

ROSETTA AND VIRTUOSO

IN LOVE WITH NEWTON



From Deep Space to Deep Sea

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ROSETTA:

VIRTUOSO COMES ON BOARD IN 1998



OUR VIRTUOSO RTOS INSIDE

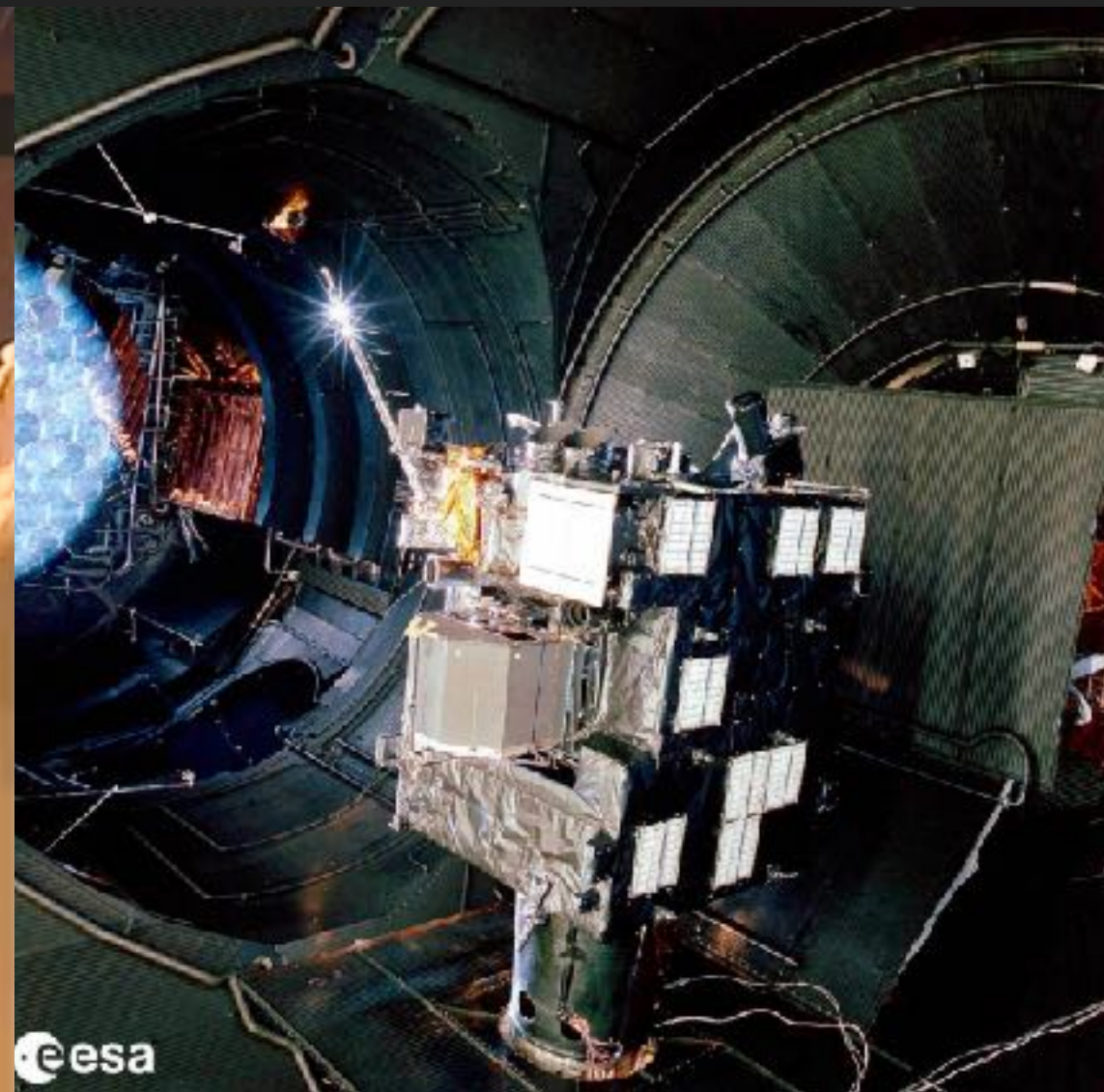


A NETWORK-CENTRIC RTOS (REAL-TIME OPERATING SYSTEM)

- ▶ First version: 1991
- ▶ Based on packet-switching
- ▶ Largest system has 1200 processors (oil exploration)
- ▶ Used by ESA from 1998 => Rosetta mission
- ▶ Acquired by WRS 2001, open sourced as "Zephyr"
- ▶ Redeveloped in 2005 with FORMAL METHODS
 - ▶ Code size: 10 x less. Very robust and safe
 - ▶ => VirtuosoNext (still in use)

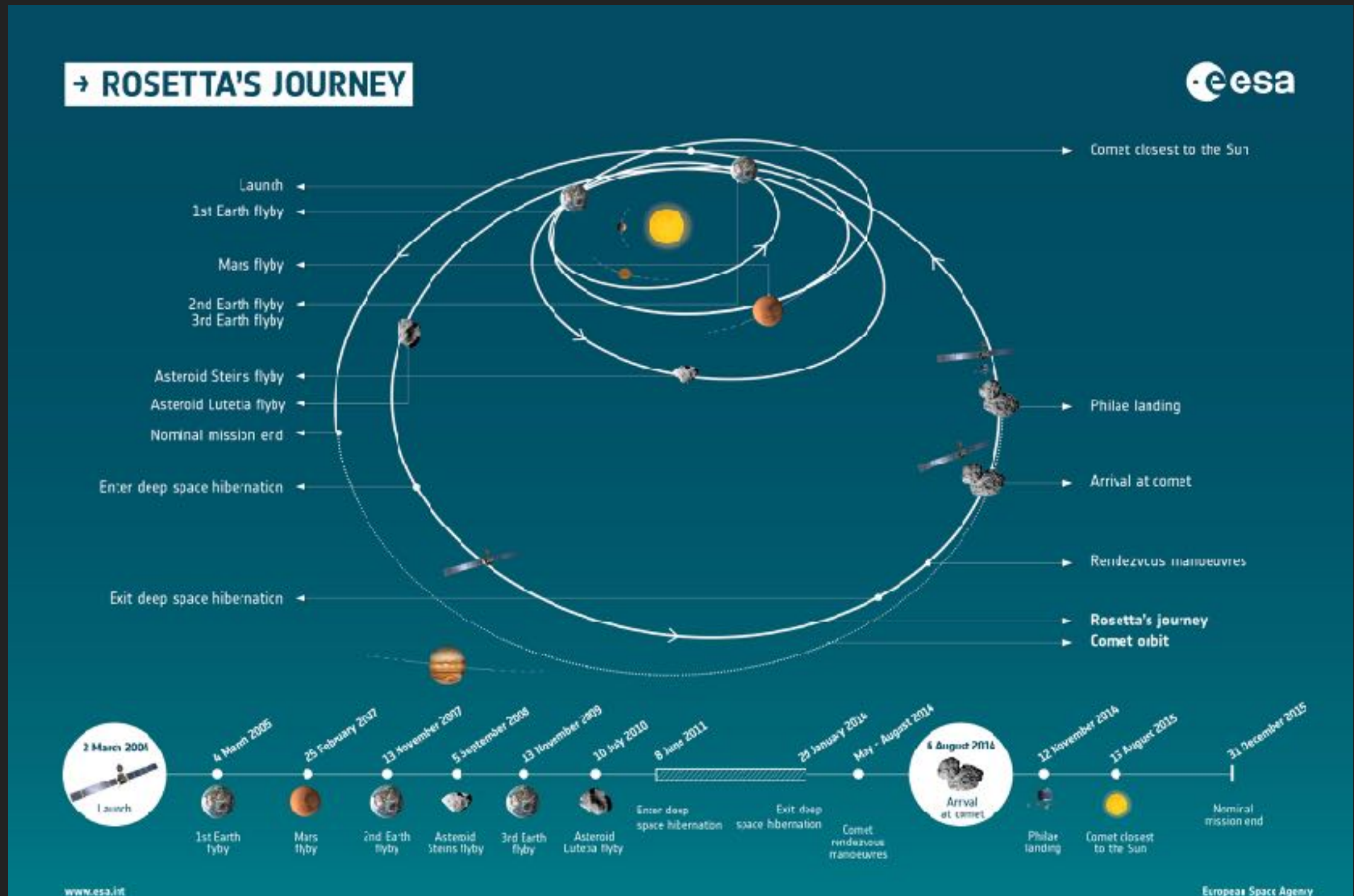
ROSETTA

TAKING A RIDE IN 2004



ROSETTA:

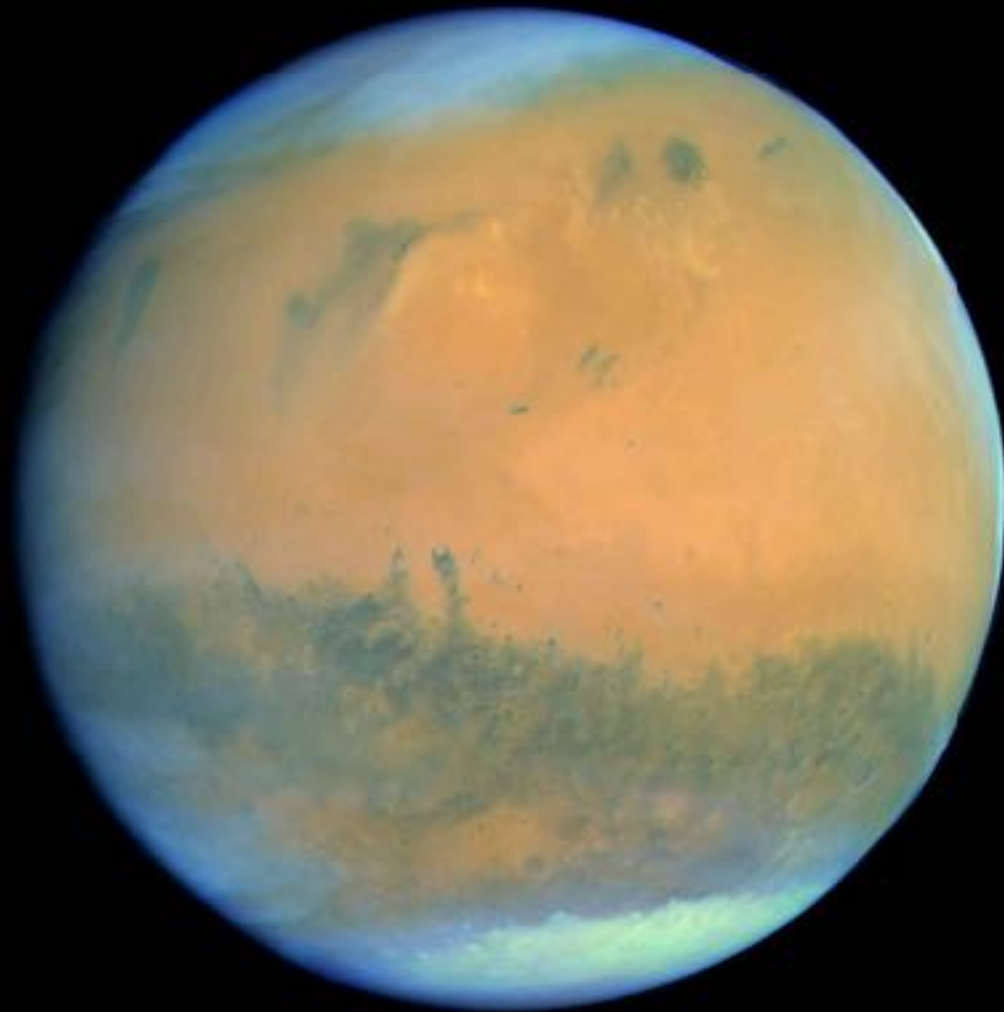
A 10 YEARS JOURNEY: 2004 – 2014 & 500 MILLION KM AWAY



ROSETTA

TOURIST TOUR

MARS



MOTHER EARTH



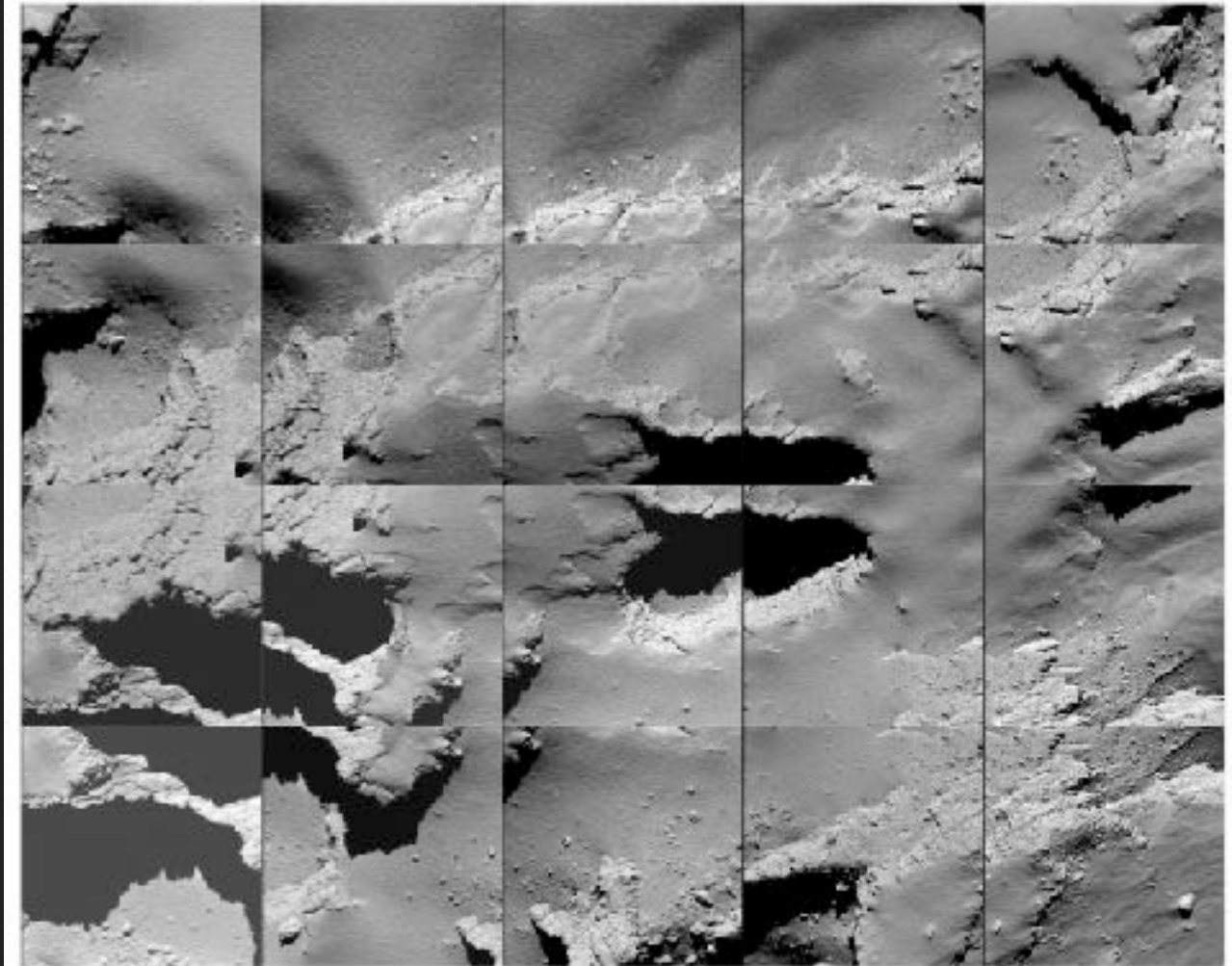
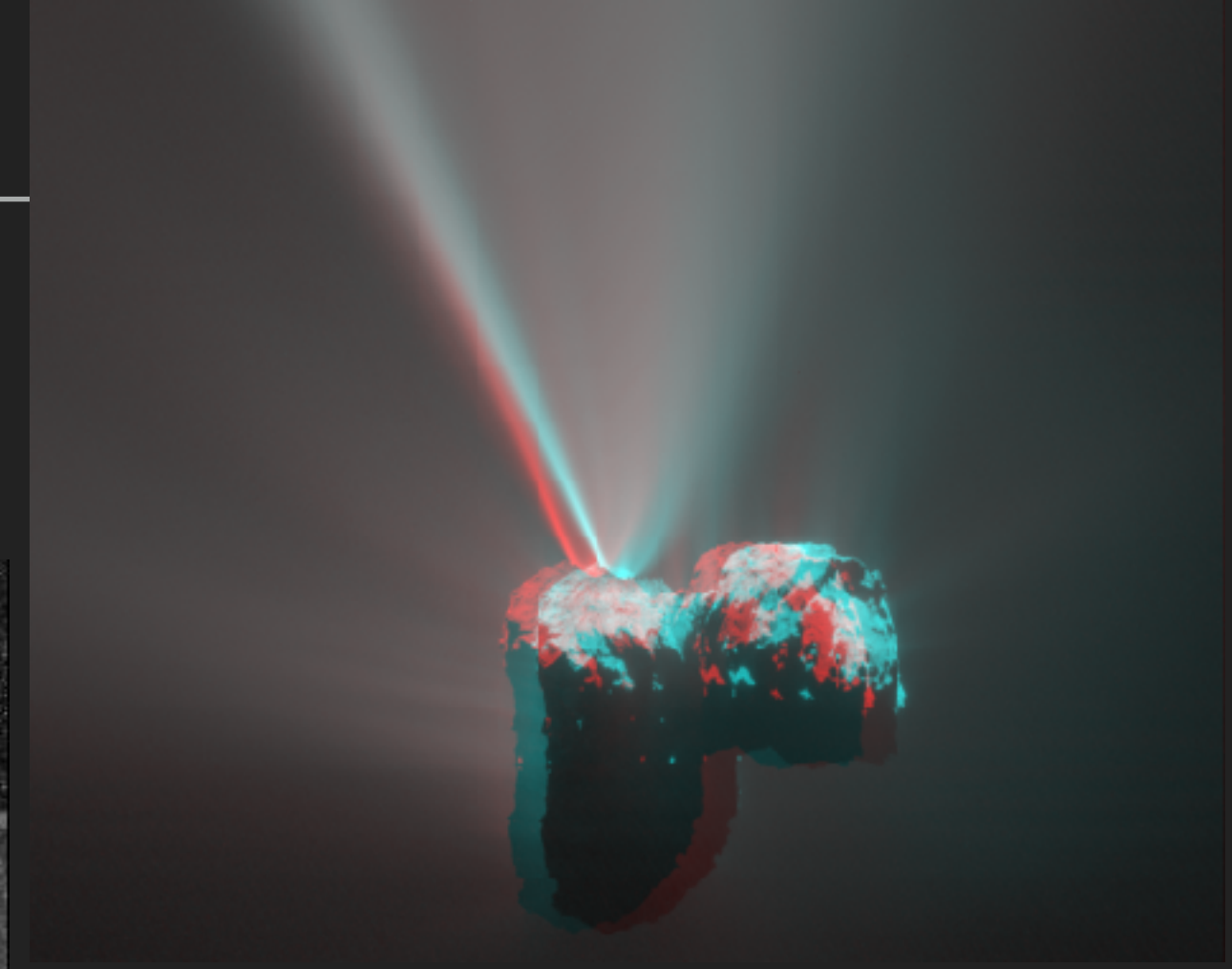
ROSETTA

CALLING HOME



ROSETTA

A ROOM WITH A VIEW

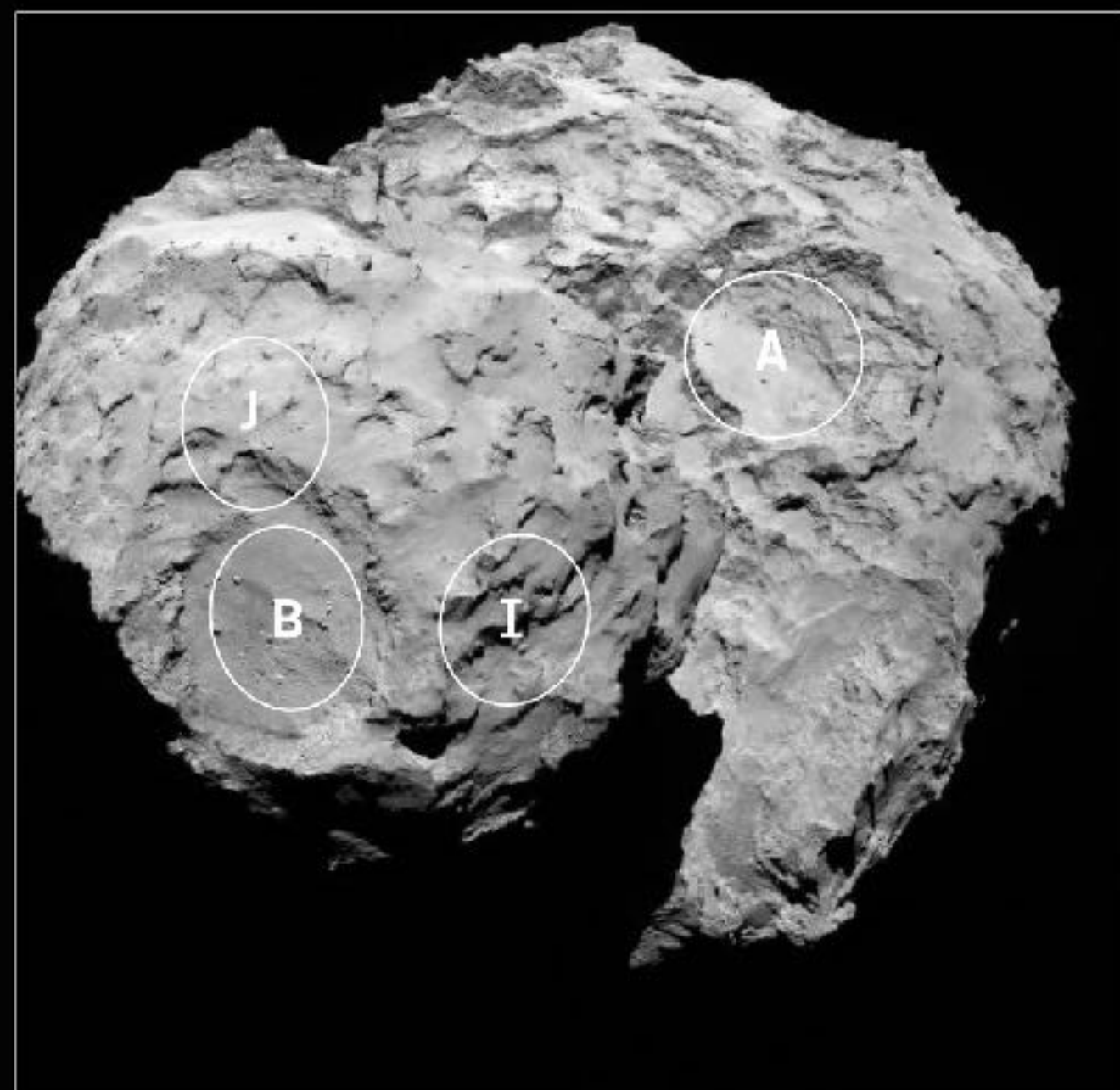


ROSETTA

PHILAE THE LANDER

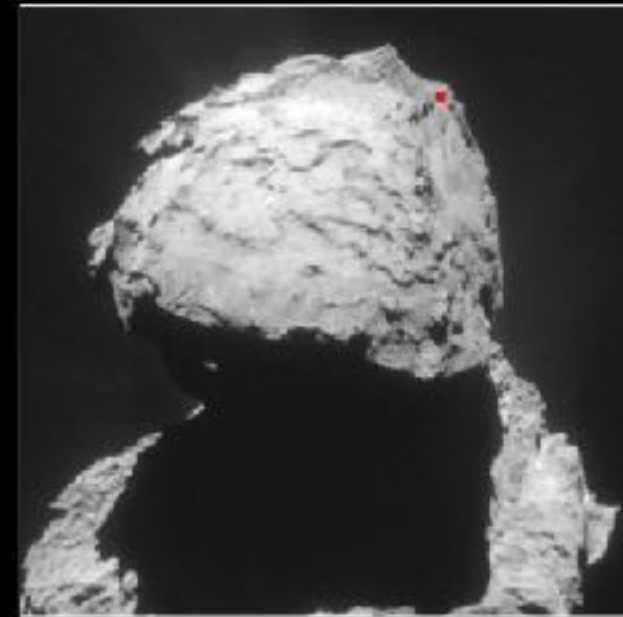
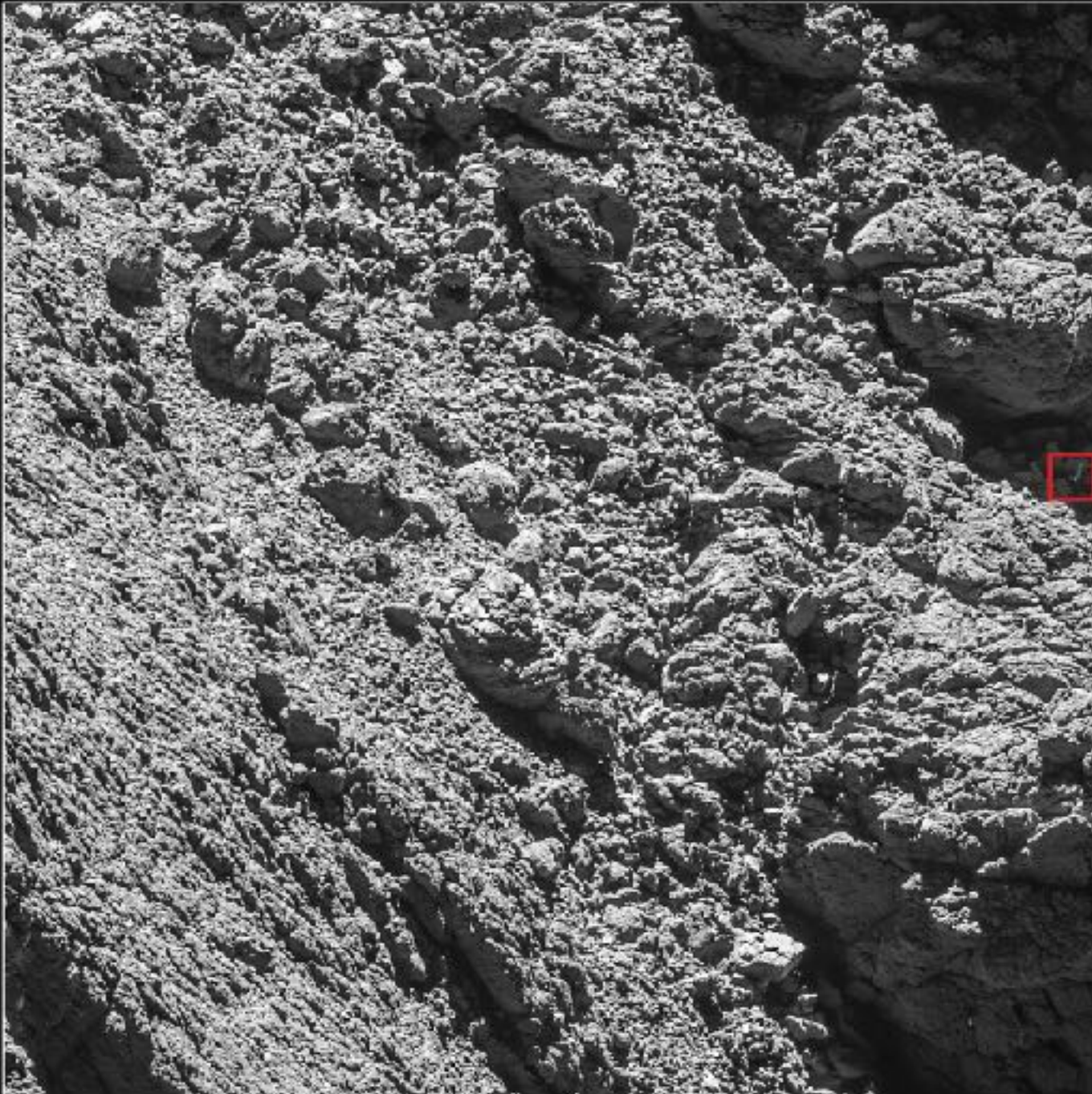


WHERE TO LAND ON A BLACK ROCK?



ROSETTA

PHILAE FOUND

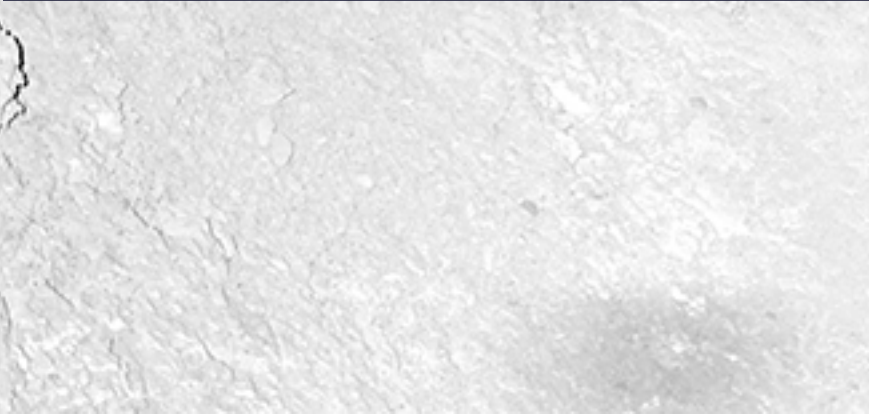
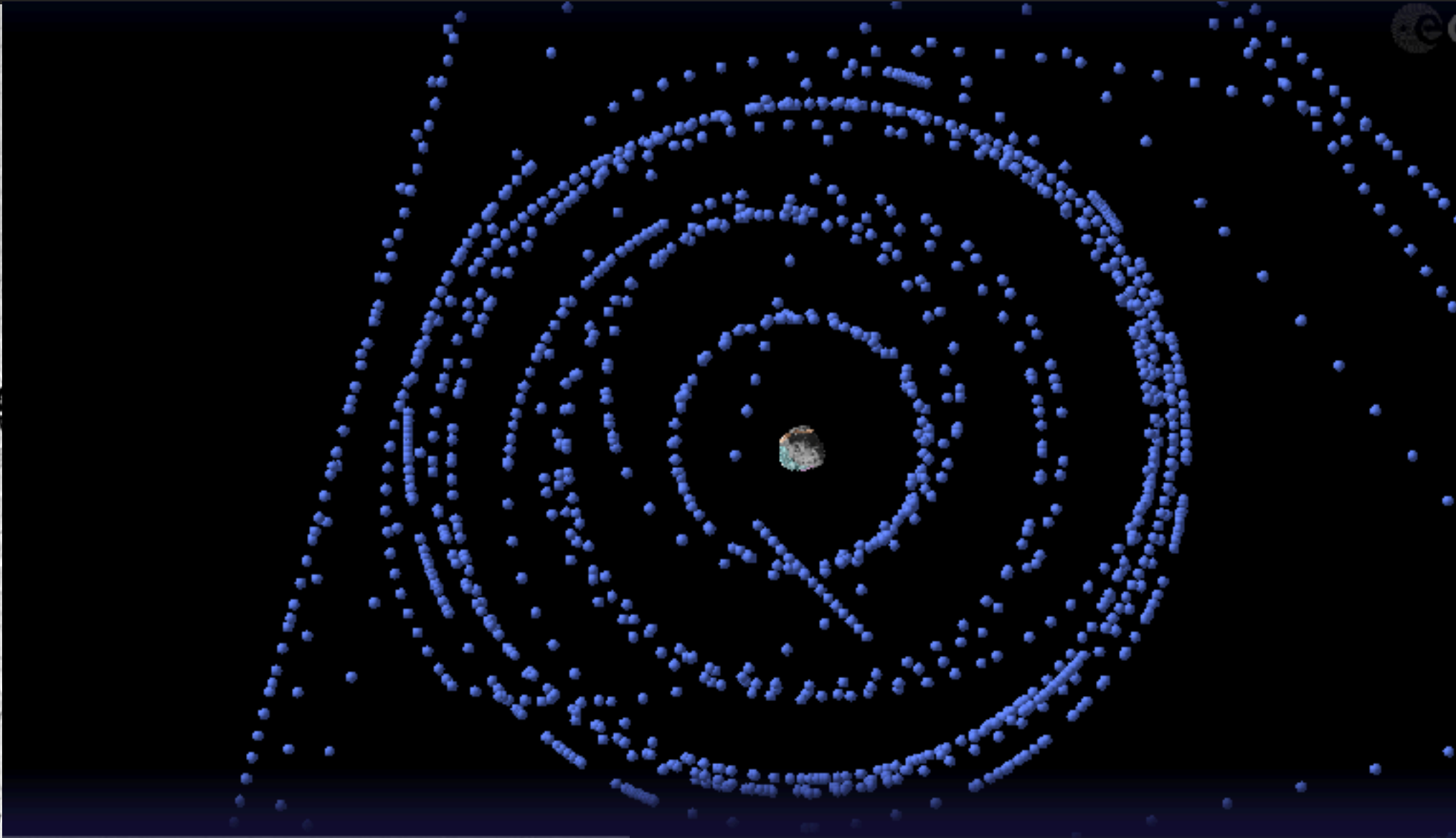
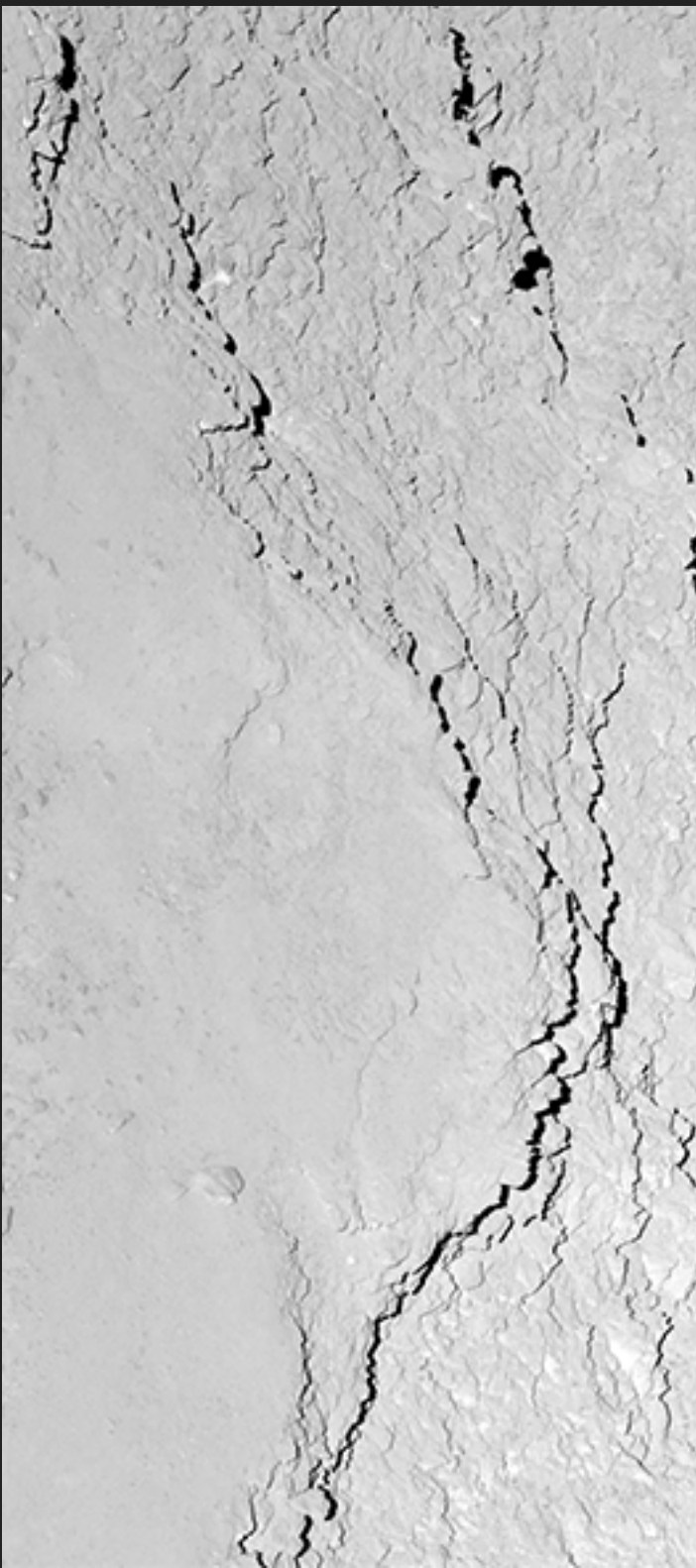


DOES IT SNOW ON A COMET?



ROSETTA

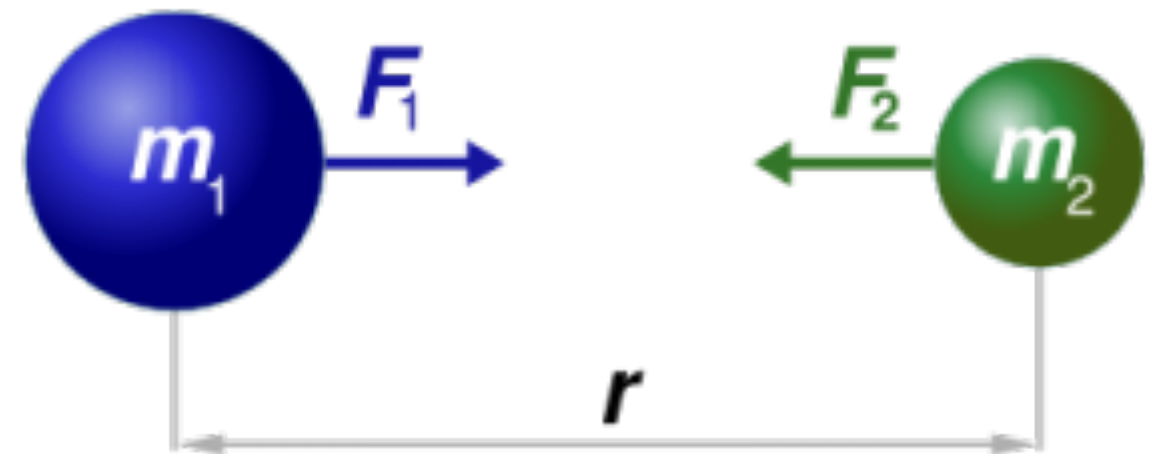
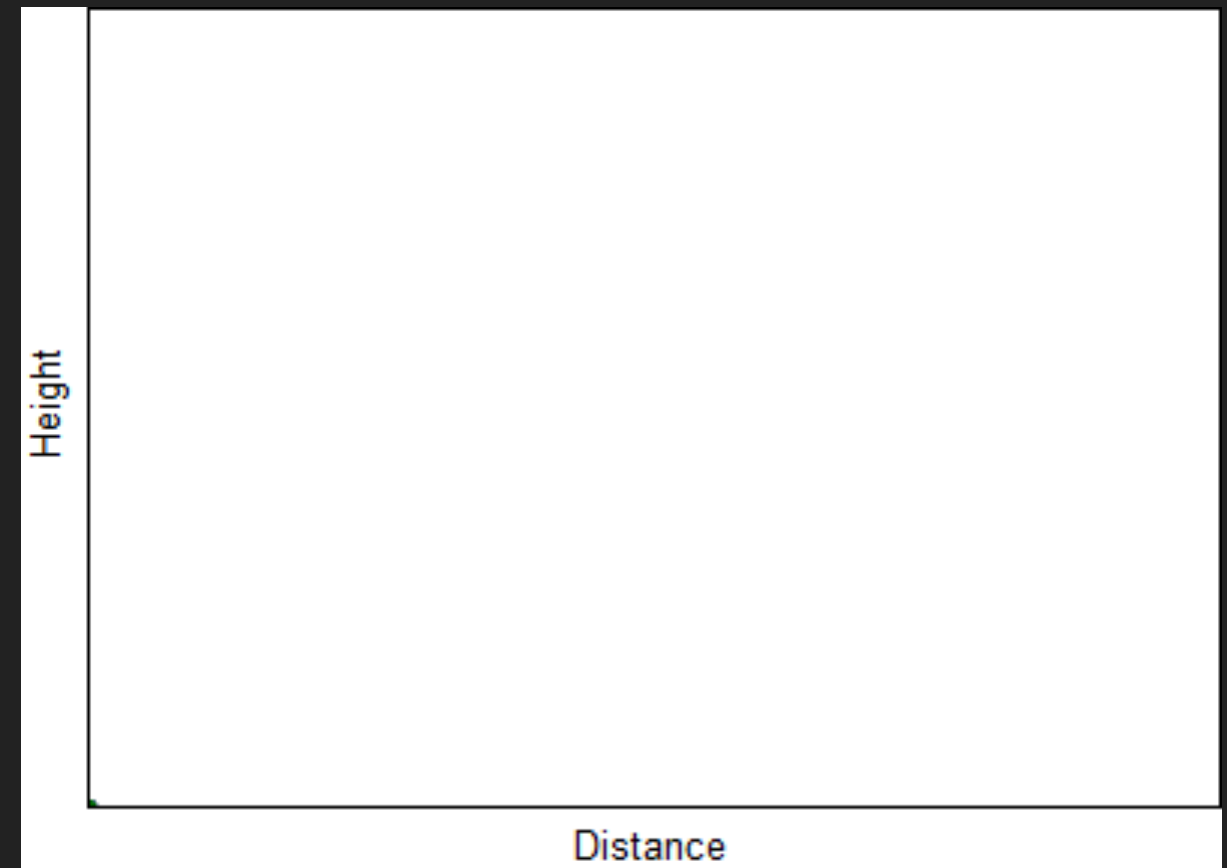
NEVER IN A STRAIGHT LINE TO COMET 67P/CHURYUMOV—GERASIMENKO



NEWTON

$$F = M.A$$

A ROCKET LAUNCH IS LIKE TROWING A ROCK



$$F_1 = F_2 = G \frac{m_1 \times m_2}{r^2}$$



KURT GOEDEL: THE INCOMPLETENESS THEOREM

- ▶ If the system is consistent, it cannot be complete
- ▶ The consistency of the axioms cannot be proved within the system
 - ▶ But all derived truth statements are consistent
 - ▶ What is the fundamental axiom in a system?
- ▶ Geometry:
 - ▶ euclidian vs. hyperbolic vs spherical => based on parallel "lines"
- ▶ The expanding universe:
 - ▶ Implies a Big Bang
- ▶ The climate:
 - ▶ Is it driven by man-made CO₂?

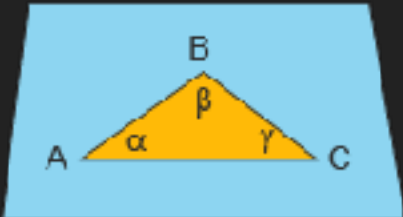
DO PARALLEL LINES CROSS?

THE LAWS OF GEOMETRY



Different Types of Geometry

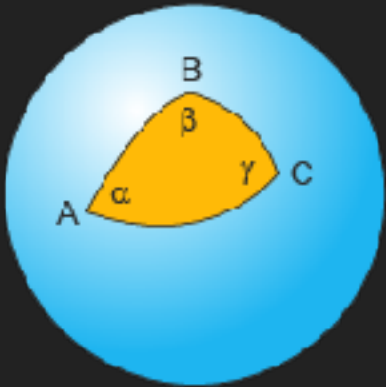
Planar Surface



Euclidean Space
 $\angle\alpha + \angle\beta + \angle\gamma = 180^\circ$

Zero Curvature
Euclidean geometry

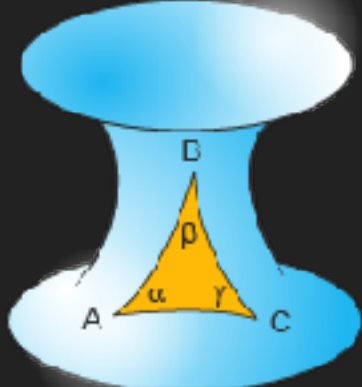
Spherical Surface



Elliptical Space
 $\angle\alpha + \angle\beta + \angle\gamma > 180^\circ$

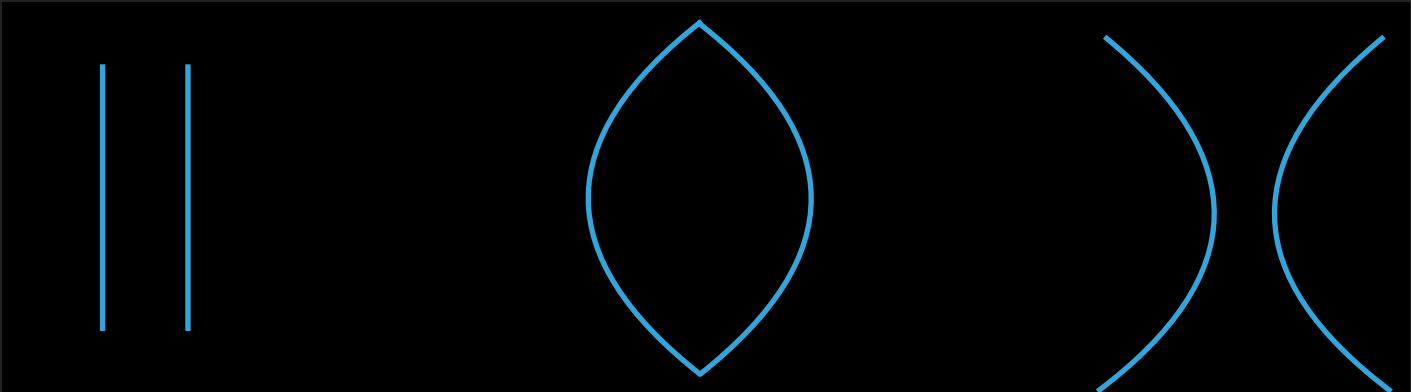
Positive Curvature
Elliptic geometry

Hyperbolic Surface



Hyperbolic Space
 $\angle\alpha + \angle\beta + \angle\gamma < 180^\circ$

Negative Curvature
Hyperbolic geometry



Euclidean

Elliptic

Hyperbolic

Right angle = 90°

Right angle > 90°

Right angle < 90°

Once

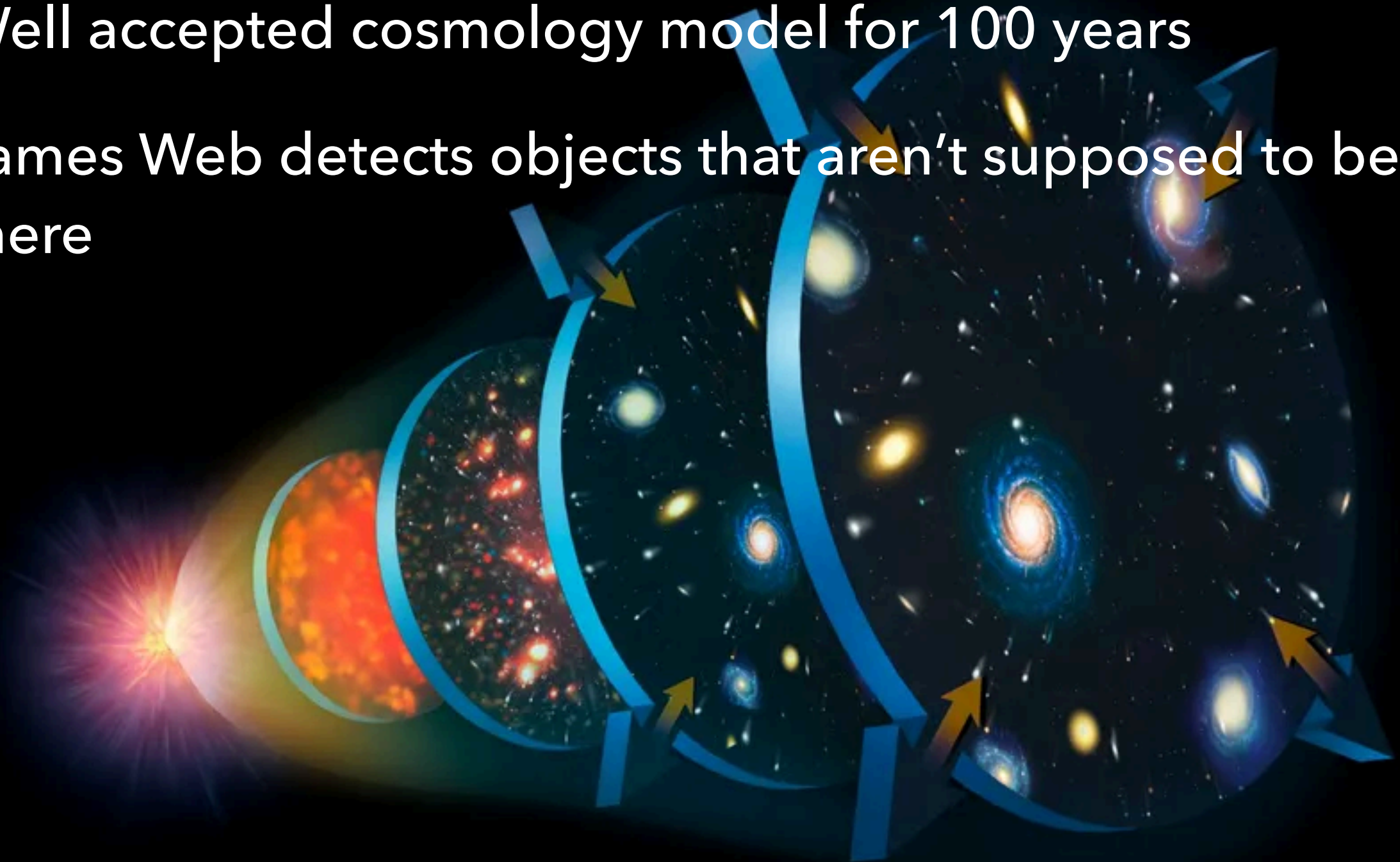
Twice

Never

(at infinity)

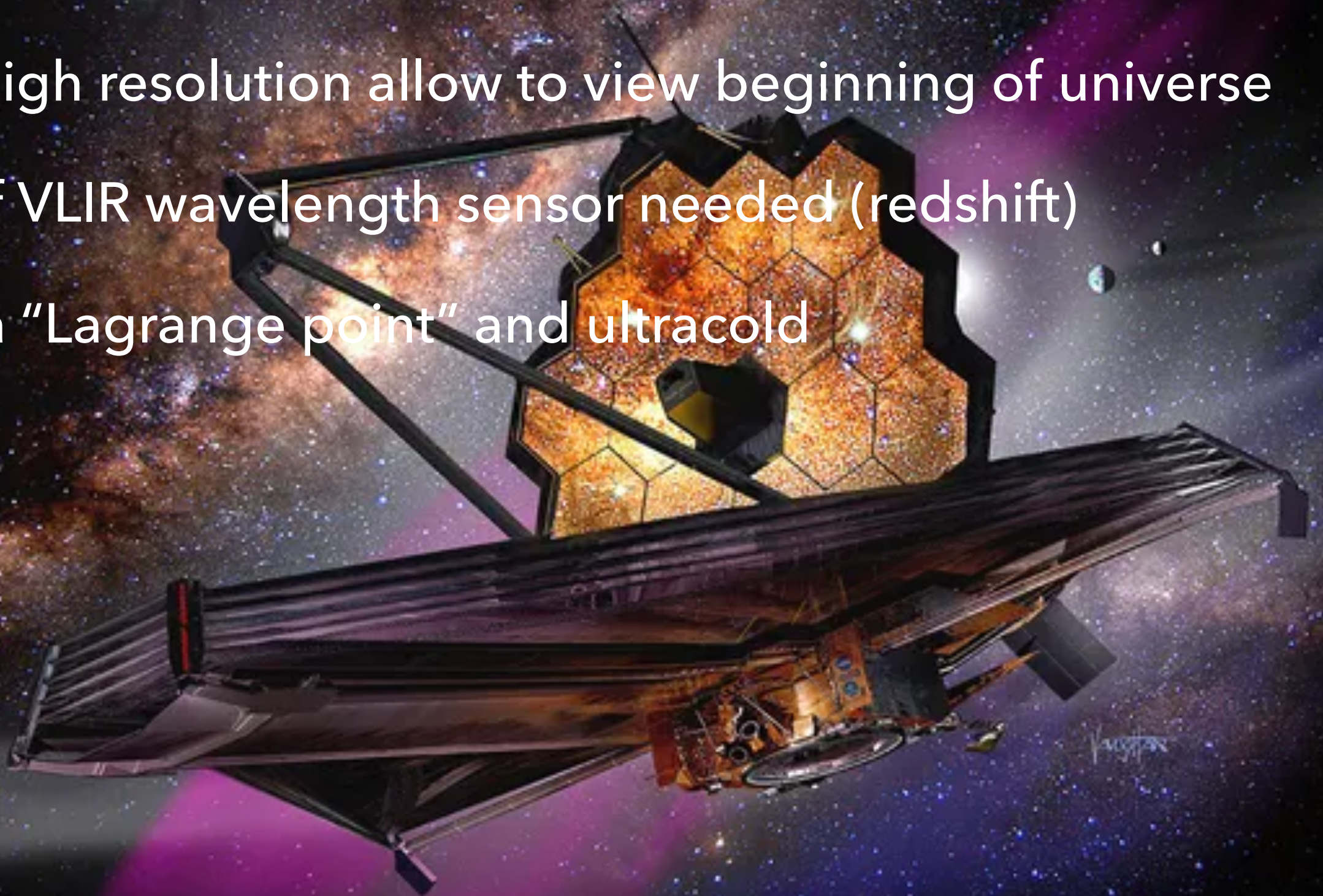
THEN IT ALL STARTED WITH A BIG BANG

- ▶ Well accepted cosmology model for 100 years
- ▶ James Webb detects objects that aren't supposed to be there



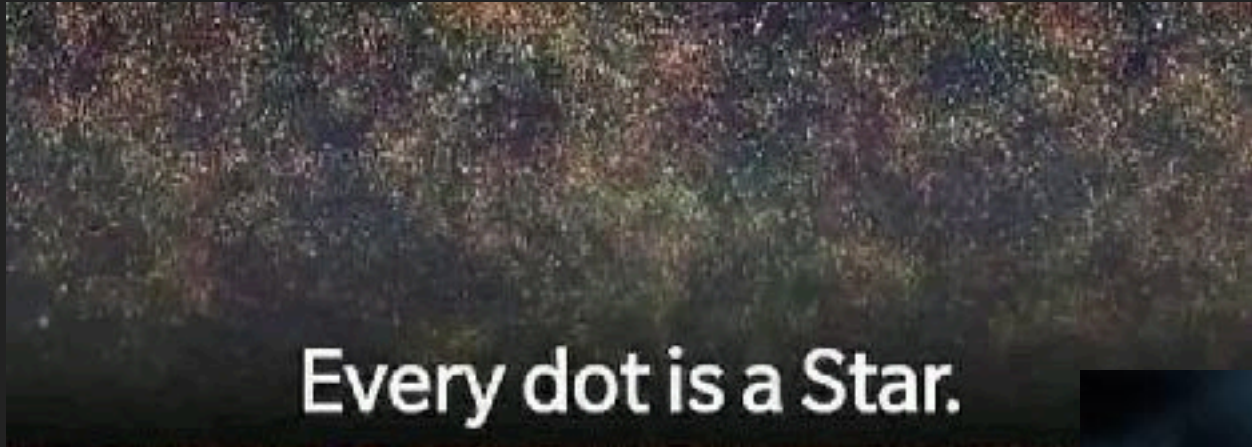
A NEW EYE FOR ASTRONOMERS

- ▶ Very high resolution allow to view beginning of universe
- ▶ Use of VLIR wavelength sensor needed (redshift)
- ▶ Kept a "Lagrange point" and ultracold




LOOKING TOWARDS THE BEGINNING OF OUR KNOWN TIME

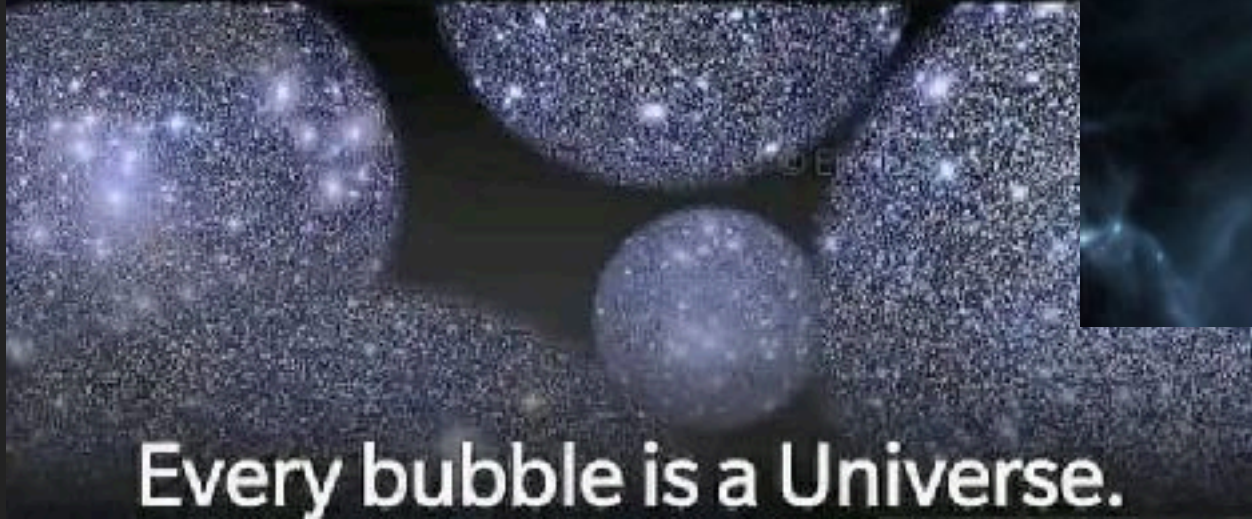
IN THE BEGINNING EVERYTHING AS ASSUMED TO BE FLAT



Every dot is a Star.



Every dot is a Galaxy.



Every bubble is a Universe.



WHAT YOU SEE IS WHAT YOU GET

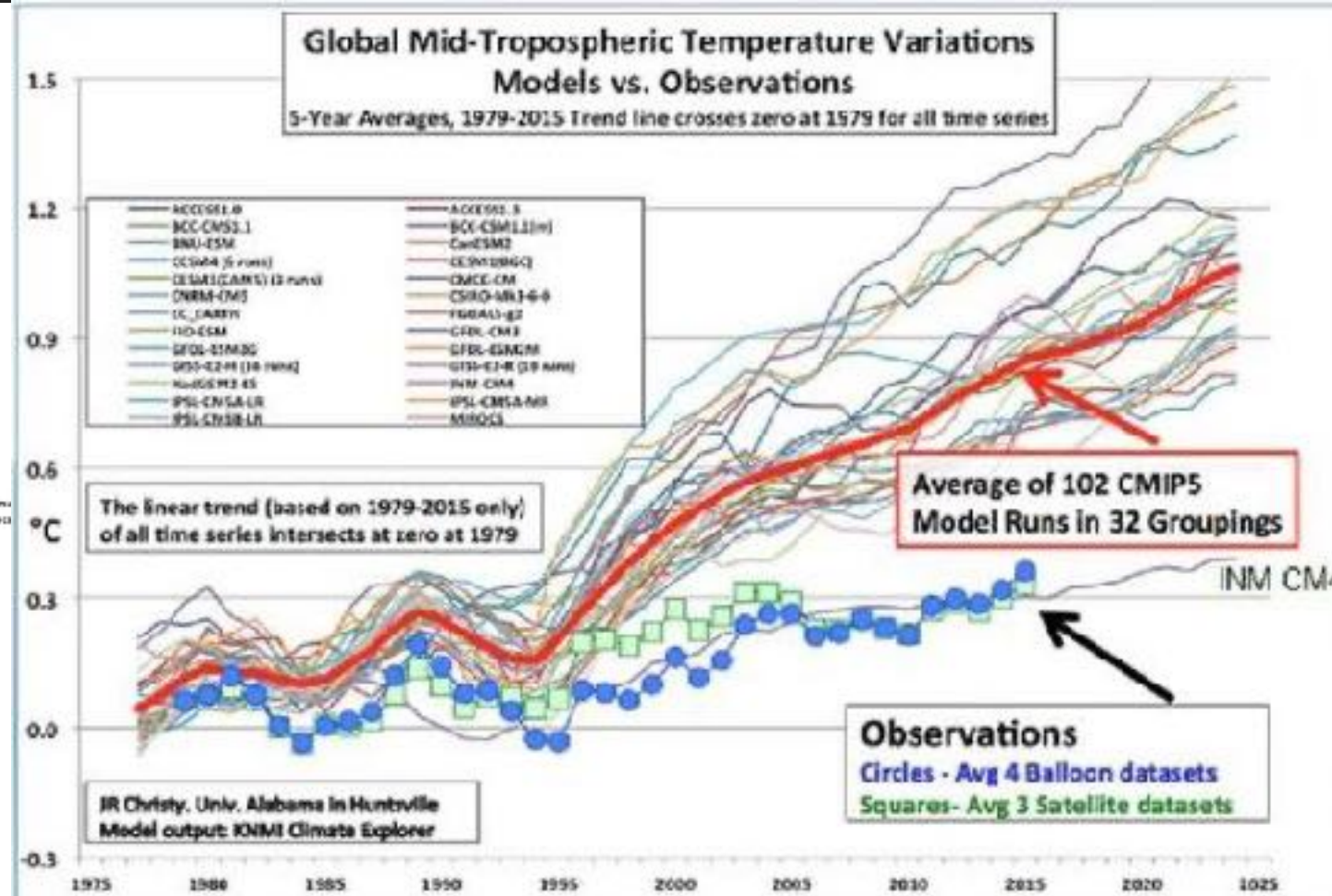
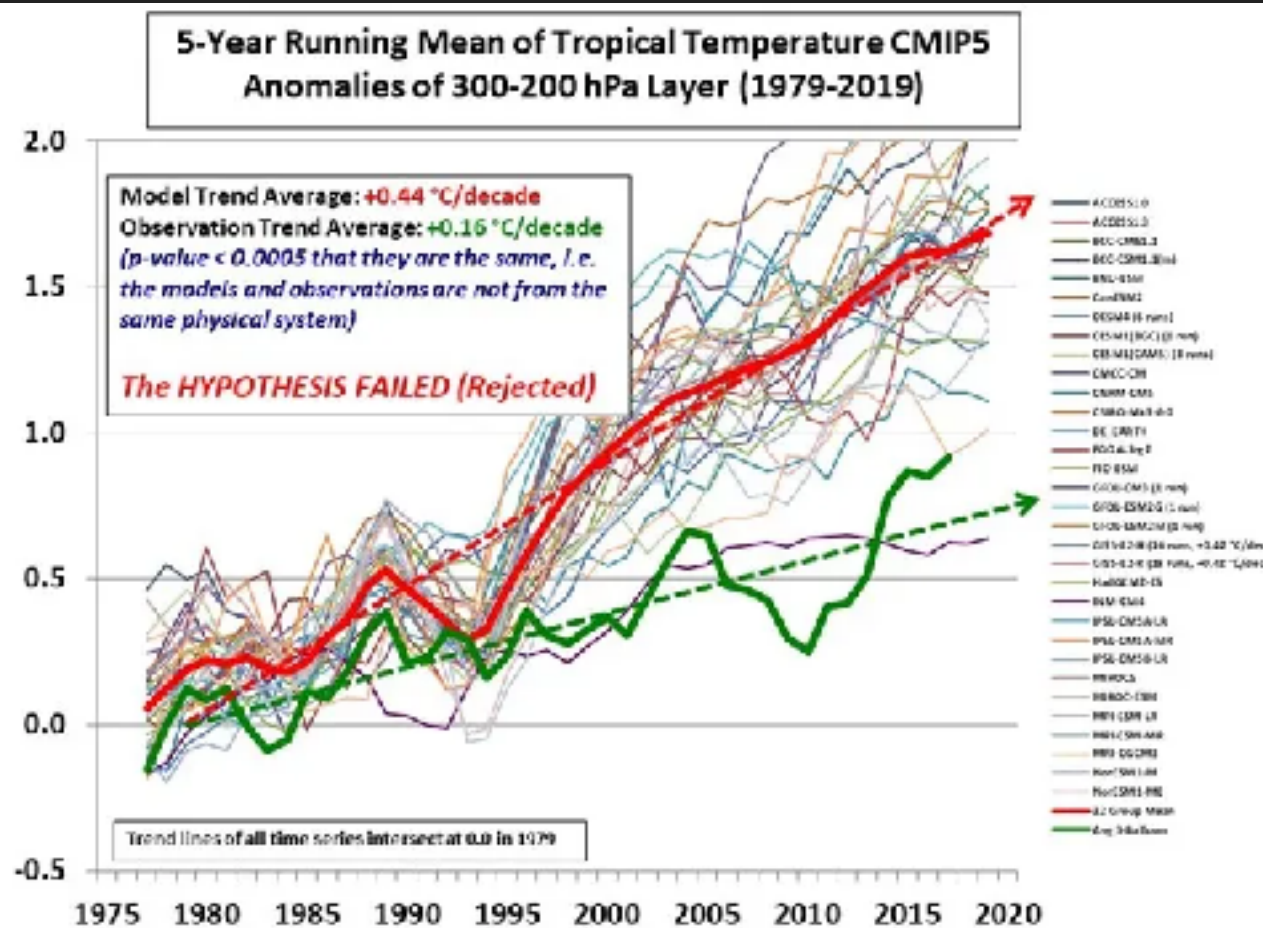
- ▶ New James Webb data questions the Big Bang model
 - ▶ Was there even a Big Bang?
- ▶ Issues: where is all the dark matter/energy (70%!)
 - ▶ Expansion is not homogenous
- ▶ Hence: a model is not the reality
 - ▶ Is fixing the model the solution?
- ▶ What if the Universe is infinite in Space and Time?
- ▶ Technology = sensors = measuring = approaching reality

WHAT IPCC MODELS IS NOT THE REAL CLIMATE

- ▶ Axiom: CO₂ warms up the planet
- ▶ Based on models but measured data is different
 - ▶ CO₂ lags warming (3/4 of the planet is water!)
 - ▶ What about clouds and water vapour?
 - ▶ What about the sun?
 - ▶ What about e.g. deserts?
- ▶ How to determine the average temperature of earth?

WHAT IPCC MODELS IS NOT THE REAL CLIMATE

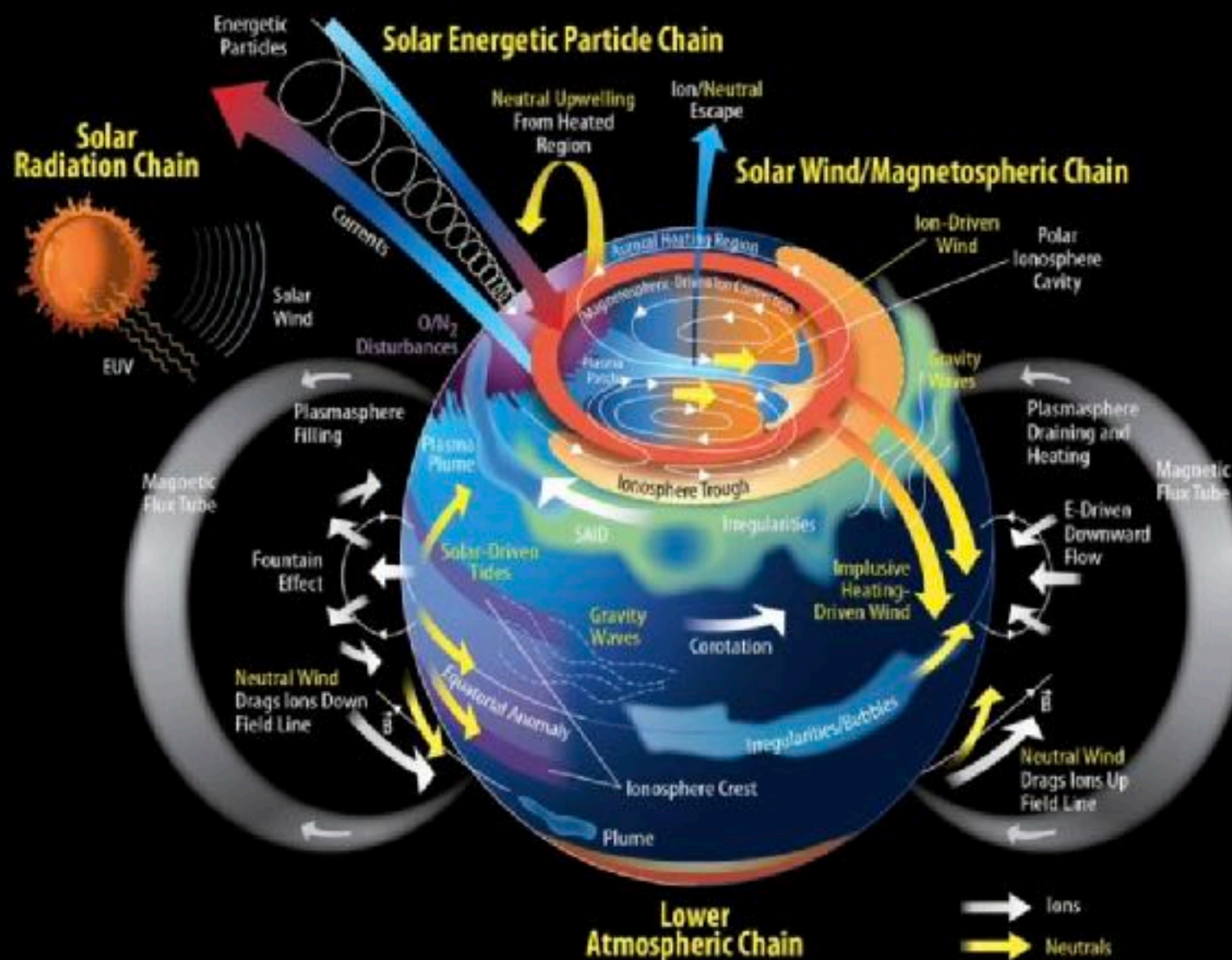
- ▶ Earth's atmosphere is an open system with the cosmos
- ▶ One model that doesn't include CO₂ can predict backwards and forwards temperature (Russian INM CM4)
- ▶ We are actually entering a small ice age



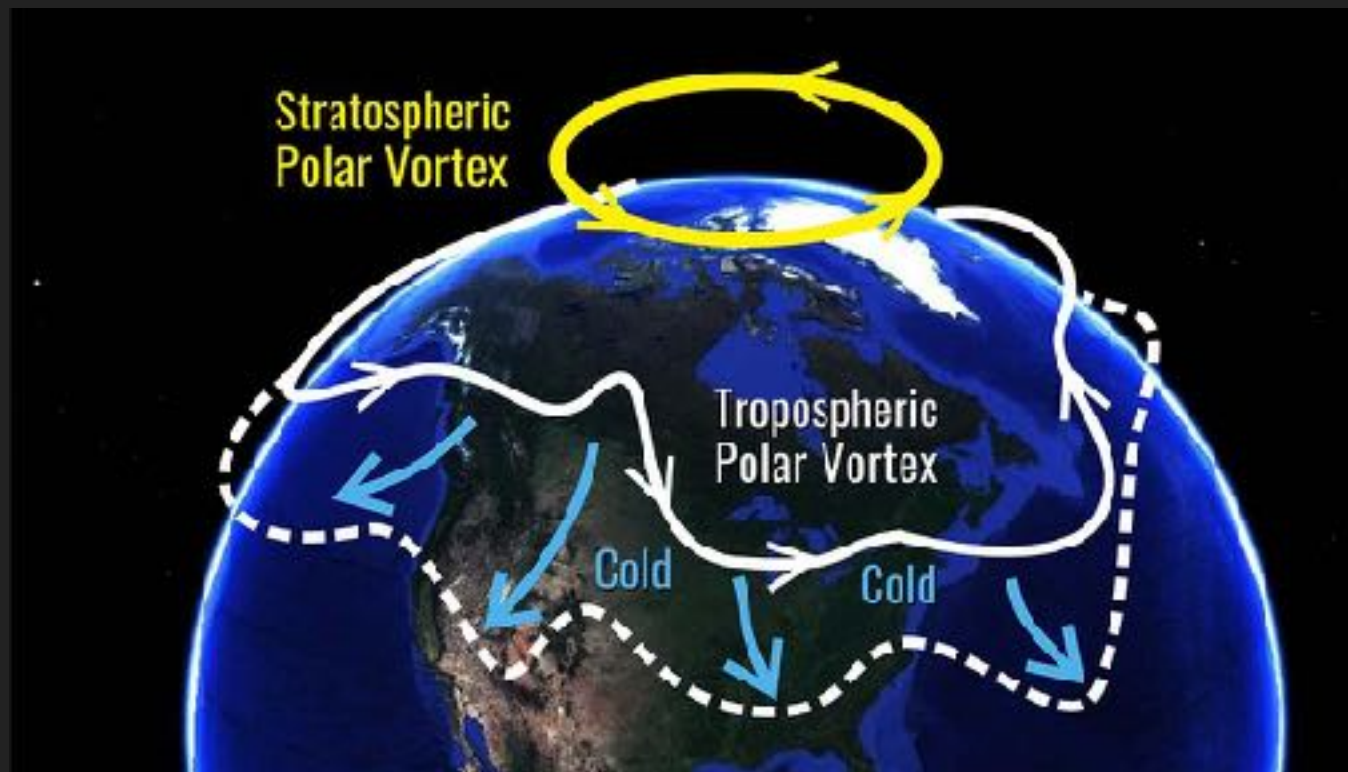
CO2 DOESN'T ADD ANY HEAT

EARTH GETS WARMED BY THE SUN AND TRAVELS THE UNIVERSE

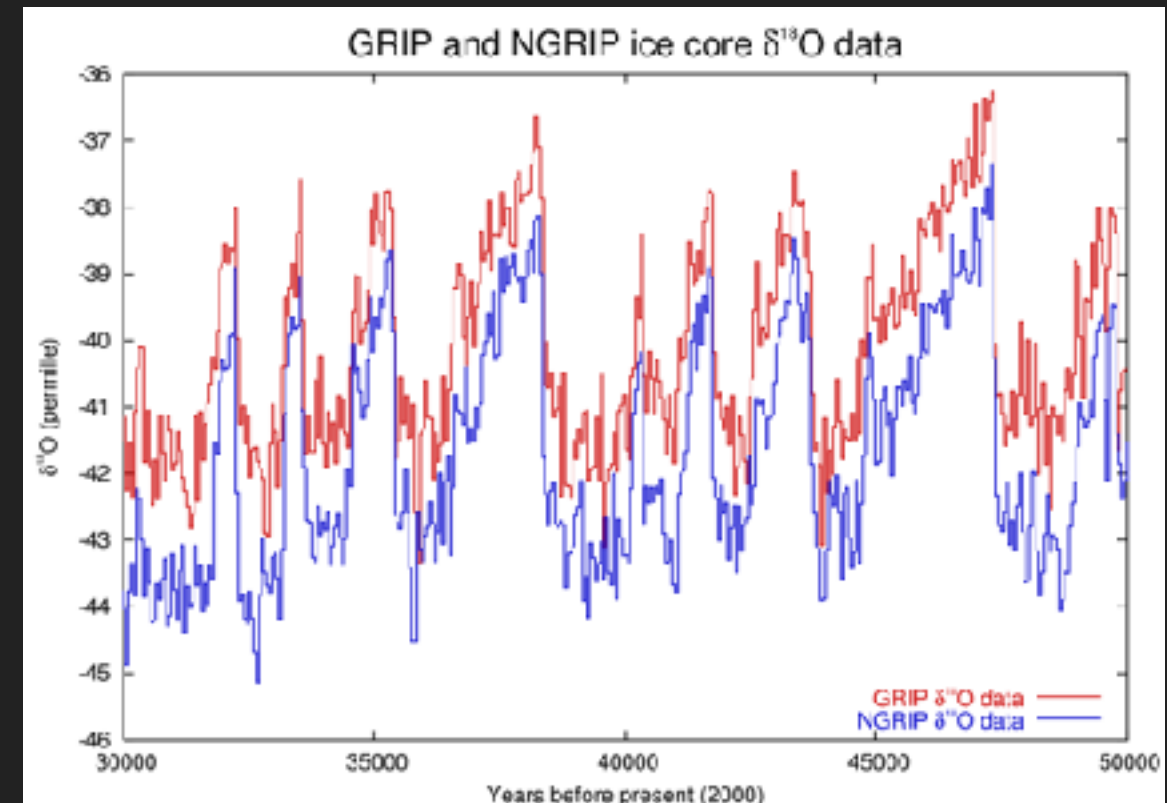
**THE CLIMATE OF EARTH IS NOT
CONTROLLED BY CARBON DIOXIDE OR
SO-CALLED "GREENHOUSE GASES"**



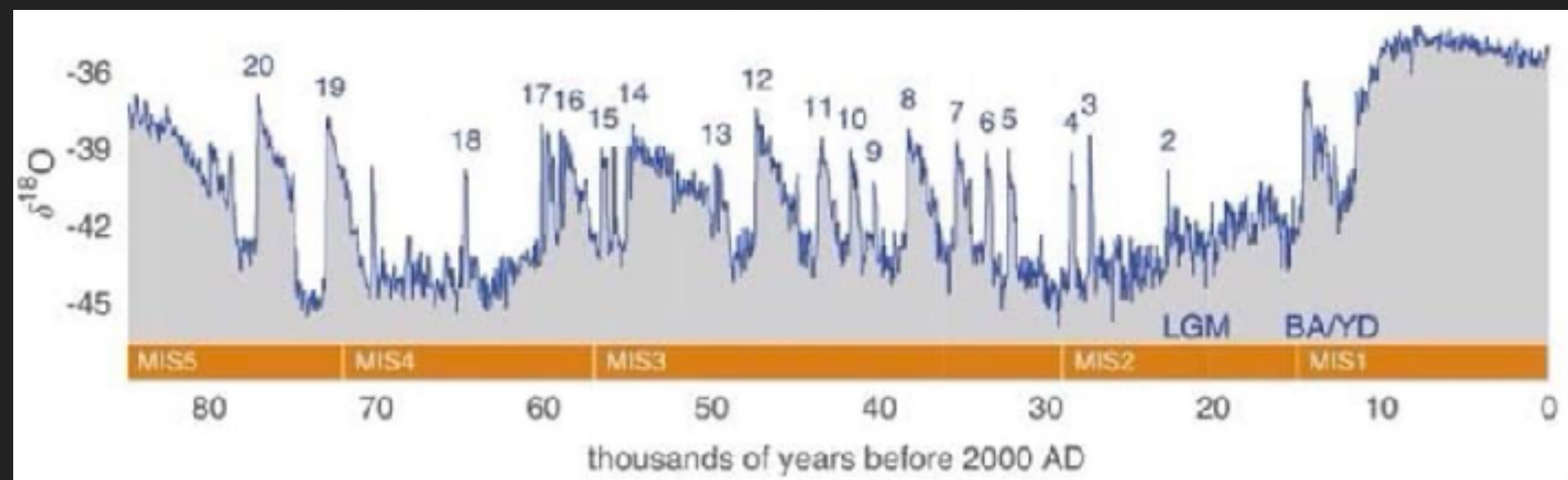
CLIMATE IS PERIODIC, WEATHER IS CHAOTIC & TURBULENT



Wind direction determines the local weather



Ice core samples from Greenland



THE SUN

CLIMATE DETERMINED BY THE SUN AND OUR COSMIC TRAJECTORY



HAPPILY ARRIVED

- ▶ Thanks for your attention

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