General Characteristics and Origin of Universe, Solar System, Planets

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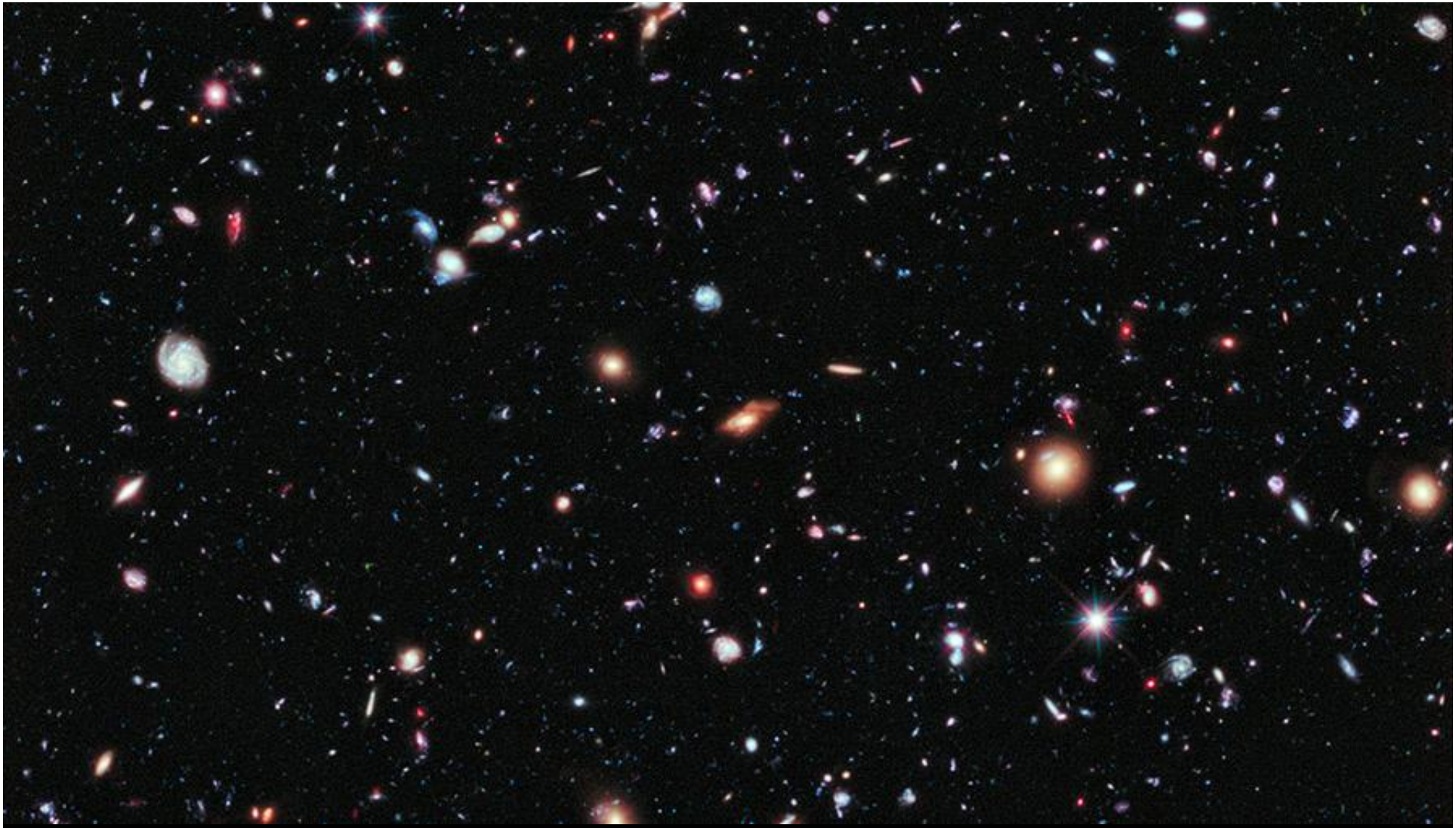
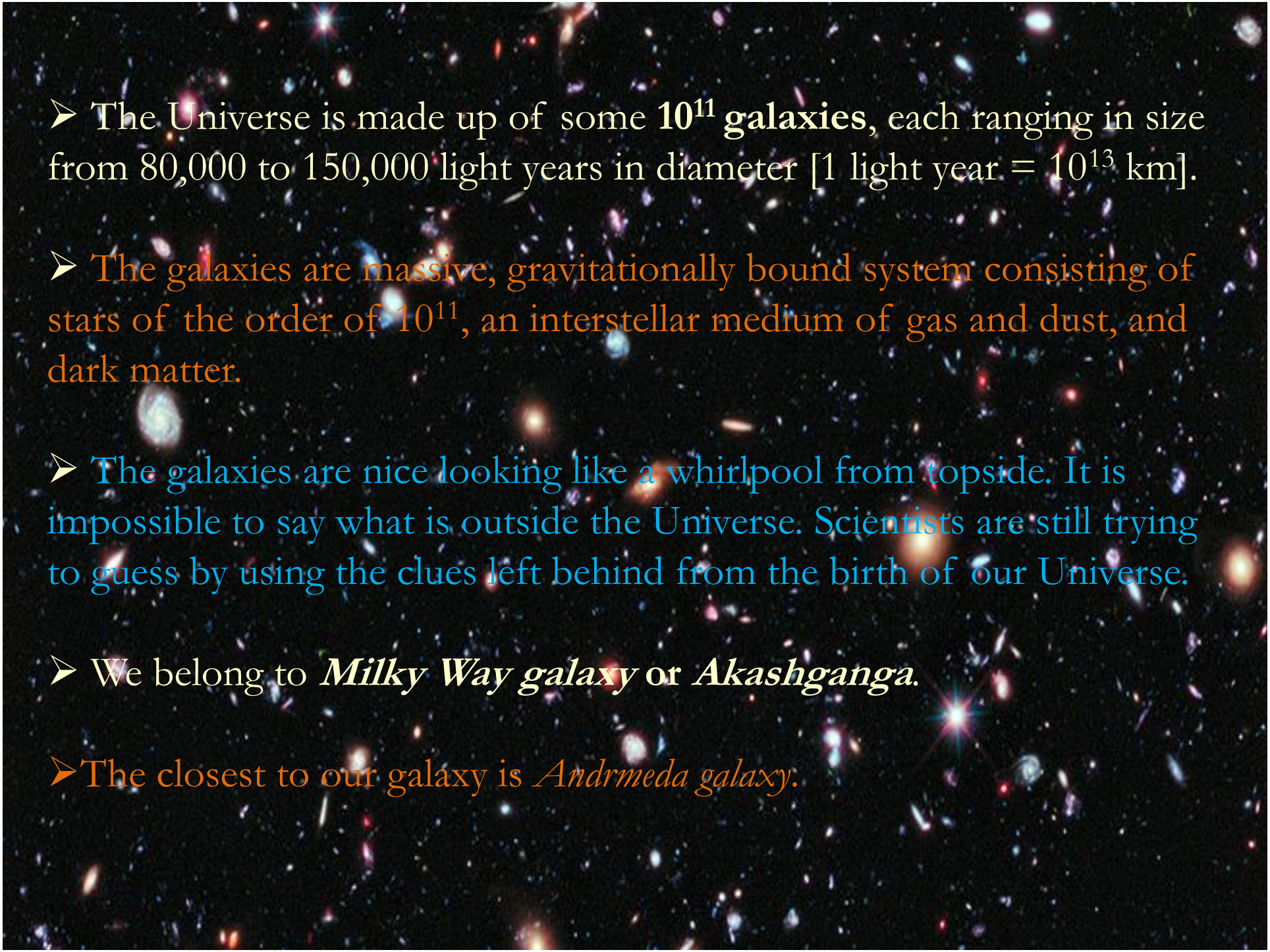


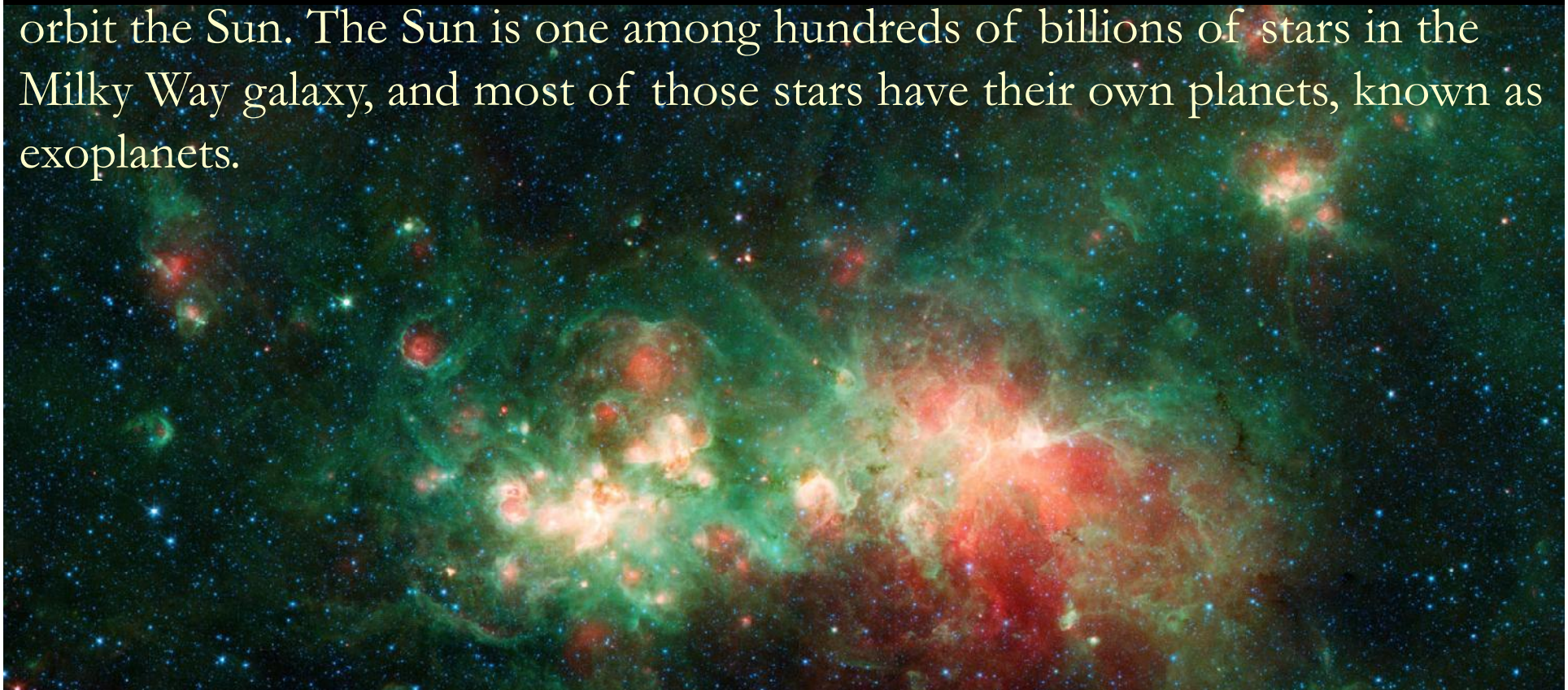
What is the universe?

The universe is everything. It includes all of space, and all the matter and energy that space contains. It even includes time itself and, of course, it includes you.

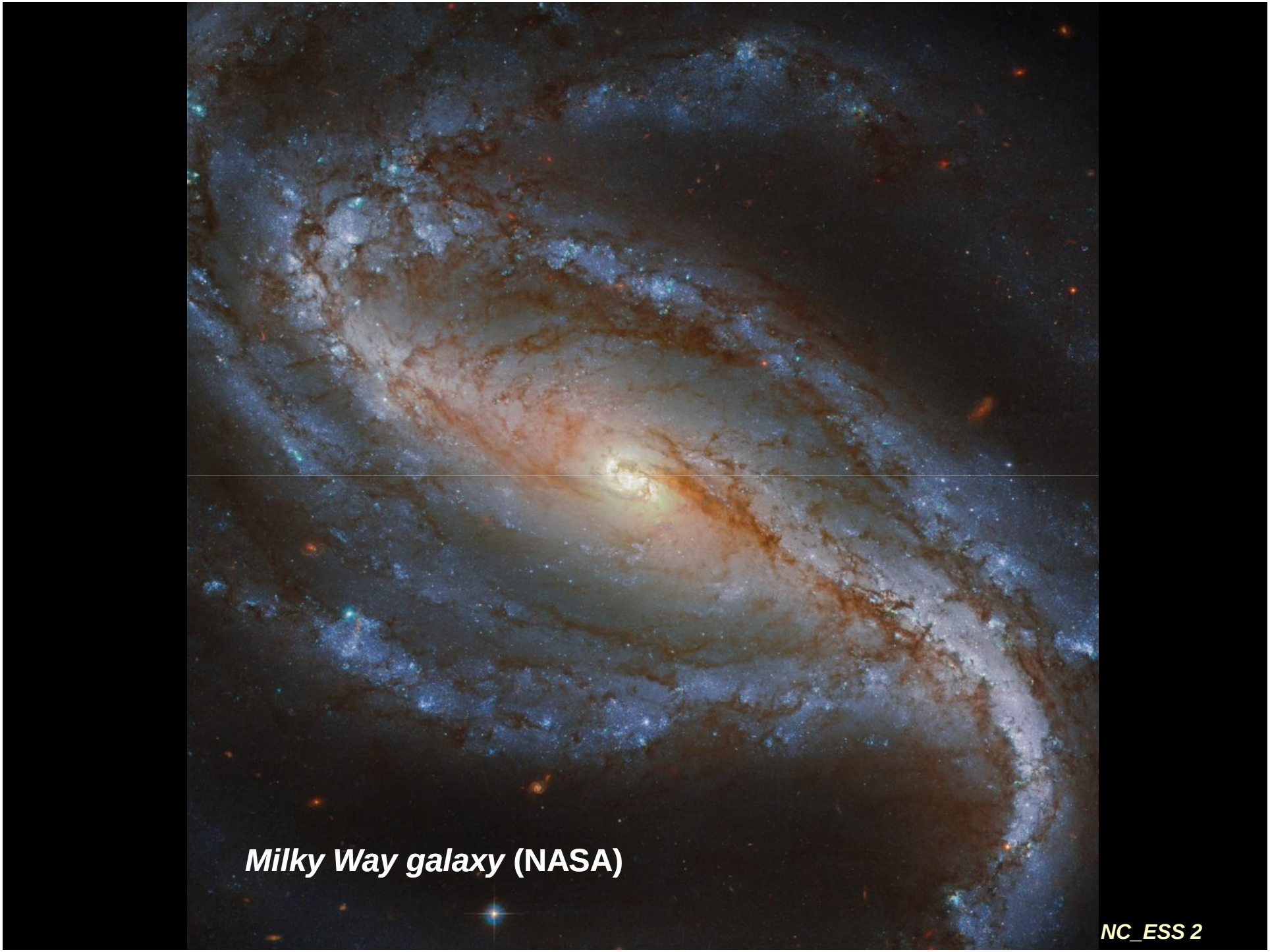


- The Universe is made up of some **10^{11} galaxies**, each ranging in size from 80,000 to 150,000 light years in diameter [1 light year = 10^{13} km].
- The galaxies are massive, gravitationally bound system consisting of stars of the order of 10^{11}, an interstellar medium of gas and dust, and dark matter.
- The galaxies are nice looking like a whirlpool from topside. It is impossible to say what is outside the Universe. Scientists are still trying to guess by using the clues left behind from the birth of our Universe.
- We belong to ***Milky Way galaxy*** **or** ***Akashganga***.
- The closest to our galaxy is *Andrmeda galaxy*.

Earth and the Moon are part of the universe, as are the other planets and their many dozens of moons. Along with asteroids and comets, the planets orbit the Sun. The Sun is one among hundreds of billions of stars in the Milky Way galaxy, and most of those stars have their own planets, known as exoplanets.



The Milky Way is but one of billions of galaxies in the observable universe — all of them, including our own, are thought to have super massive black holes at their centres. All the stars in all the galaxies and all the other stuff that astronomers can't even observe are all part of the universe. It is, simply, everything.


Milky Way galaxy (NASA)

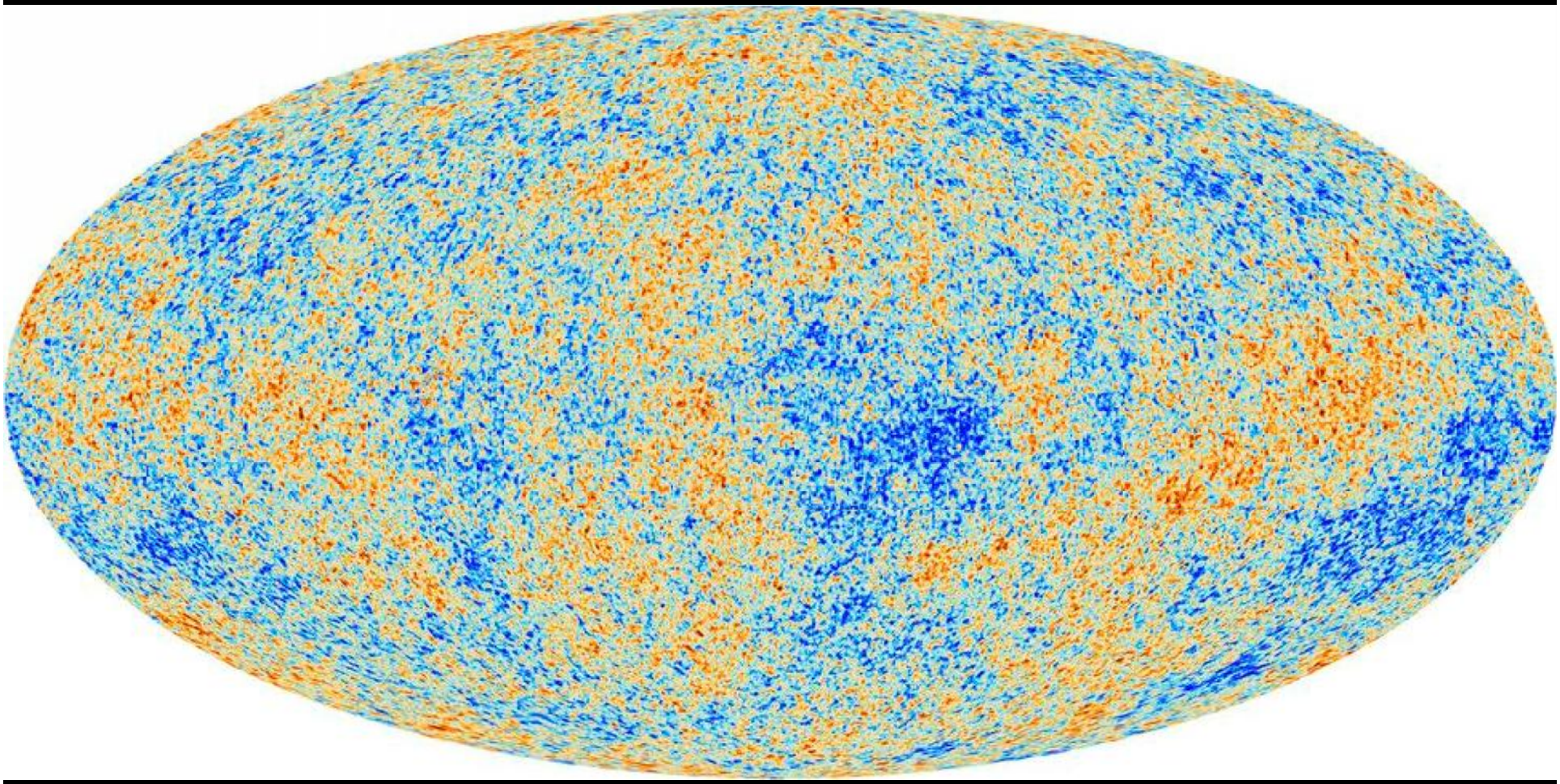

Origin of the Universe

- In 1927, an astronomer named Georges Lemaître had a big idea. He said that a very long time ago, the universe started as just a single point. He said the universe stretched and expanded to get as big as it is now, and that it could keep on stretching.

The BIG BANG is how astronomers explain the way the universe began. It is the idea that the universe began as just a single point, then expanded and stretched to grow as large as it is right now—and it is still stretching!

BIG BANG

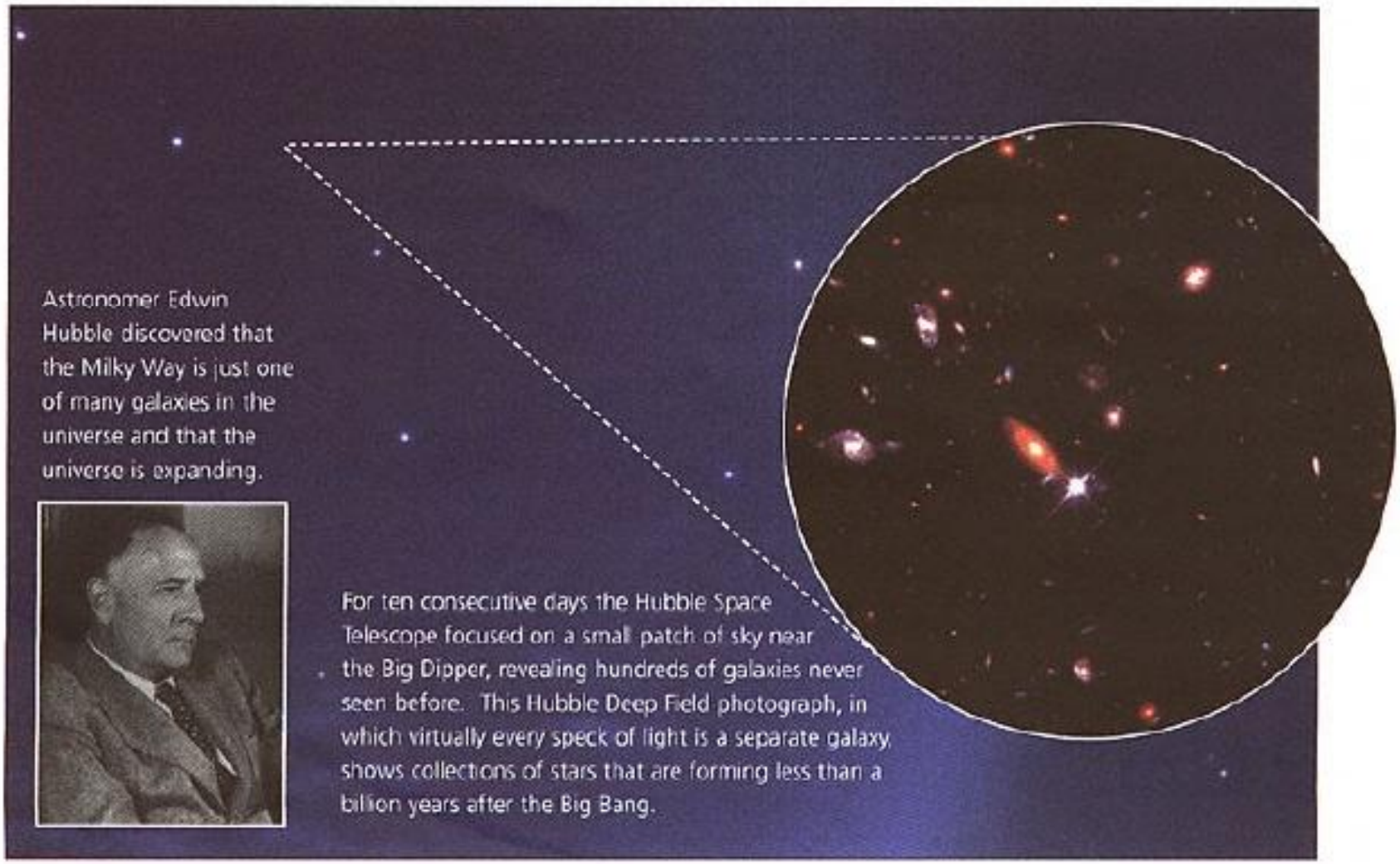
Hubble images show the far-distant galaxy GN-z11 as it appeared shortly after the Big Bang. (Image credit: NASA)



A map of the background radiation left over from the Big Bang. ESA's Planck spacecraft captured **the oldest light in the universe**. This information helps astronomers determine the age of the universe.
(Image credit: ESA and the Planck Collaboration, CC BY-SA)

Just two years later, an astronomer named **Edwin Hubble** noticed that :

other galaxies were moving away from us. And that's not all. The farthest galaxies were moving faster than the ones close to us.

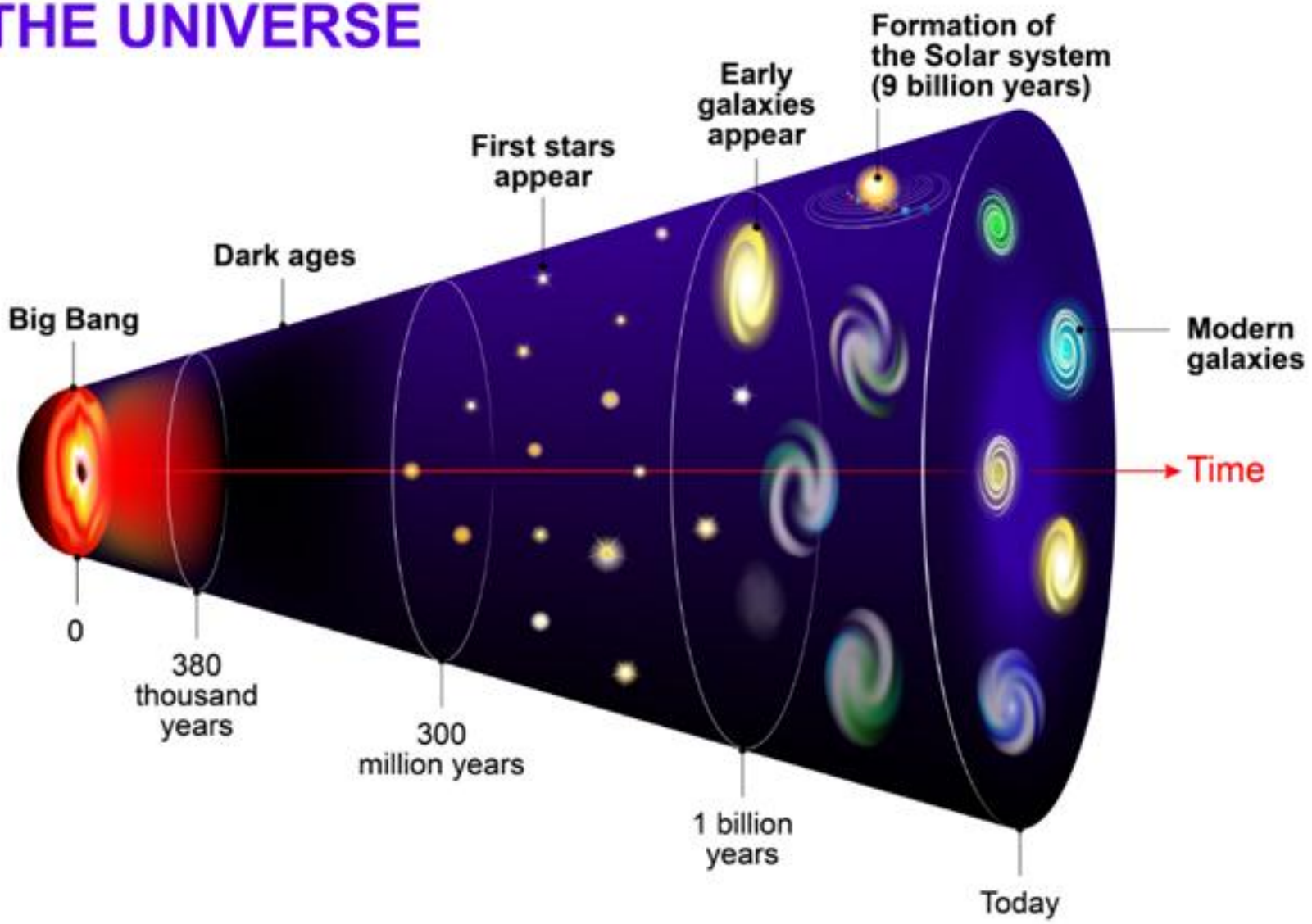


- When the universe began, it was just hot, tiny particles mixed with light and energy.

- The tiny particles grouped together. They formed atoms. Then those atoms grouped together. Over lots of time, atoms came together to form stars and galaxies.

- The first stars created bigger atoms and groups of atoms. That led to more stars being born. At the same time, galaxies were crashing and grouping together. As new stars were being born and dying, then things like asteroids, comets, planets, and black holes formed!

EVOLUTION OF THE UNIVERSE



THE EXPANSION OF THE UNIVERSE

- The universe is not only expanding, but expanding faster. This means that with time, nobody will be able to spot other galaxies from Earth or any other vantage point within our galaxy.

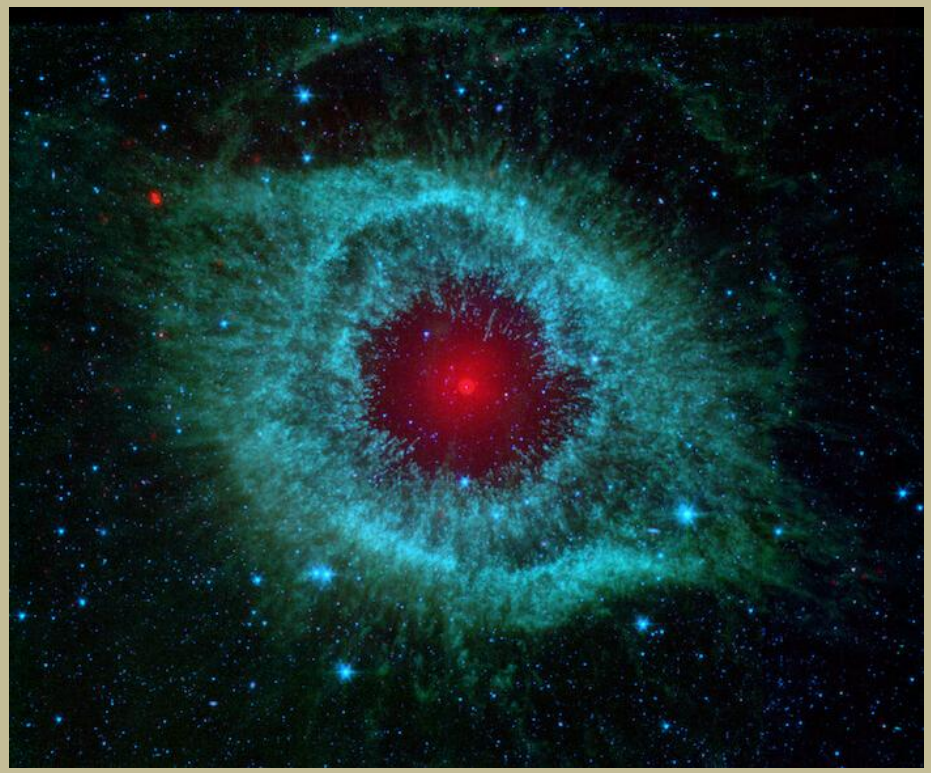
"We will see distant galaxies moving away from us, but their speed is increasing with time,“---- Harvard University astronomer **Avi Loeb (**March 2014 Space.com article).

"So, if you wait long enough, eventually, a distant galaxy will reach the speed of light. What that means is that even light won't be able to bridge the gap that's being opened between that galaxy and us. There's no way for extraterrestrials on that galaxy to communicate with us, to send any signals that will reach us, once their galaxy is moving faster than light relative to us."


Origin of the
Solar System

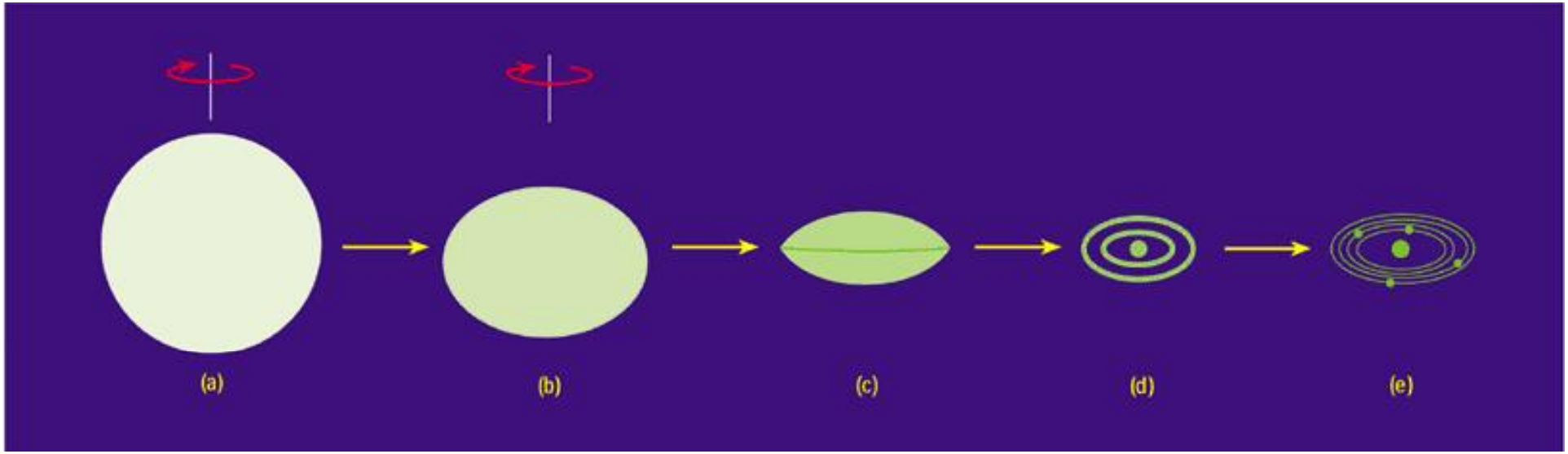
What is Nebula?

In Latin for "mist" or "cloud.
A nebula is **a giant cloud of dust and gas in space, wh**ich astronomers refer to as **a distinct luminescent part of interstellar medium**.
Some nebulae (more than one nebula) come from the gas and dust thrown out by the explosion of a dying star, such as a supernova. Other nebulae are regions where new stars are beginning to form.



NASA's Spitzer Space Telescope captured this image of the Helix Nebula, which is located in the constellation Aquarius-about 700 light-years away from Earth

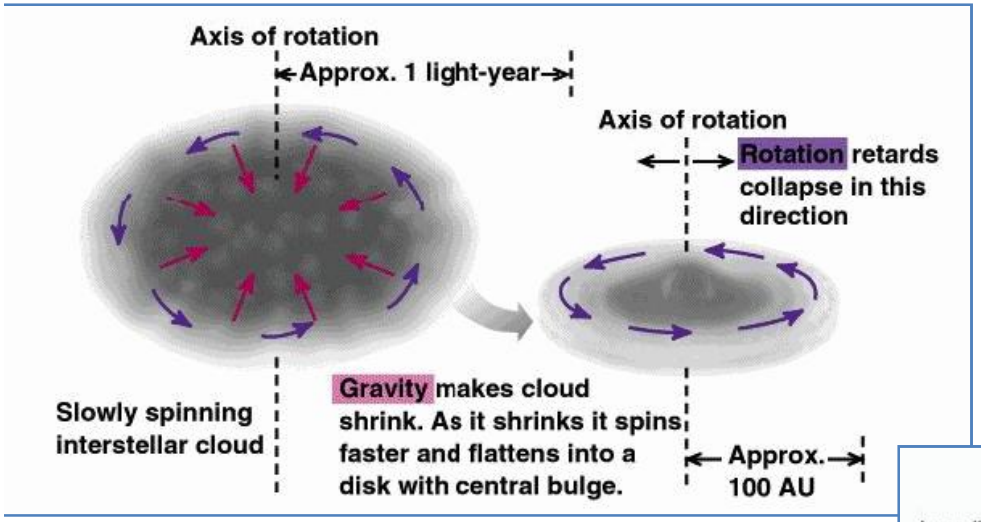
Nebular Hypothesis-Kant (1755) & Laplace (1796)

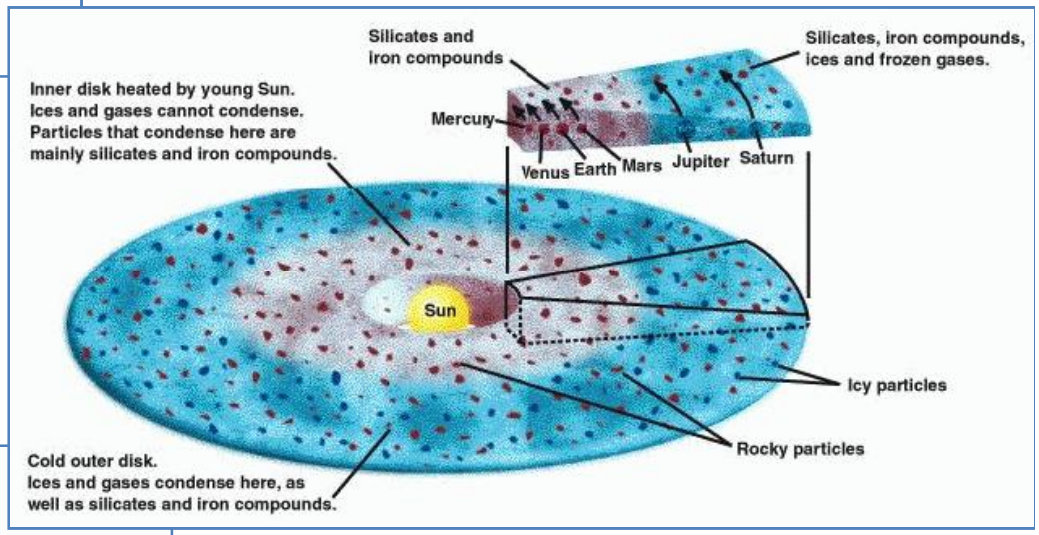


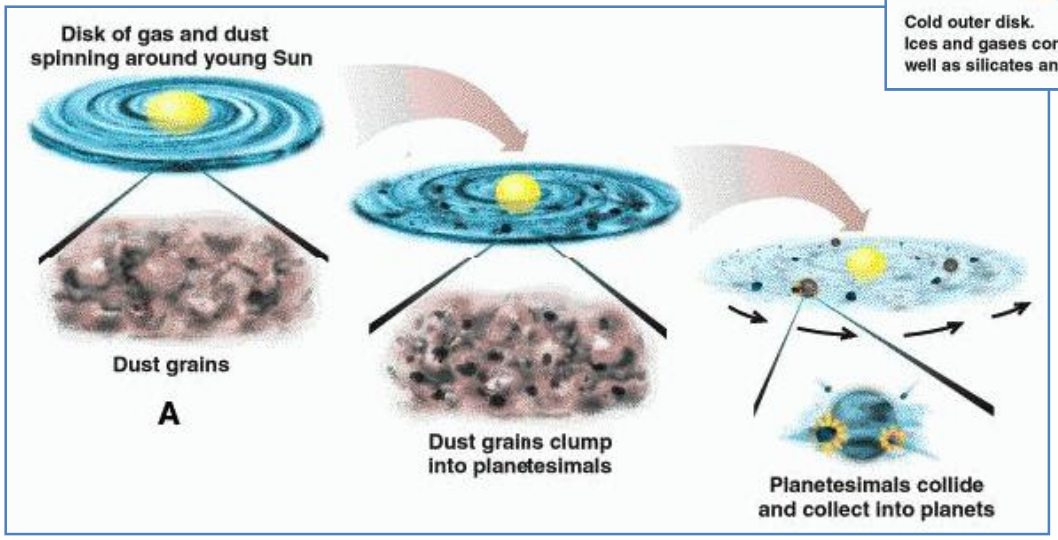
An illustration of Laplace's nebula theory. (a) A slowly rotating and collapsing gas-and-dust sphere. (b) An oblate spheroid forms as the spin rate increases. (c) The critical lenticular form. (d) RIngs left behind in the equatorial plane. (e) One planet condensing in each ring.

A&G, Volume 41, Issue 1, February 2000, Pages 1.12–1.19, https://doi.org/10.1046/j.1468-4004.2000.00012.x

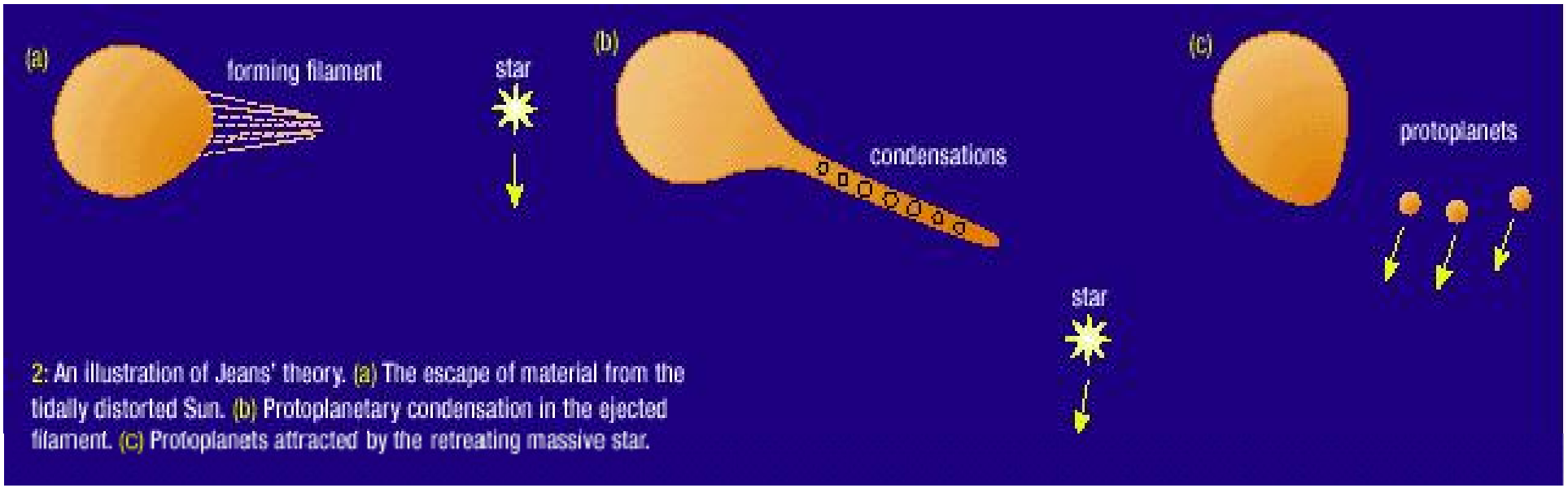
Weizsacker's Dust-gas Cloud Hypotheses (1943)







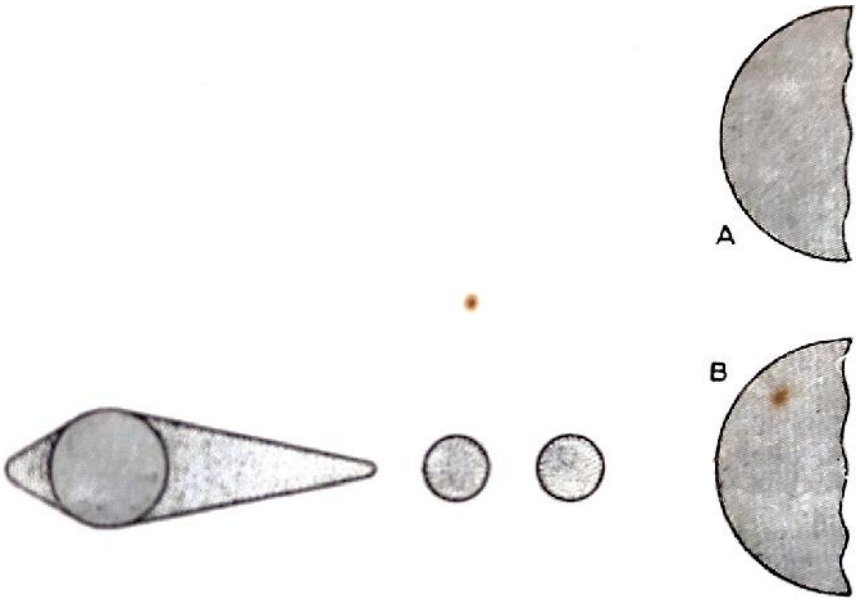
Gaseous Tidal Hypothesis-Jeans & Jeffreys (1925)



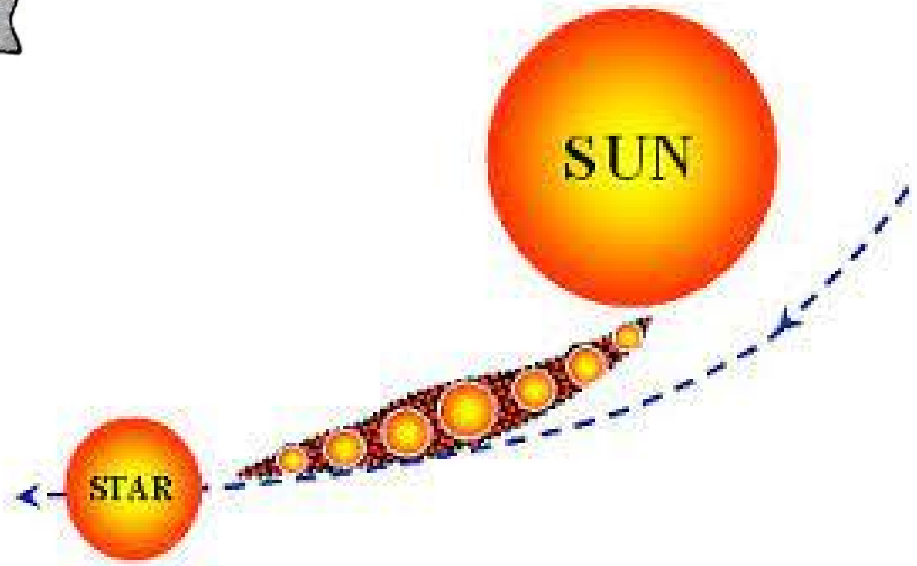
An illustration of Jeans' theory. (a) The escape of material from the tidally distorted Sun. (b) Protoplanetary condensation in the ejected filament. (c) Protoplanets attracted by the retreating massive star.

A&G, Volume 41, Issue 1, February 2000, Pages 1.12–1.19, https://doi.org/10.1046/j.1468-4004.2000.00012.x

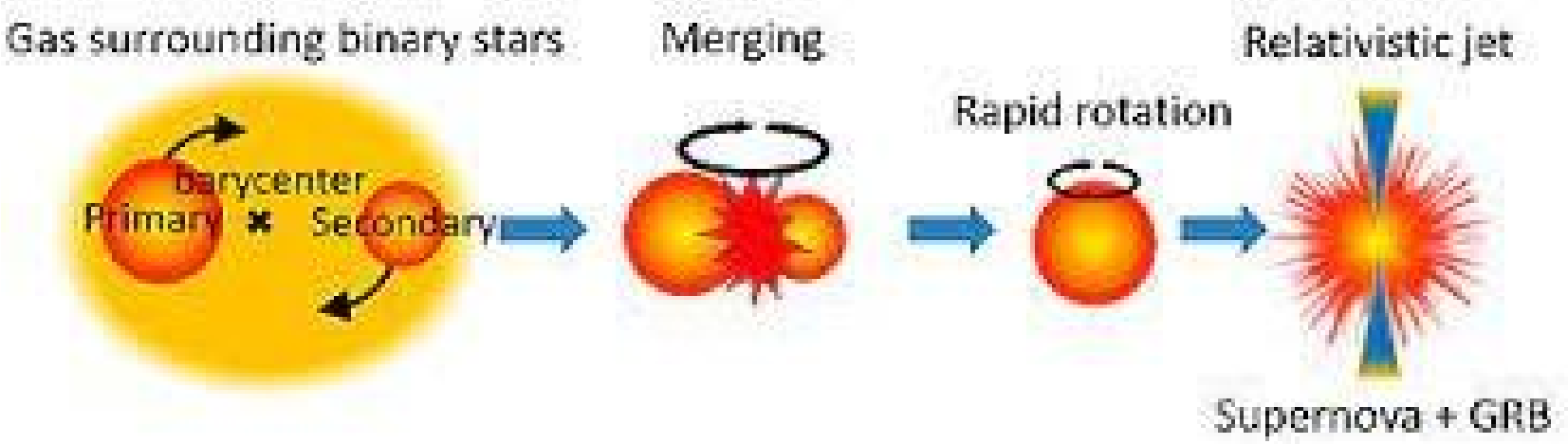
Planetesimal Hypothesis-Chamberlin and Forest Moulton (1905)



Gravitational pull of the passing star



Binary Star Hypothesis -Russell and Lyttleton (1937)

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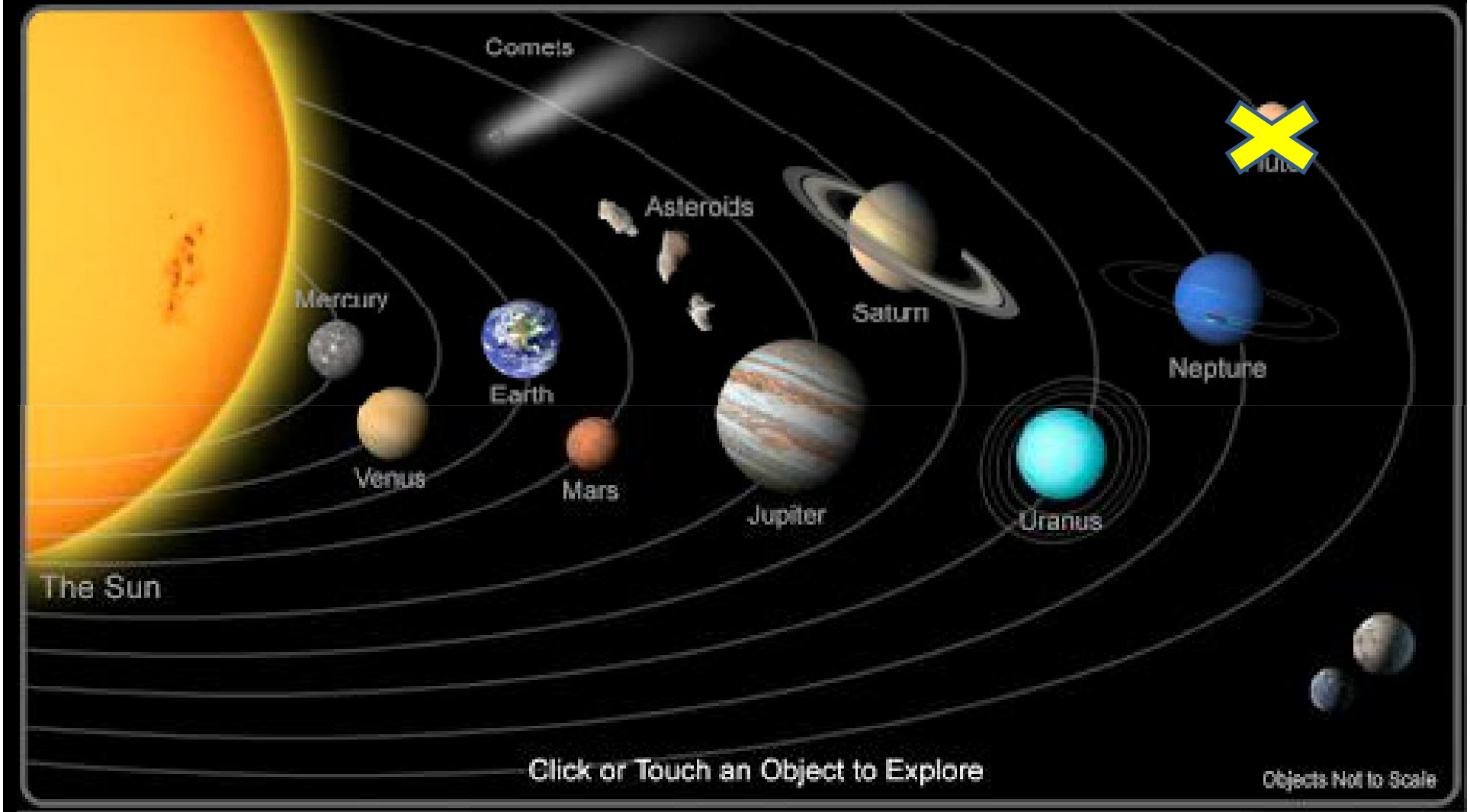
Comets
Asteroids
Mercury
Earth
Saturn
Nepture
Venus
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Jupiter
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The Sun
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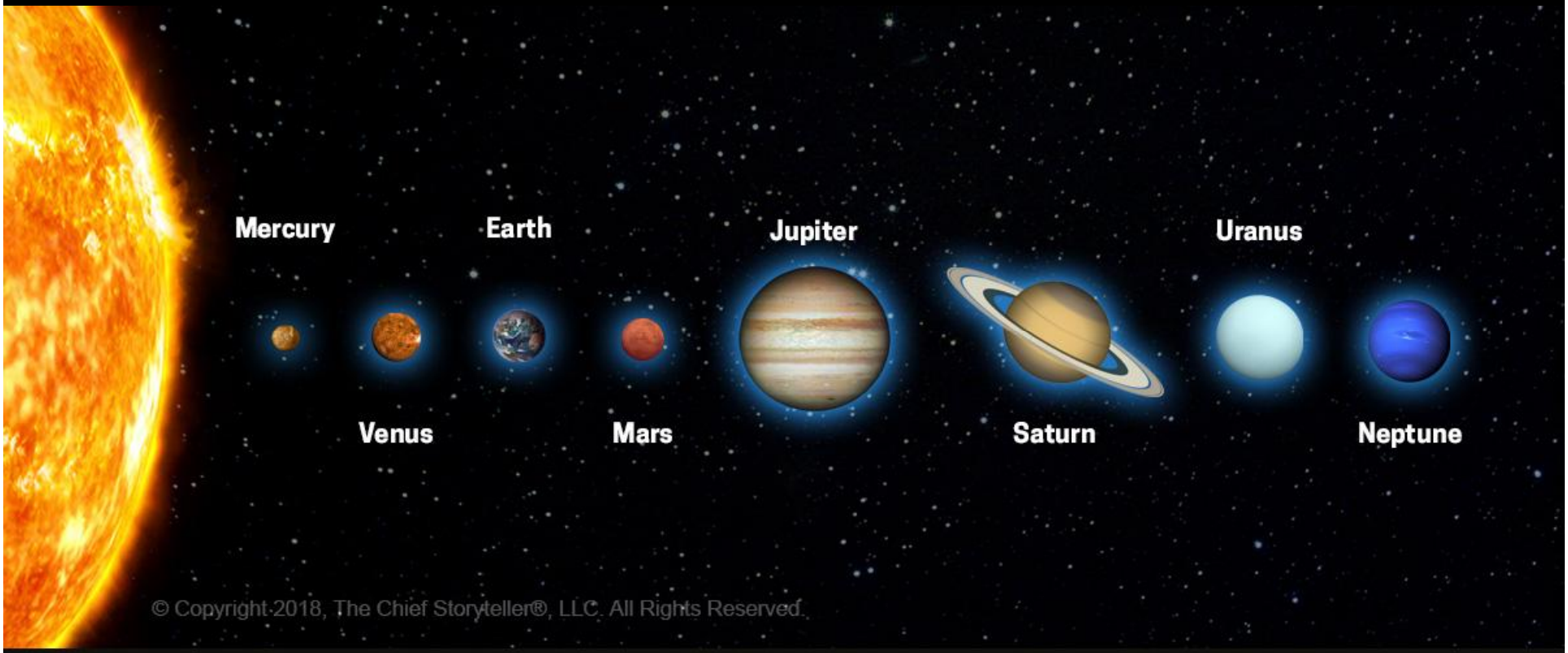

Terrestrial Planet	Jovian Planet
1. Also known as inner planets. They are **Mercury, Venus, Earth and Mars**	1. Also known as outer planets. They are **Jupiter, Saturn, Uranus and Neptune.**
2. Sizes are small, nearly the size of the Earth.	2. Sizes are huge.
3. Their surfaces are mainly rocky in nature and contain massive iron cores.	3. They do not have solid surfaces. Instead, they are composed primarily of hydrogen and helium
4. They consist of nitrogen and carbon dioxide in their atmospheres.	4. They are called gas giants because they are mostly made up of gases.
5. These planets are closer to the sun, and are hence warmer that the rest of the planets in our solar system.	5. These planets are further away from the sun, and are hence colder than the rest of the planets in our solar system.

PLANET EARTH

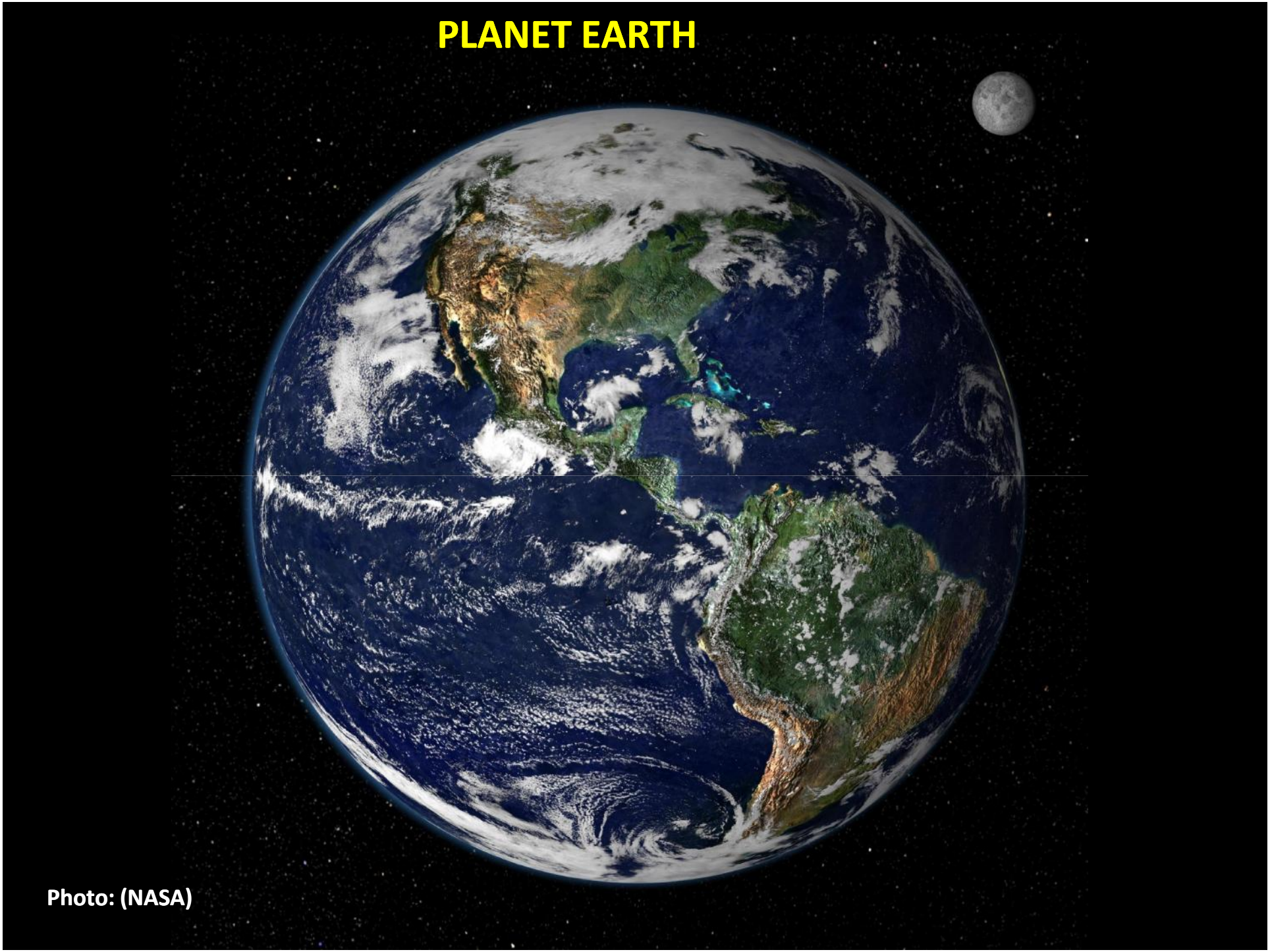

Photo: (NASA)

- Third planet from the sun, Earth is the only place in the known universe confirmed to host life.
- Only one known for sure to have liquid water on its surface. With a radius of 3,959 miles, Earth is the fifth largest planet in our solar system
- Earth orbits the sun once every 365.25 days. Since our calendar years have only 365 days, we add an extra leap day every four years to account for the difference.
- Earth rotates on its axis every 23.9 hours, defining day and night for surface dwellers. This axis of rotation is tilted 23.4 degrees away from the plane of Earth's orbit around the sun, giving us seasons.
- Radioactive decay of isotopes on Earth and in asteroids, scientists have learned that our planet and the solar system formed around **4.6 billion years** ago.

Source: Nat.Geo.

Mean radius	6371.0 km (3958.8 mi)
Equatorial radius	6378.137 km (3963.191 mi)
Polar radius	6356.752 km (3949.903 mi)
Flattening	1/298.25722210
Surface area	Total: 510072000 km^2 Land: 148940000 km^2 Water: 361132000 km^2
Volume	1.08321×10^{12} km^3
Mass	5.972168×10^{24} kg
Mean density	5.5134 g/cm^3
Surface gravity	9.80665 m/s^2
Escape velocity	11.186 km/s
Axial tilt	23.4392811°[
Albedo	•0.367 geometric
Temperature	287.91 K (14.76 °C; 58.57 °F
Atmospheric pressure (surface)	101.325 kPa (at sea level)

Composition by volume	•78.08% nitrogen (N_2; dry air) •20.95% oxygen (O_2) •~ 1% water vapor (climate variable) •0.9340% argon •0.0413% carbon dioxide •0.00182% neon •0.00052% helium •0.00019% methane •0.00011% krypton •0.00006% hydrogen

Thank you…