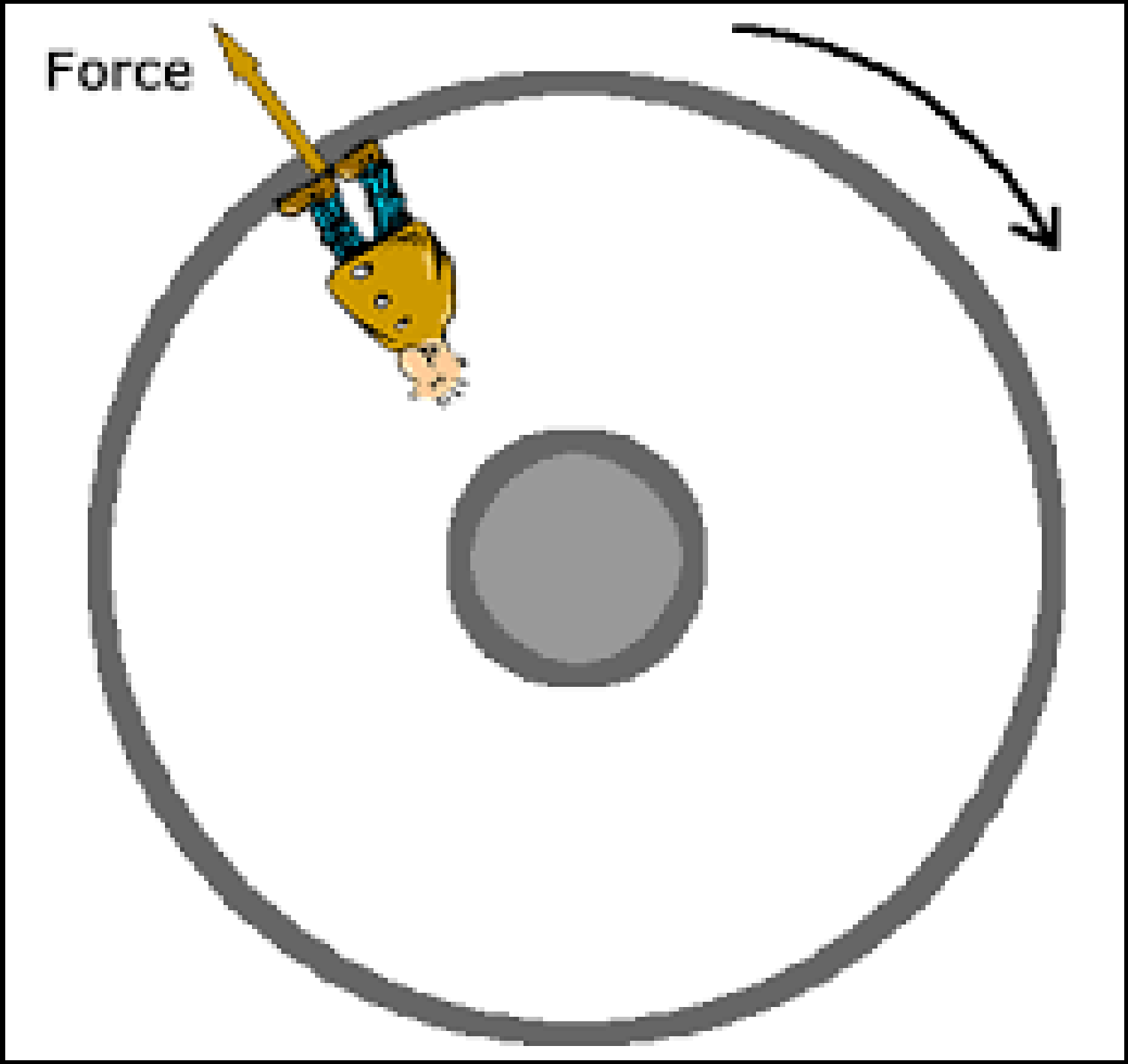
- Point at student living in Cape Town South Africa.
- Do heaver things fall faster than light things?
- Why doesn't a bullet fired from a gun fall?
- Why doesn't the Moon (or a satellite) fall to Earth?

The Moon in Orbit



Gravity Questions

- Point at student living in Cape Town South Africa.
- Do heaver things fall faster than light things?
- Why doesn't a bullet fired from a gun fall?
- Why doesn't the Moon (or a satellite) fall to Earth?
- Why it there no gravity on the Space Station?


Force

Gravity Questions

- Point at student living in Cape Town South Africa.
- Do heaver things fall faster than light things?
- Why doesn't a bullet fired from a gun fall?
- Why doesn't the Moon (or a satellite) fall to Earth?
- Why it there no gravity on the Space Station?
- If I throw a rock or shoot a bullet at the Moon will it hit it?

Escape Velocity

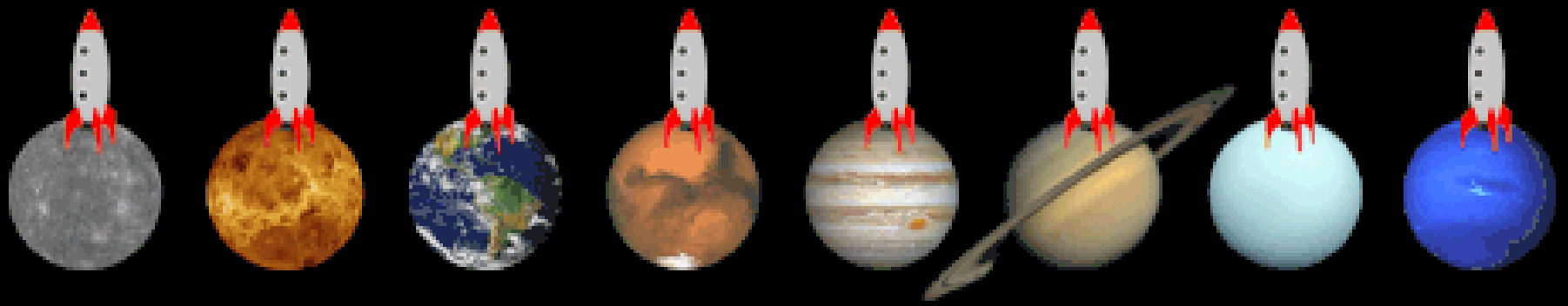
- How fast would a bullet need to go to leave Earth?

25,000 MPH!

Escape Velocity

Body	Escape Velocity in Miles/Hour
Ceres	1,430 mph
The Moon	5,320 mph
Earth	25,038 mph
Jupiter	133,018 mph
Sun	1,381,600 mph
Sirius B (a white dwarf star)	11,625,120 mph

HOW FAST A ROCKET WOULD HAVE TO GO TO LEAVE EVERY PLANET

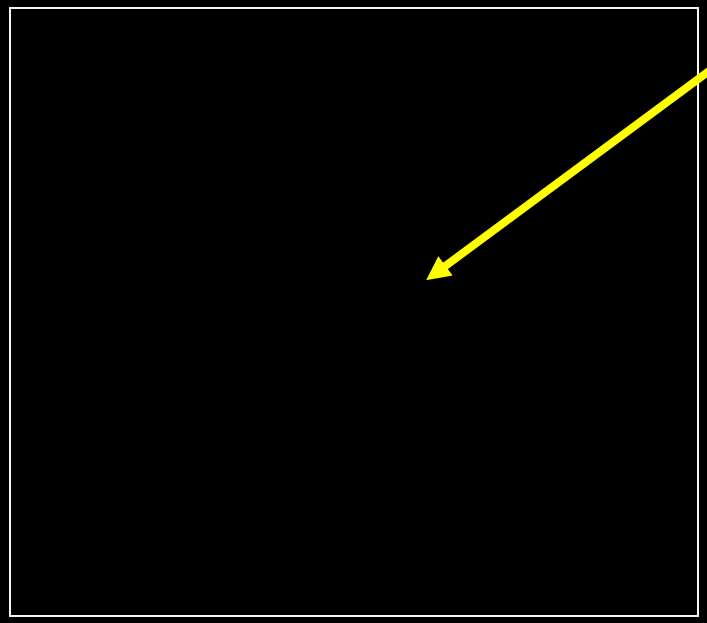


Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
9,507 mph	23,175 mph	25,031 mph	11,252 mph	134,664 mph	80,731 mph	47,826 mph	52,702 mph

BUSINESS INSIDER


I HAVE NO FRIENDS
I ATE THEM ALL...
imgflip.com

What is a Black Hole?



Mass is so great in such a small volume that the velocity needed to escape is greater than the speed of light

An unimaginably dense region of space where space is curved so completely that nothing, not even light, can escape.

How Much Would You Weigh”?

On Earth, let’s say you weigh 150 lbs.

On the Moon, you’d weigh 25 lbs.

On Jupiter, you’d weigh 350 lbs.

On the Sun, you’d weigh 4,000 lbs.

Near a Black Hole,
you’d weigh over
20 TRILLON POUNDS !!!





Falling into a Black Hole



Falling into a Black Hole



Falling into a Black Hole

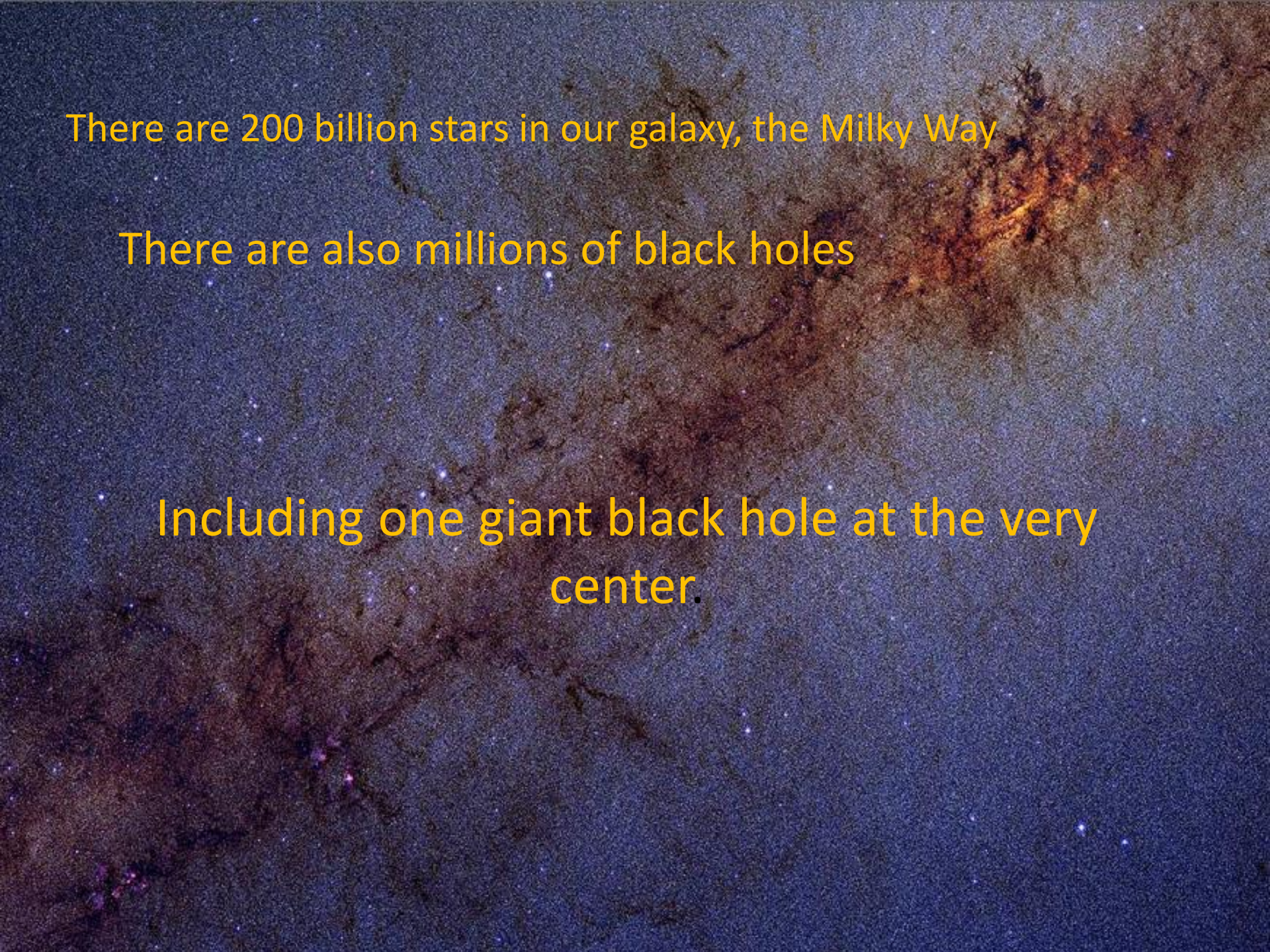


Falling into a Black Hole








There are 200 billion stars in our galaxy, the Milky Way
There are also millions of black holes
Including one giant black hole at the very center.



Where do Black Holes come from?

Exploding Massive Star

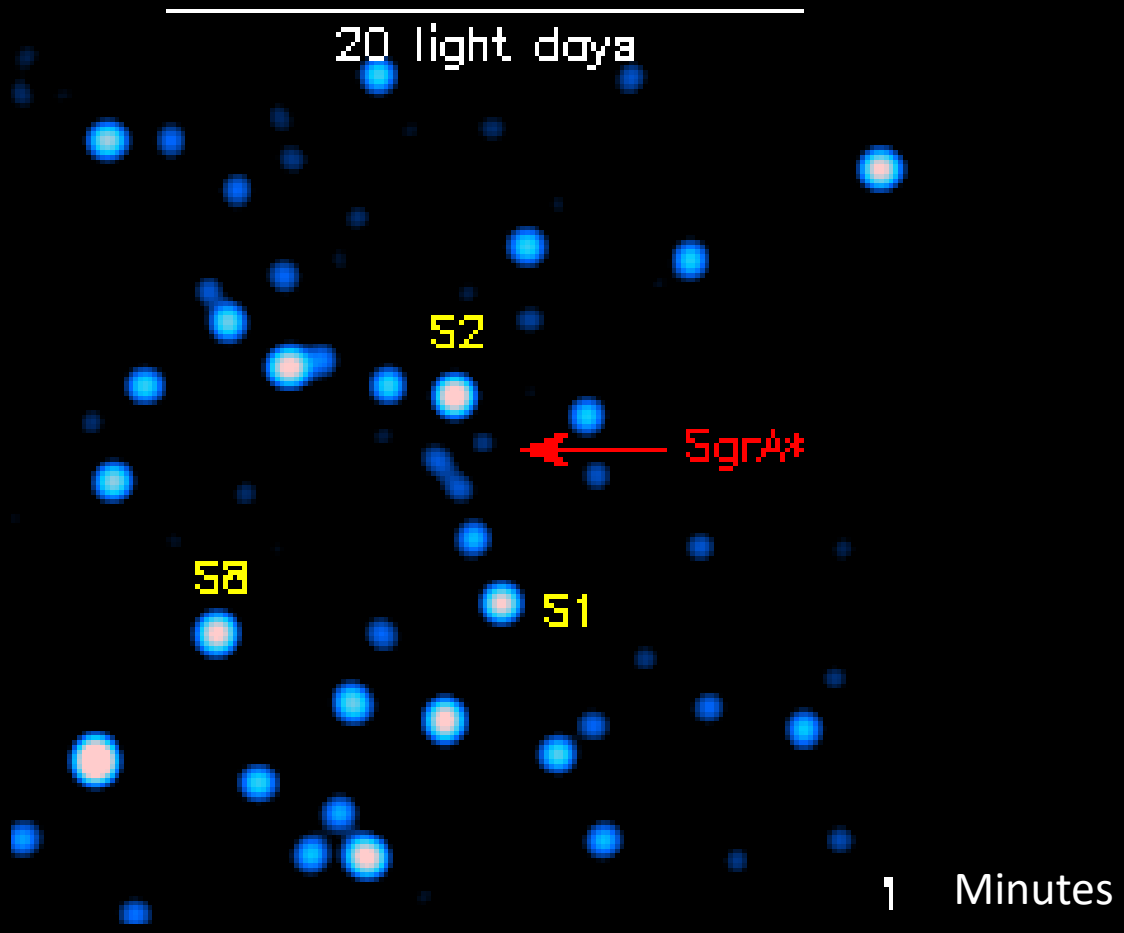


SUPERNOVA!

If You Can’t See a Black Hole, how do We Know it’s there?

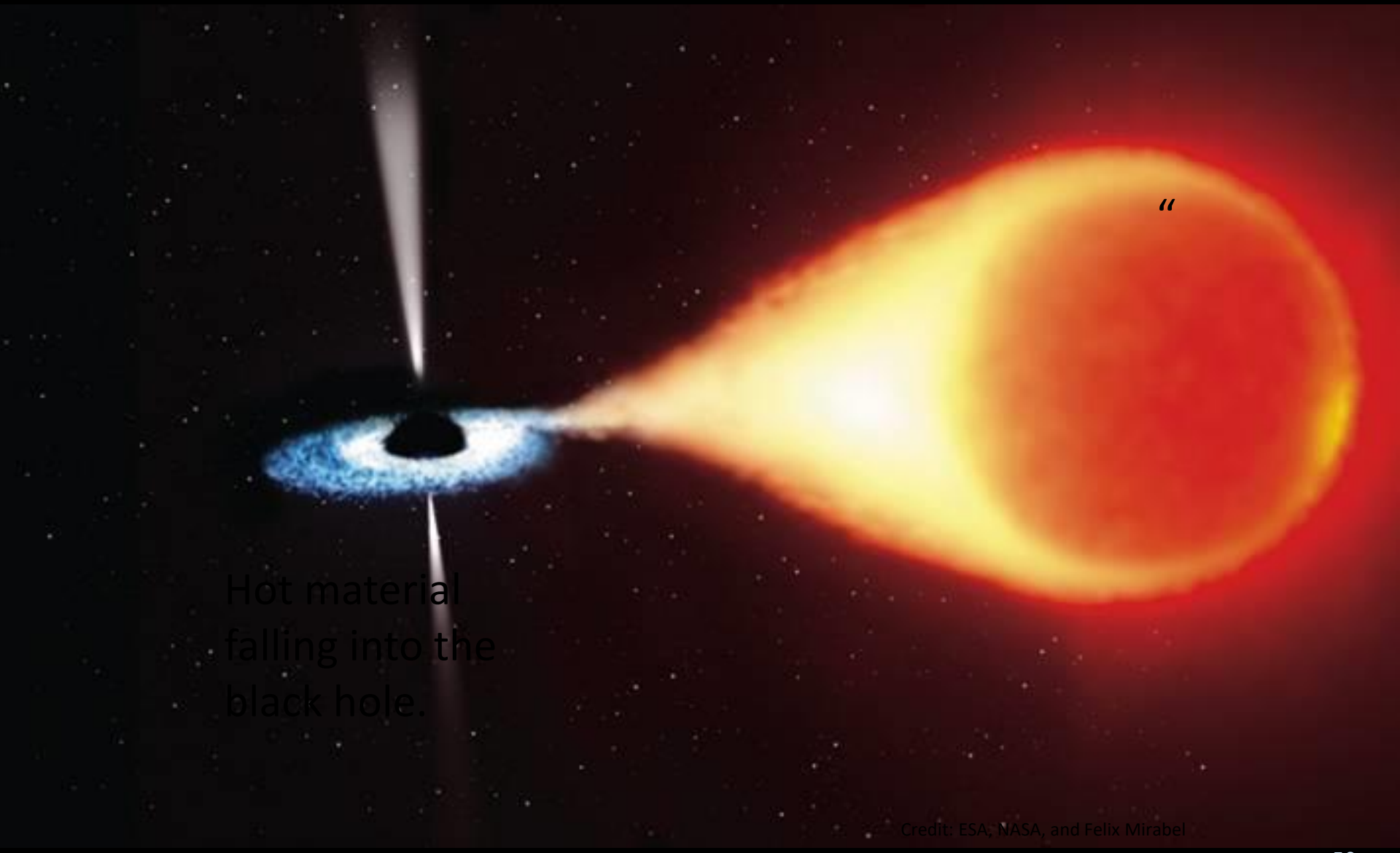
How Do We Know a Black Hole is There?

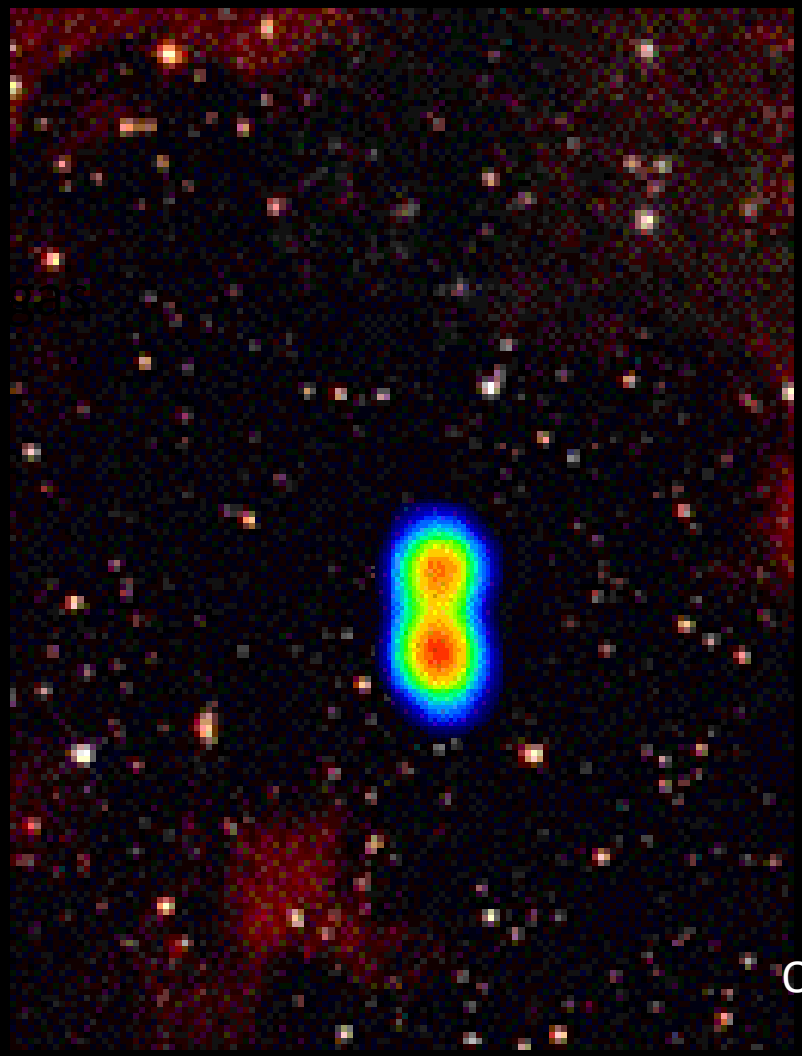
- Flares caused by stuff falling into the Black Hole.


20 light days
S2
SgrA*
S8
S1
1 Minutes

How Do We Know a Black Hole is There?

- Flares caused by stuff falling into the Black Hole.
- Spotting the jets coming off the Black Hole.


“
Hot material falling into the black hole.
Credit: ESA, NASA, and Felix Mirabel

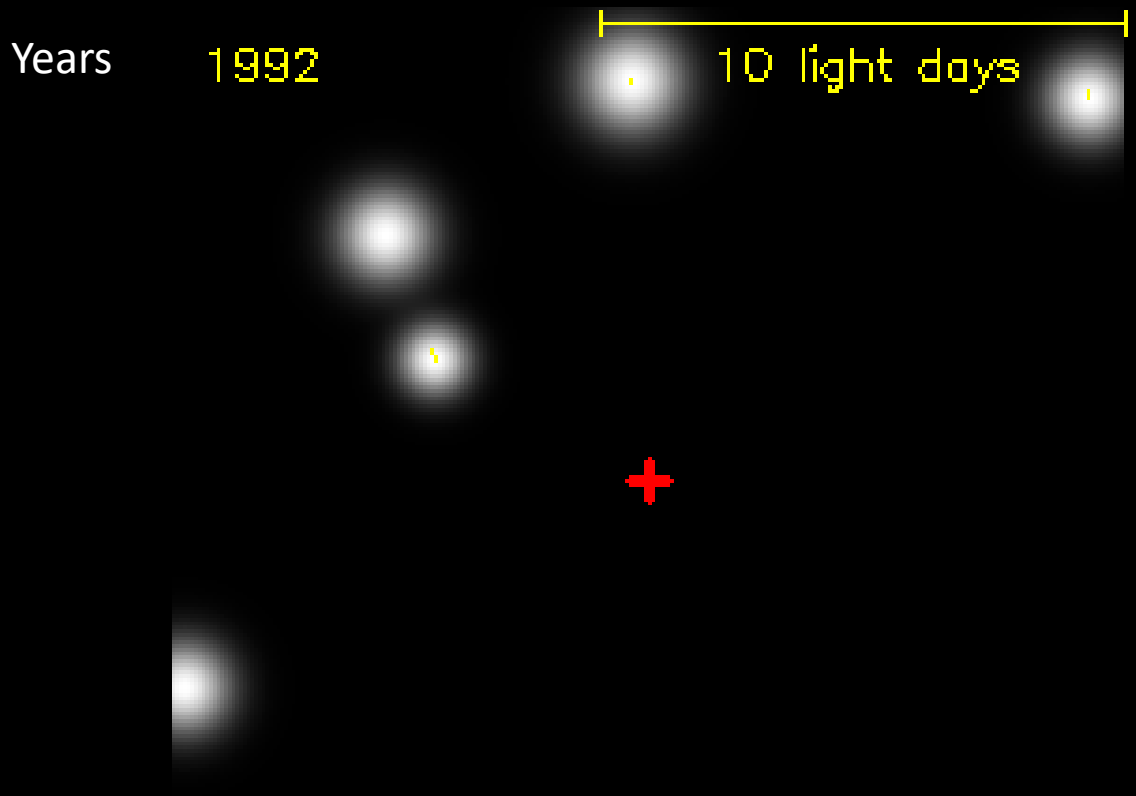


One month

How Do We Know a Black Hole is There?

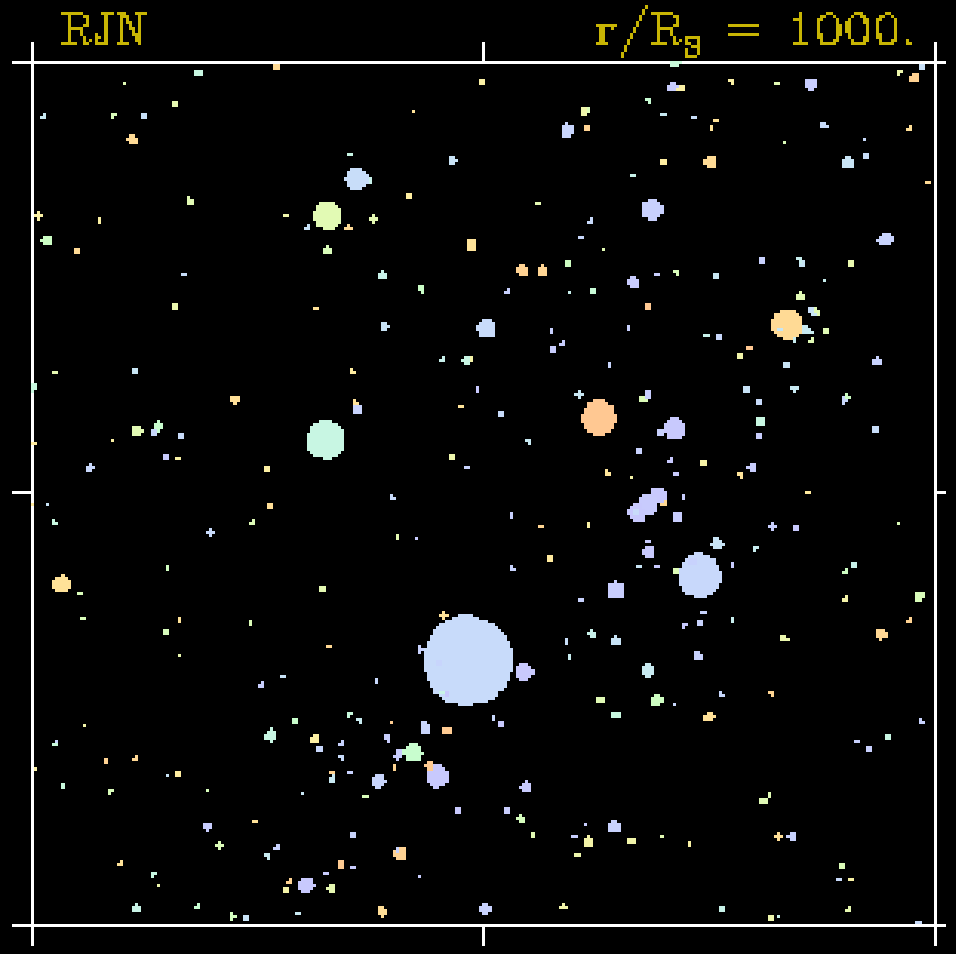
- Flares caused by stuff falling into the Black Hole.
- Spotting the jets coming off the Black Hole.
- Weird motion of stars around the Black Hole.

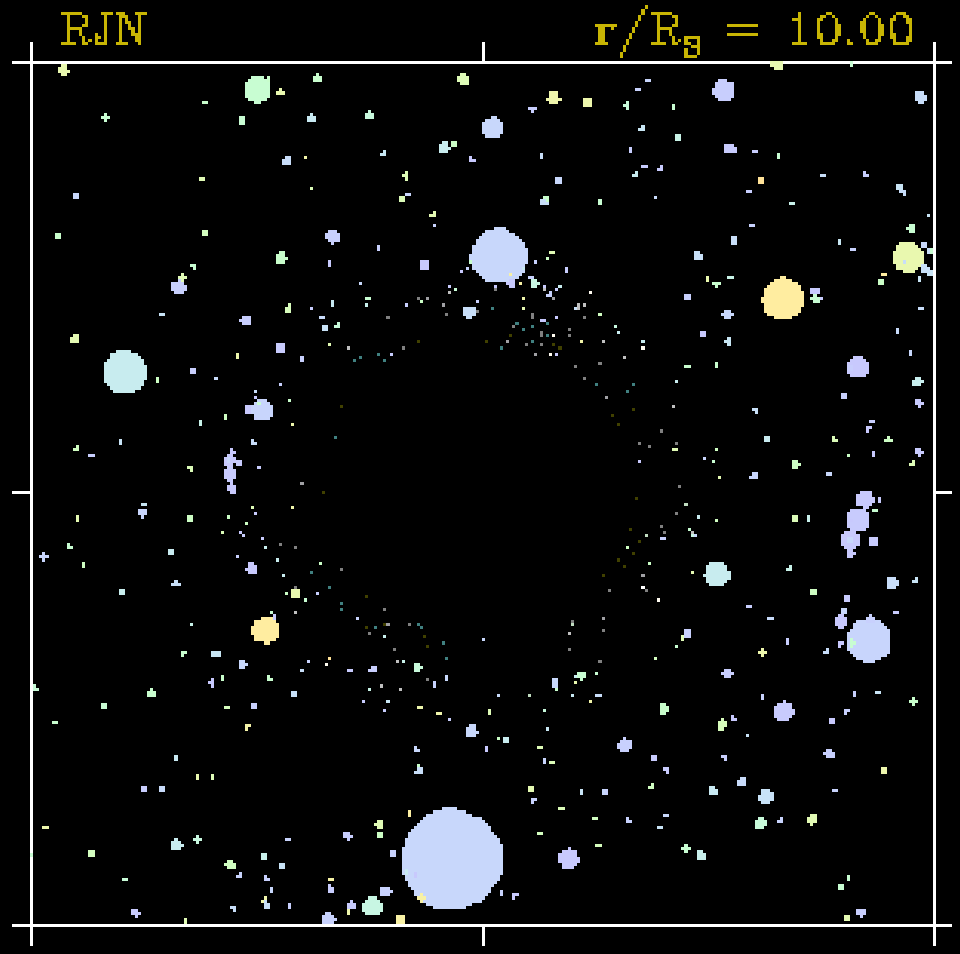
How do we know it's there?



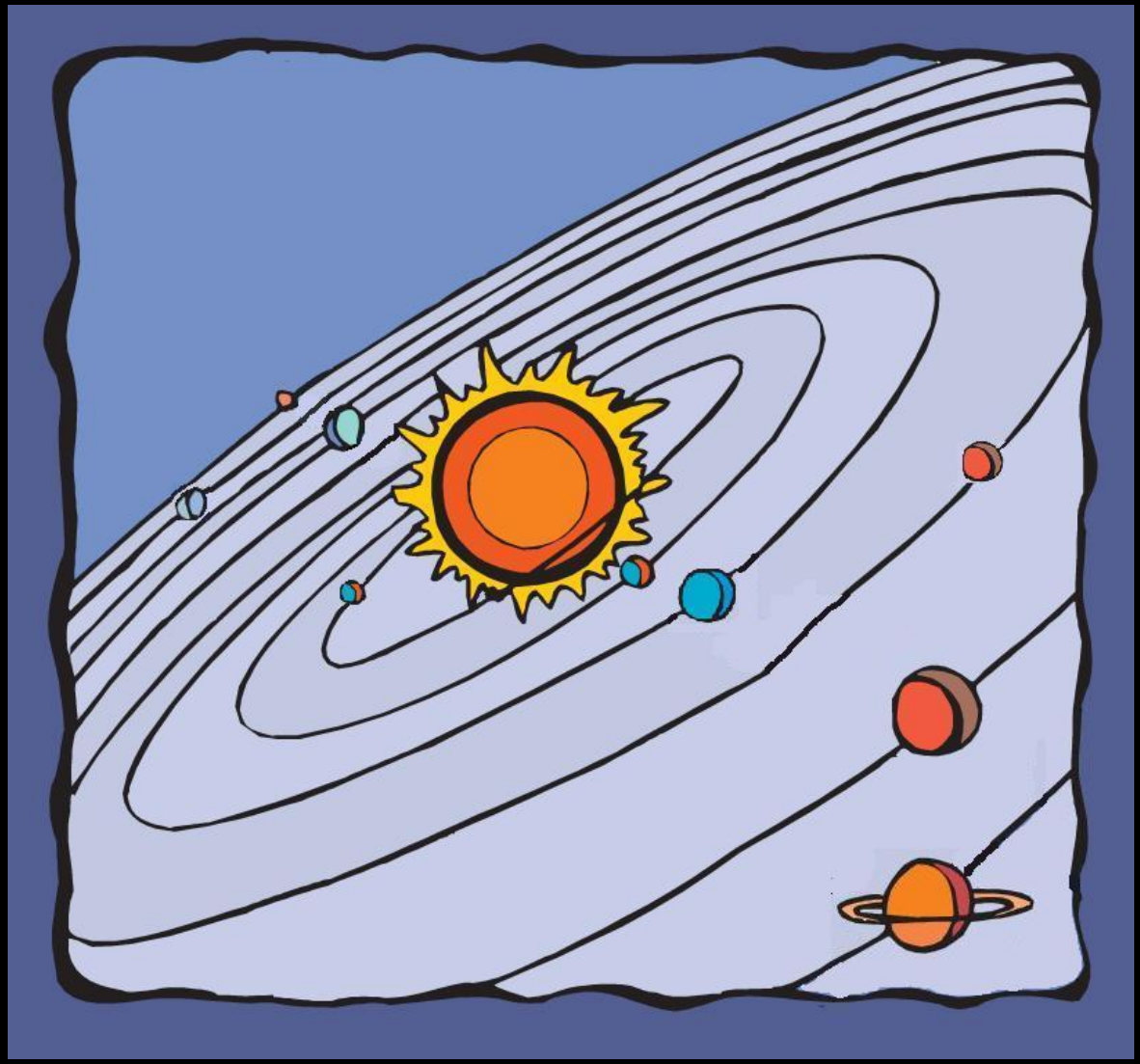
How Do We Know a Black Hole is There?

- Flares caused by stuff falling into the Black Hole.
- Spotting the jets coming off the Black Hole.
- Weird motion of stars around the Black Hole.
- Gravitational Lensing


RJN
r/Rs = 1000.

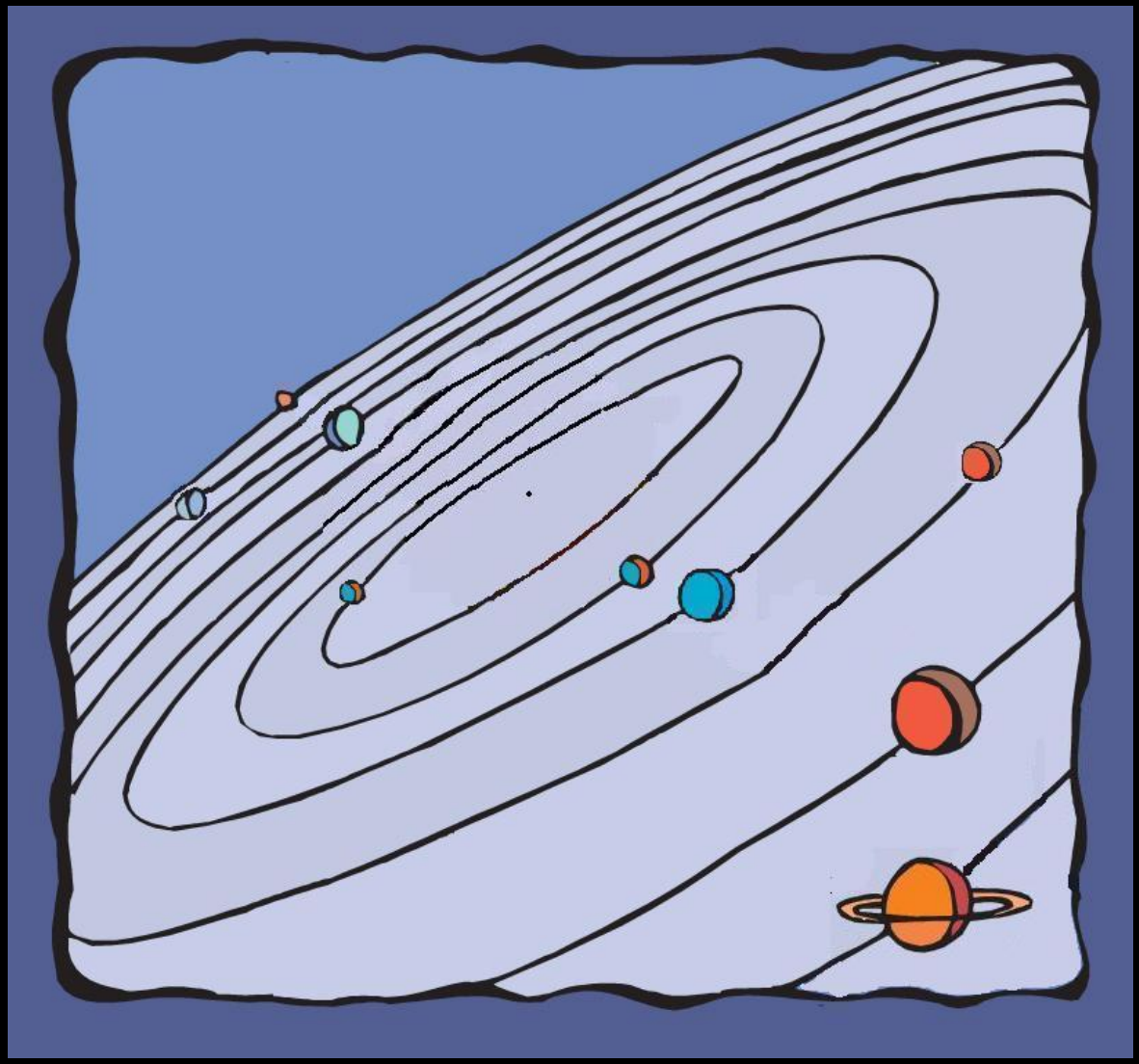

RJN
r/Rs = 10.00

What would happen if the Sun was…



Not to Scale

… changed into a Black Hole?



Not to Scale


The
END