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Bringing Nobel Prize Physics in the Classroom

FRONTIERS in Astrophysics and Cosmology

Rosa Doran

GALILEO
Teacher Training Program

 SA

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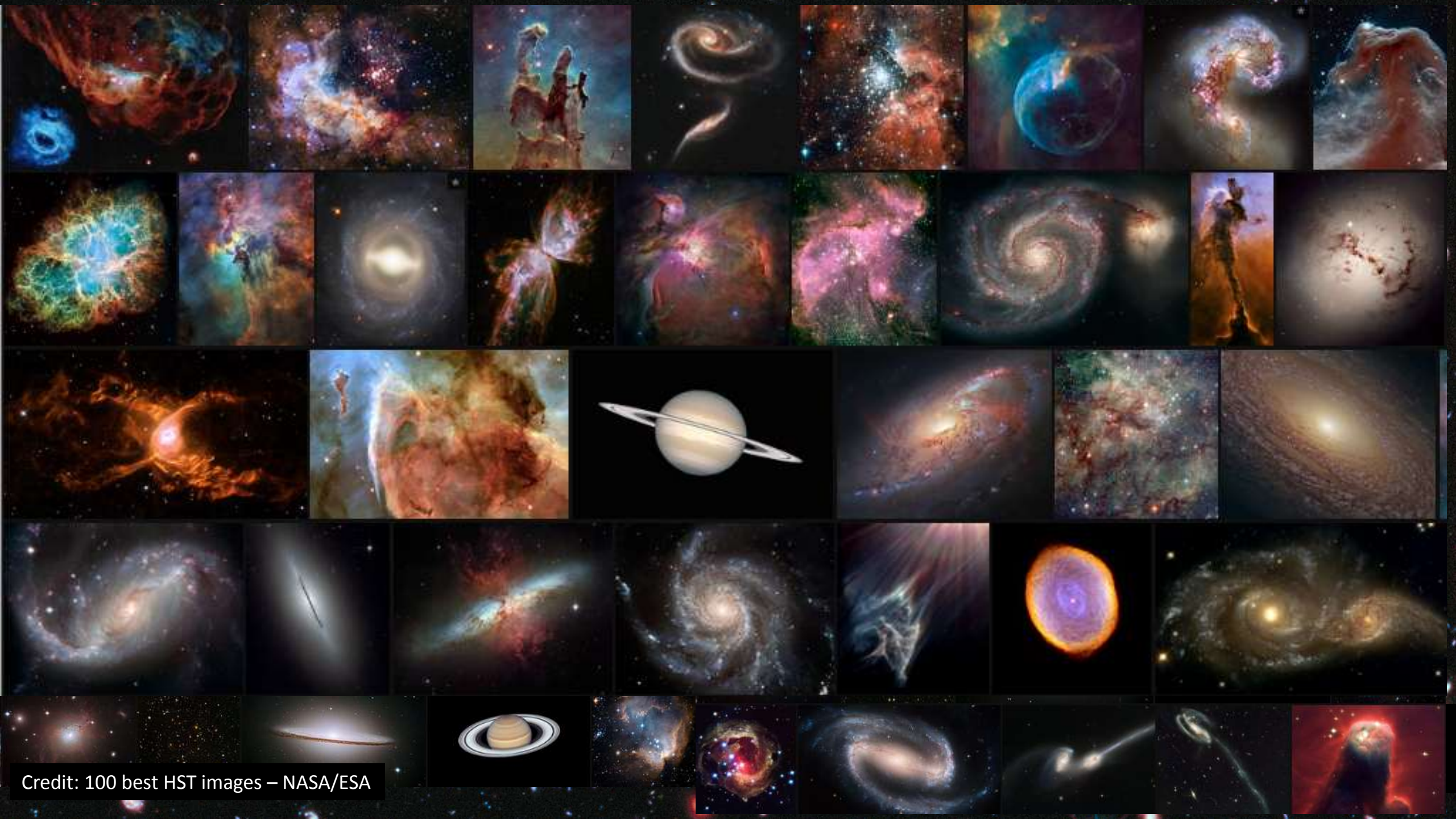
What do we ”know” about our Universe ?!!!

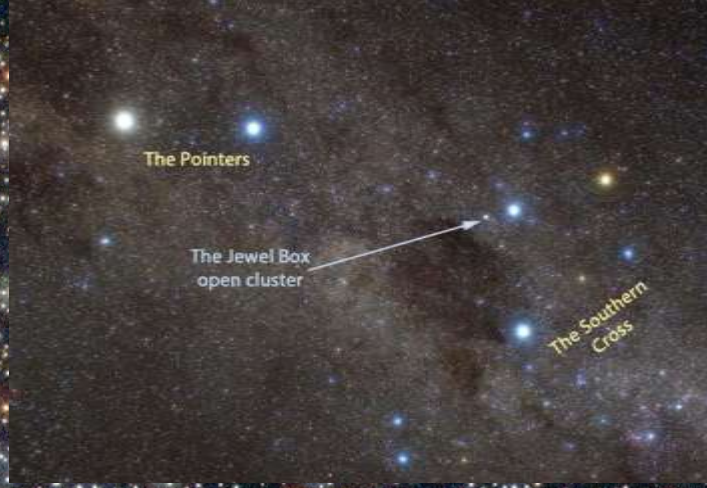


Credit: 100 best HST images – NASA/ESA

Gas and Dust

© NGC602 - HST

Stars



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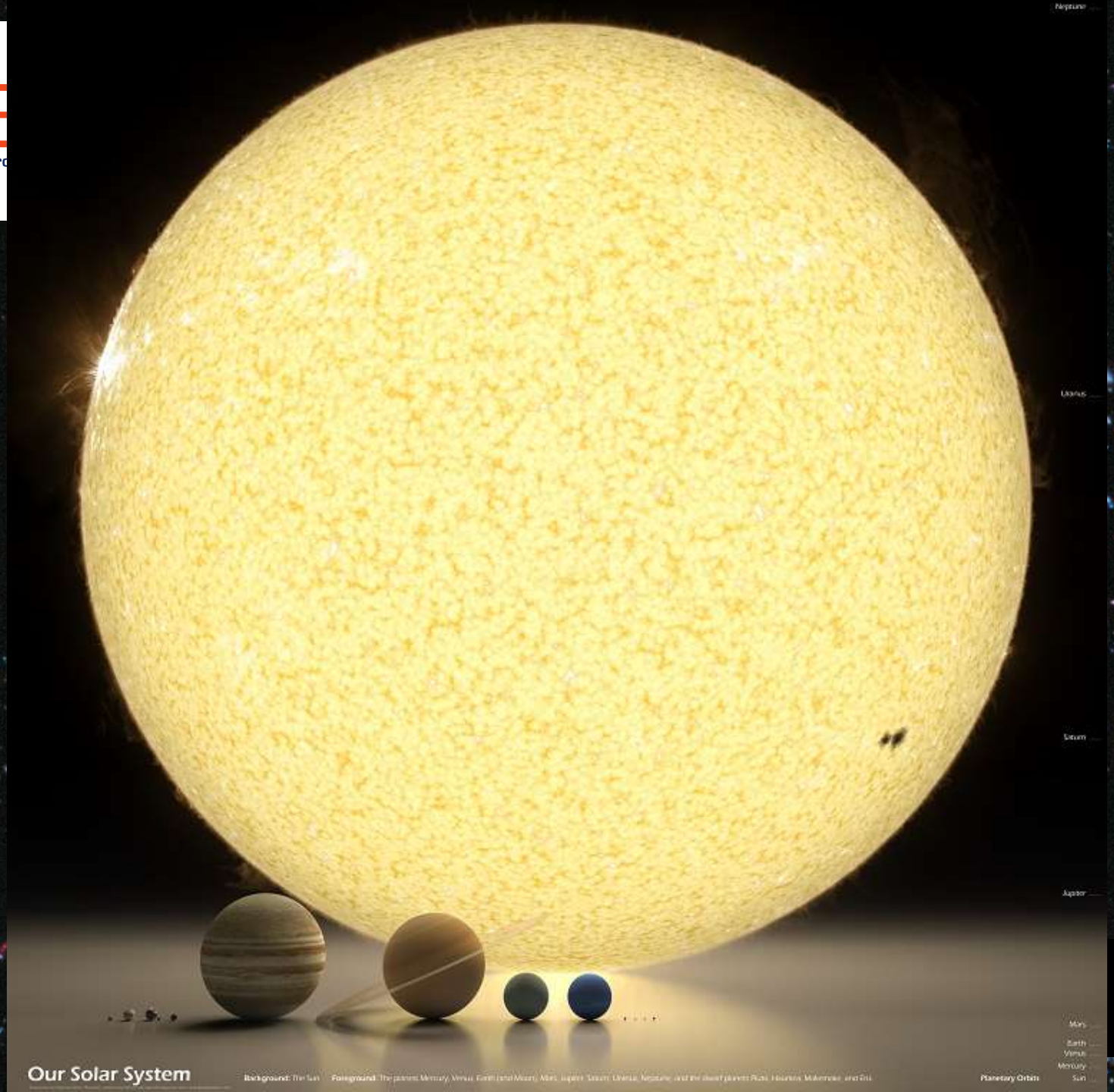
Planets



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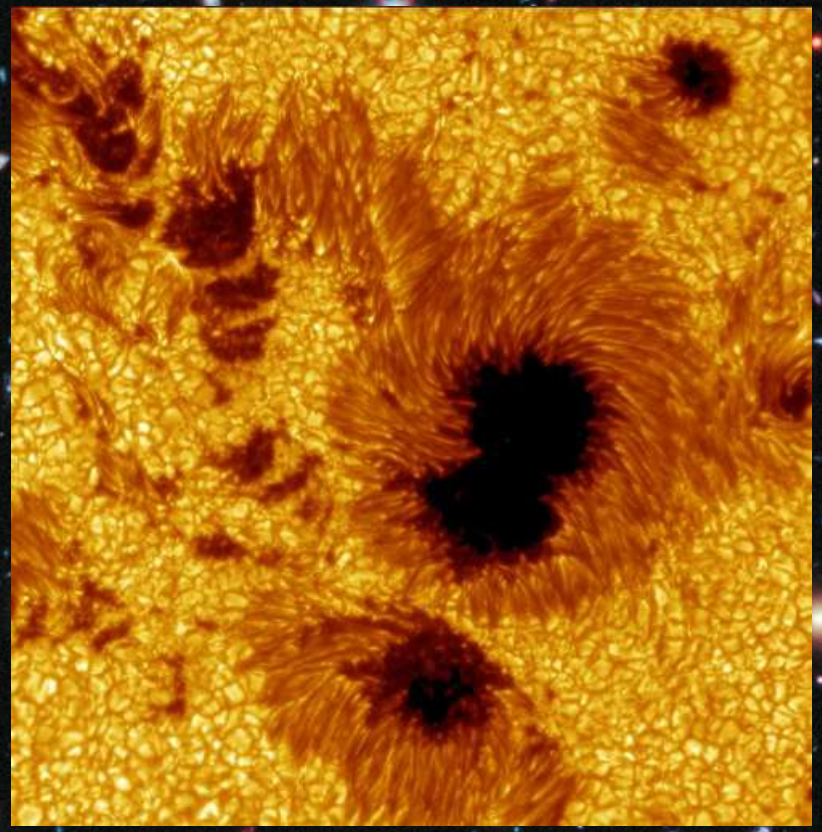
For sure you know our star very well. Don't you?



Credit: SST/Royal Swedish Academy of Sciences]

Does the Sun Rotate?

What is the size of these spots? What are they?

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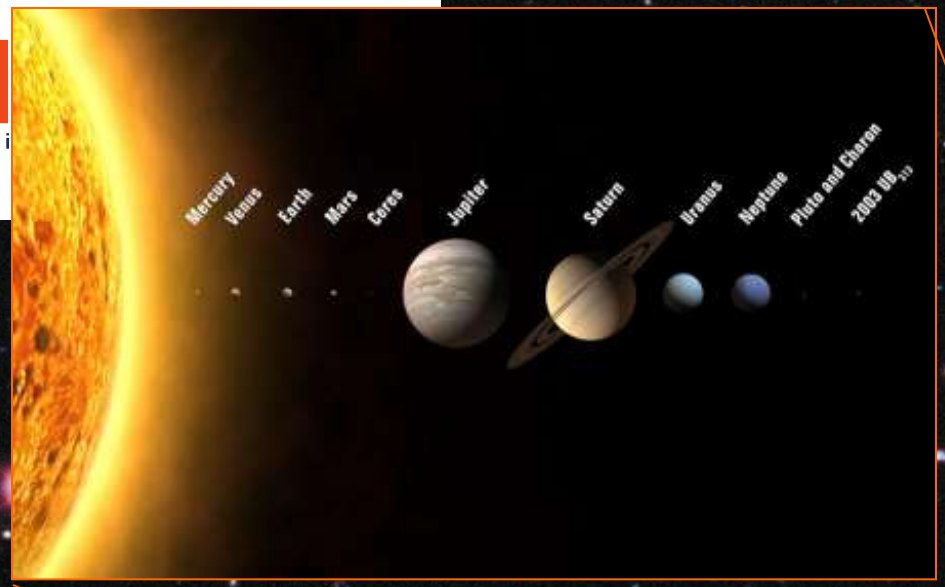
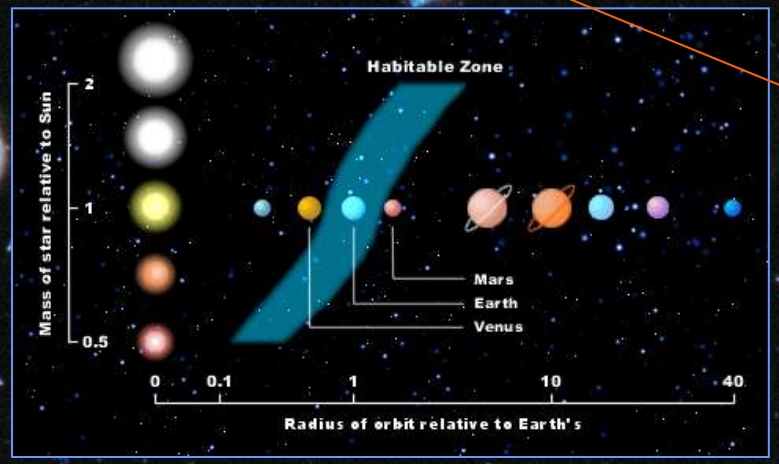
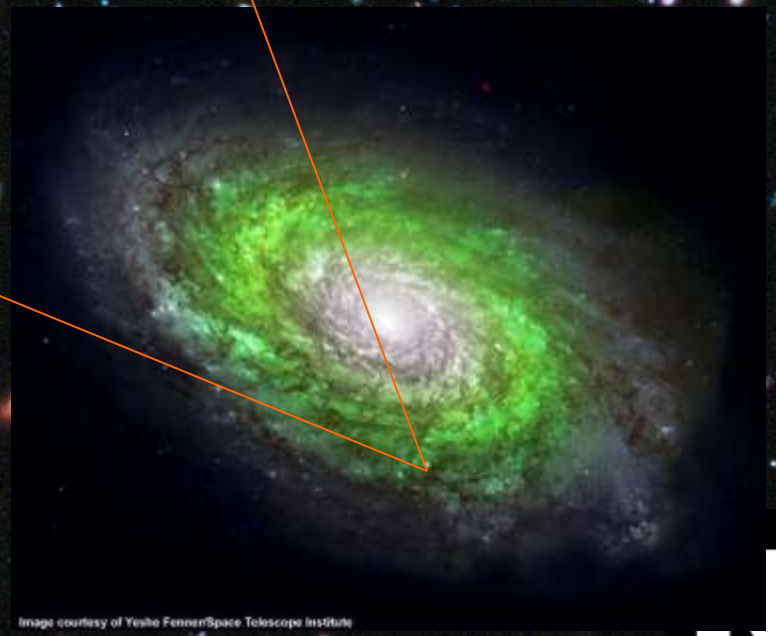
© NASA

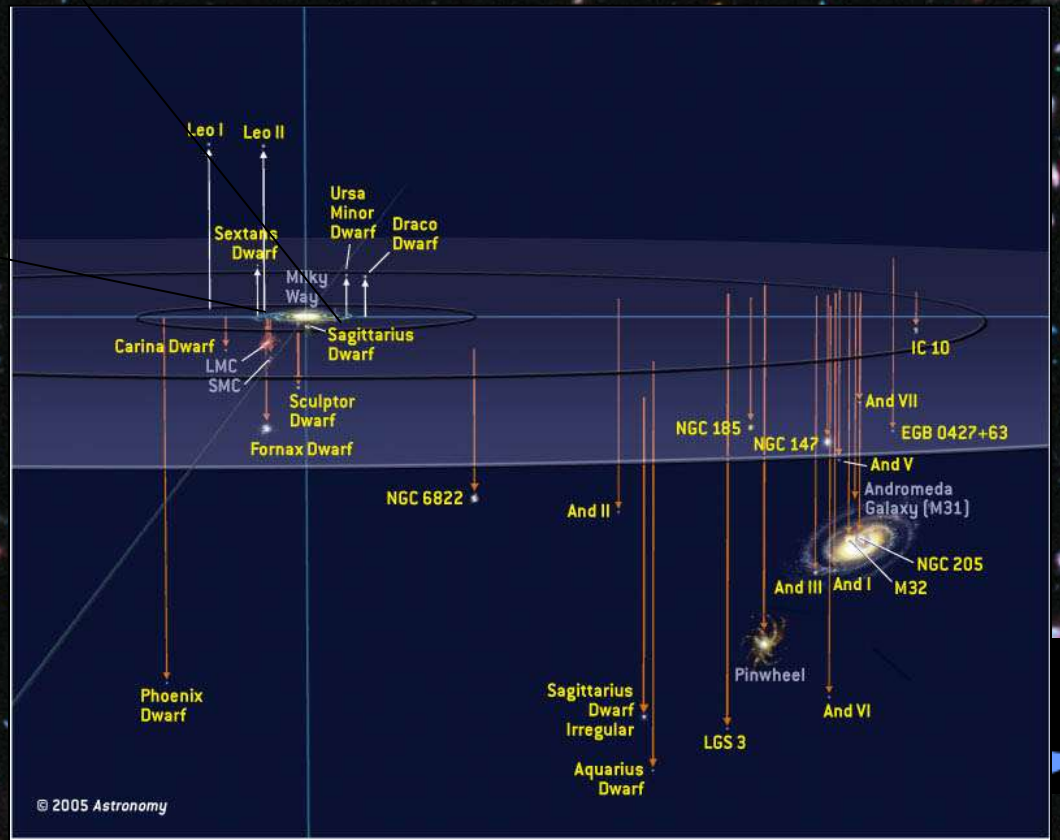
Habitable Zone



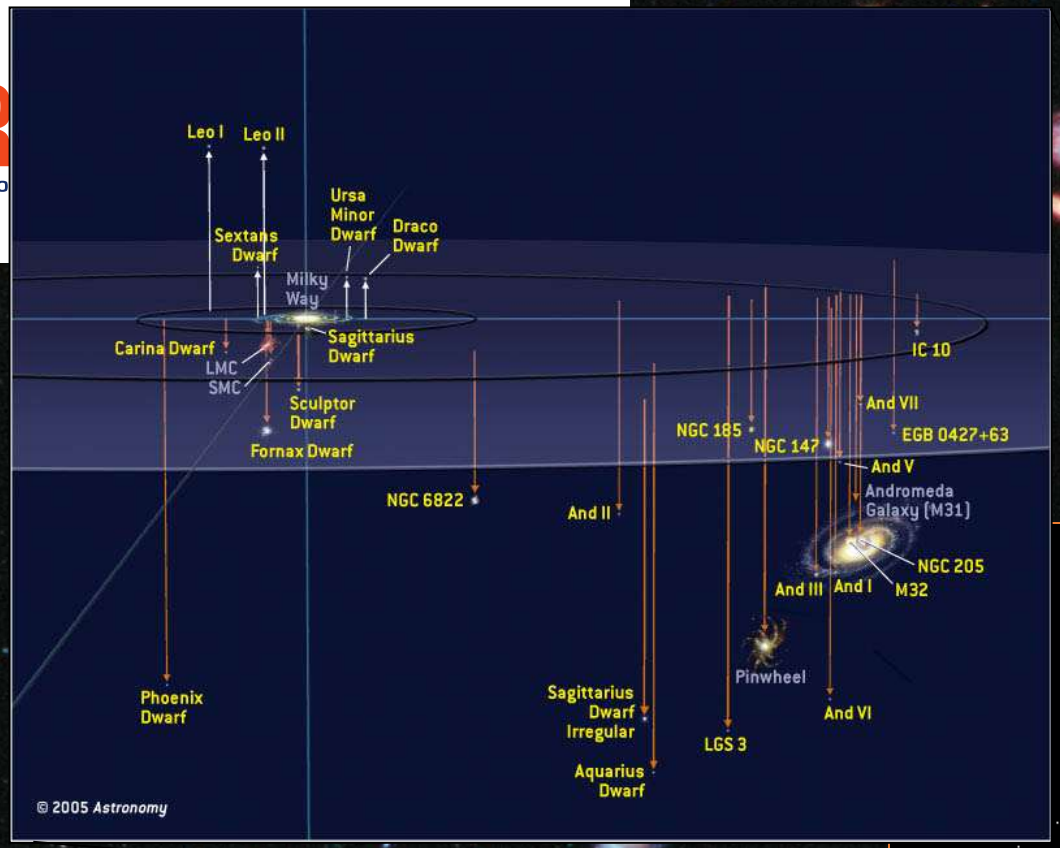


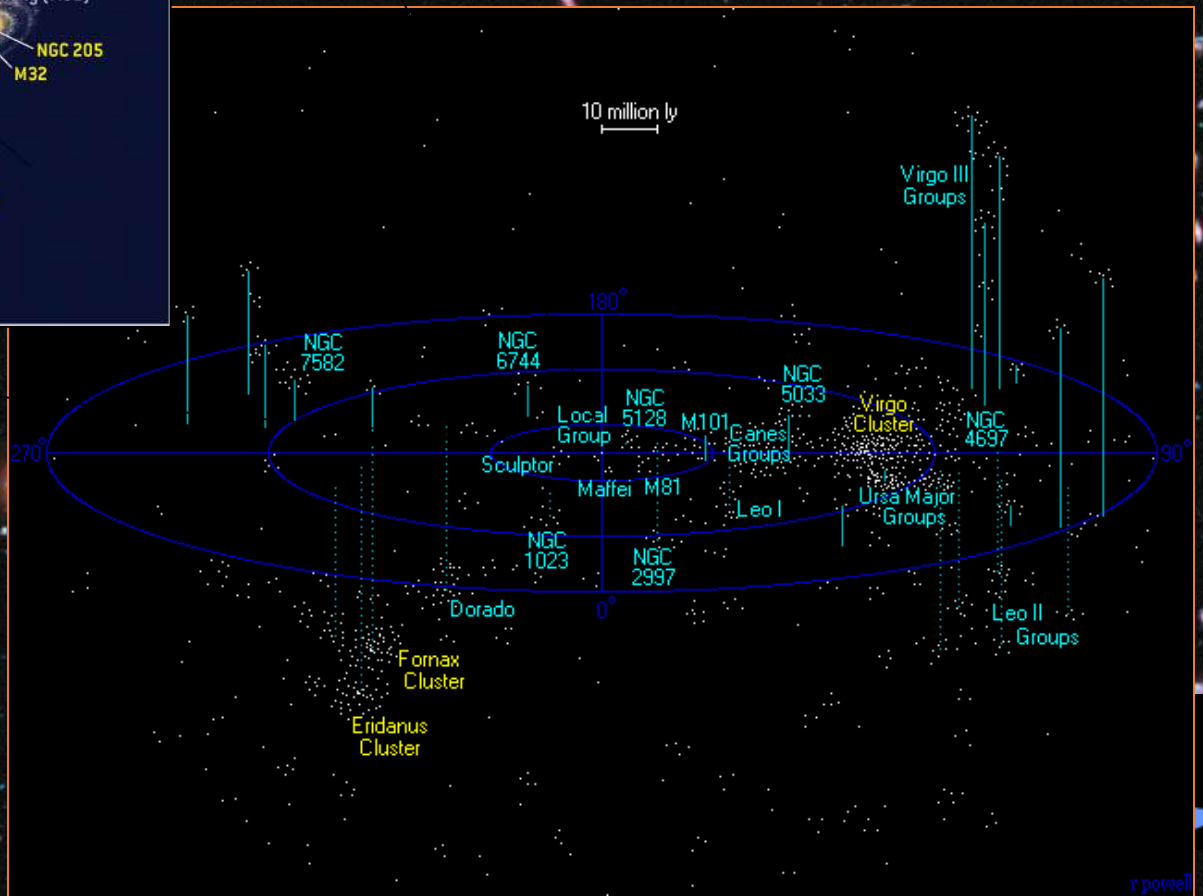


Local Group

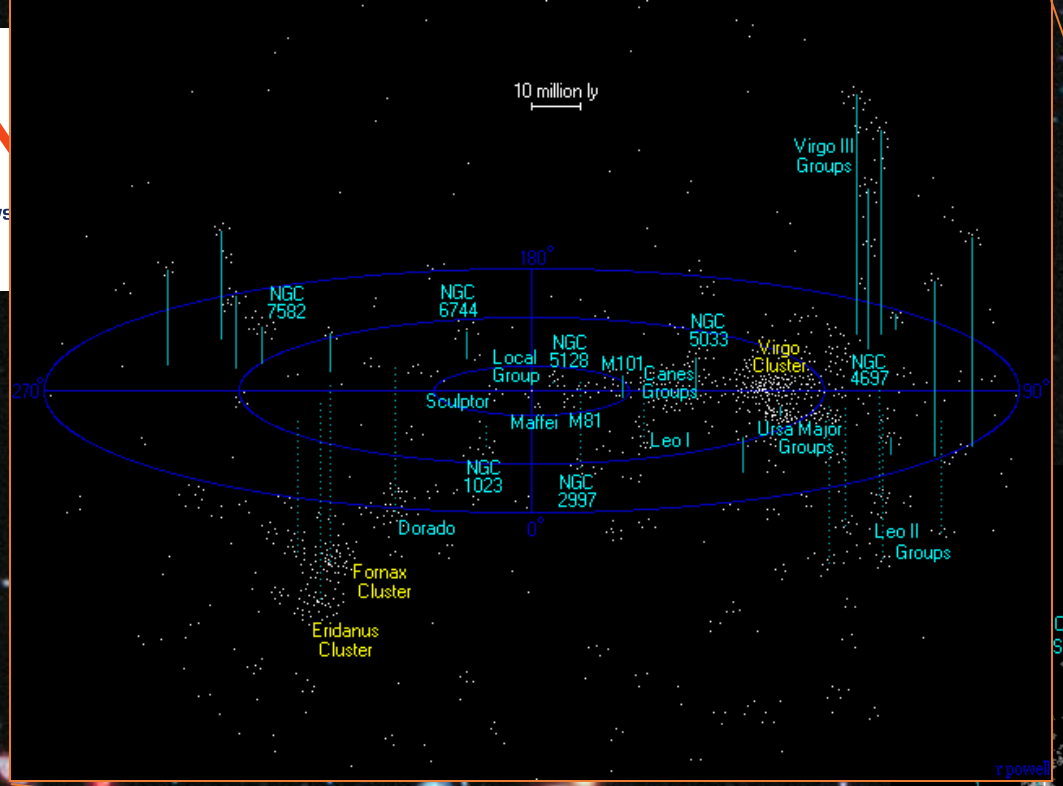


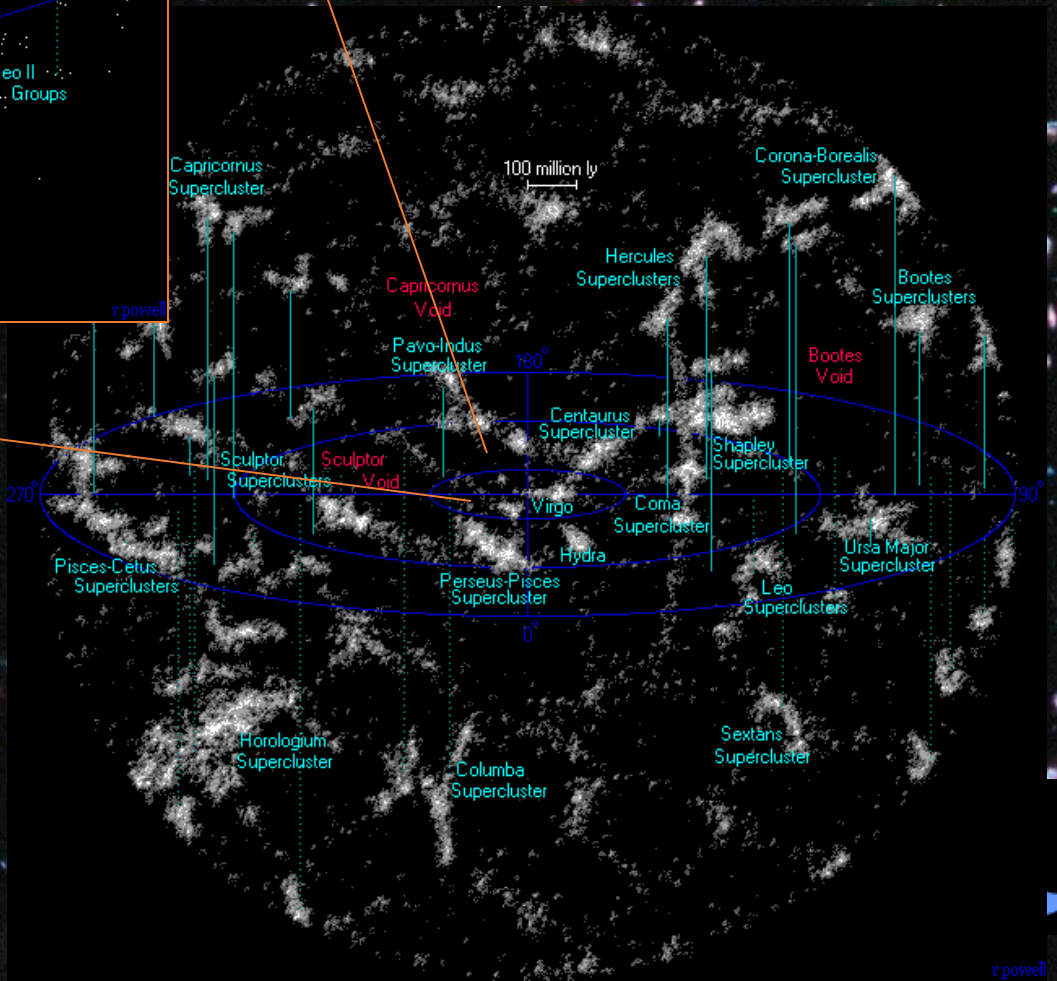
The Virgo Cluster



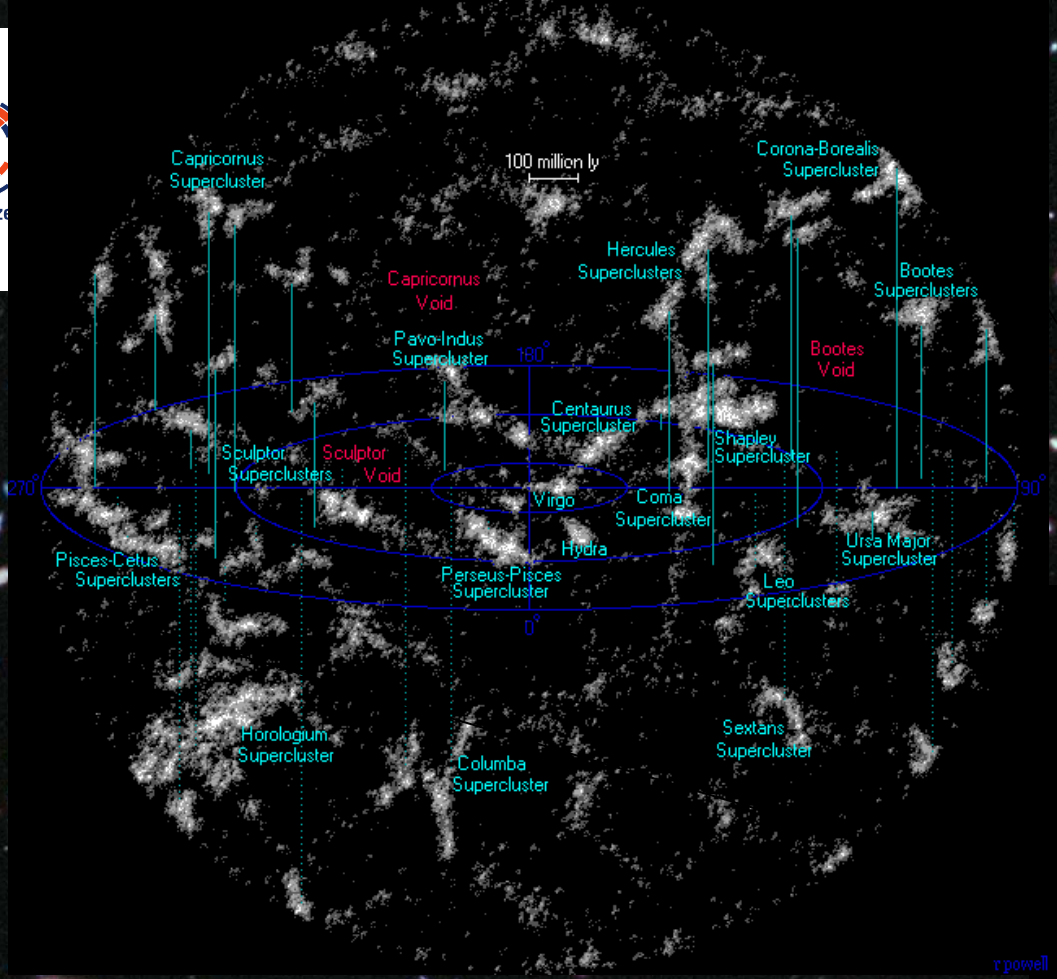


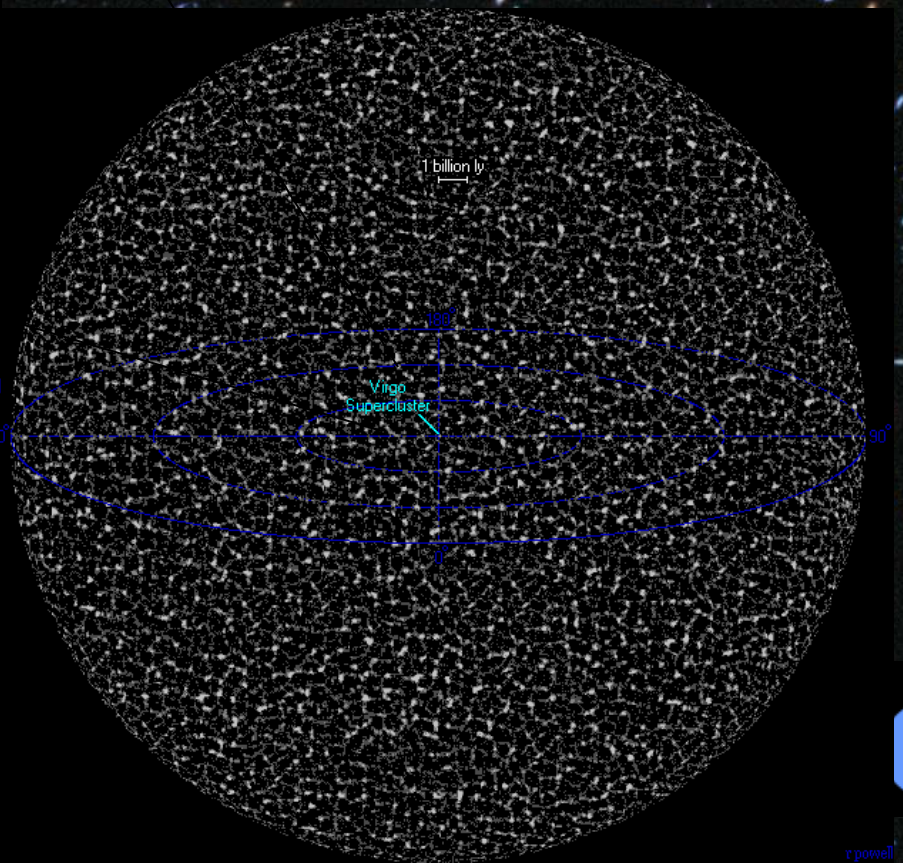
Other Clusters

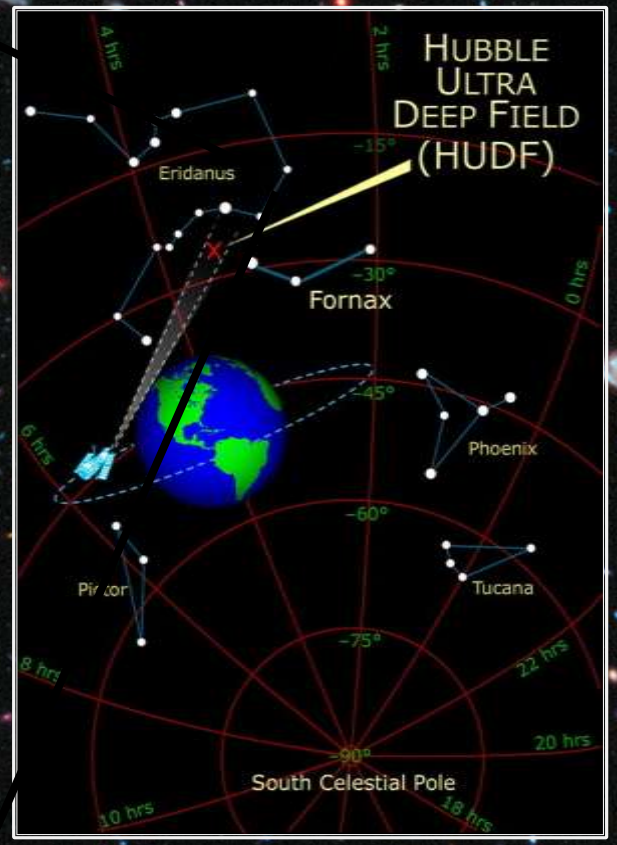




The Observable Universe







Some galaxies are 13.2 billion years away from us

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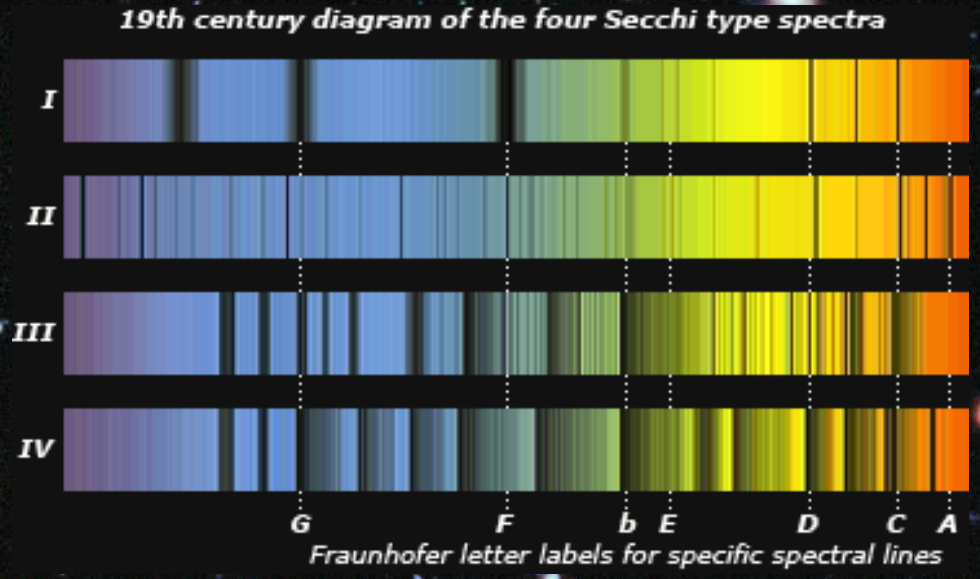
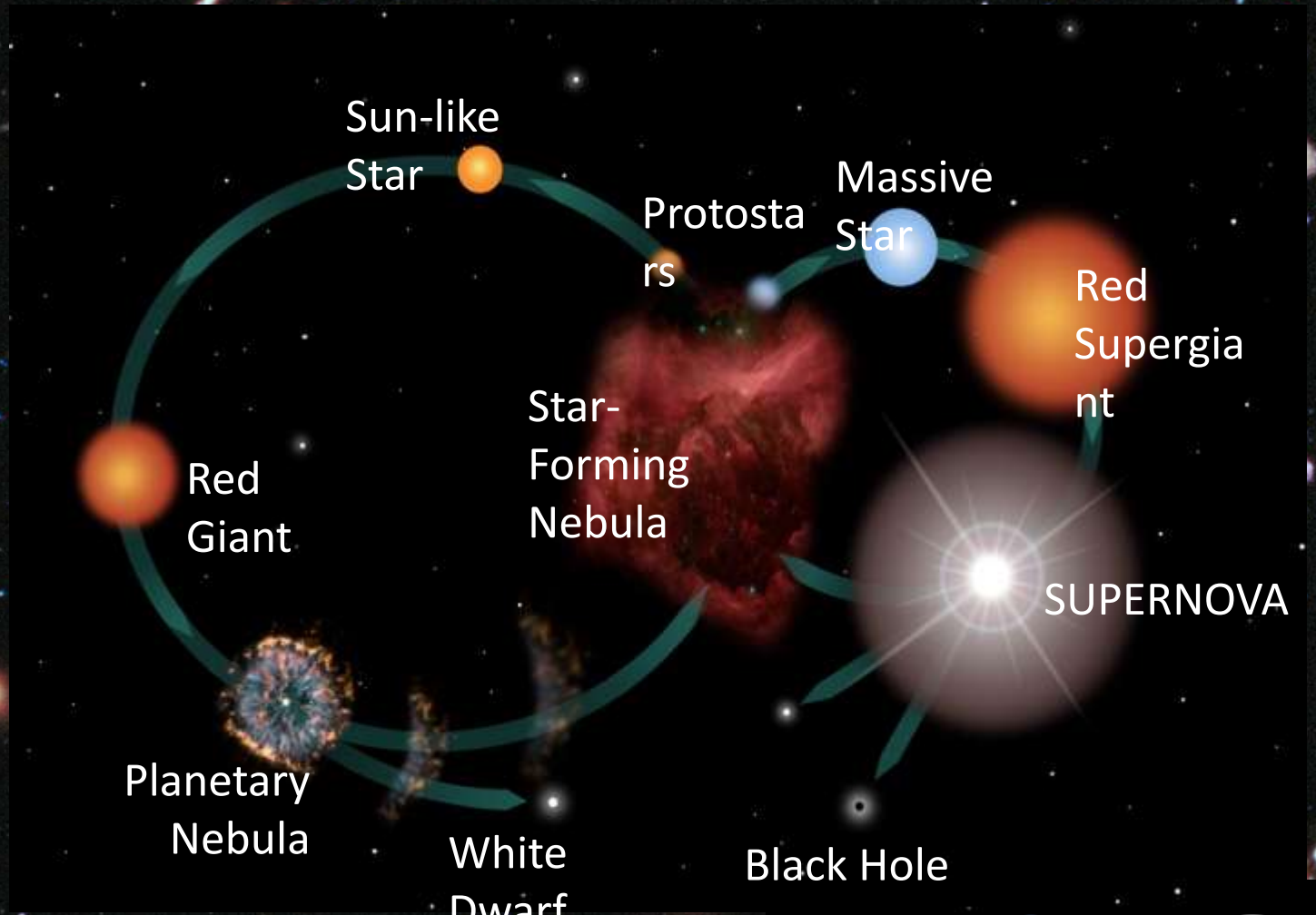
Life Cycle of Stars

How do we know!?!?





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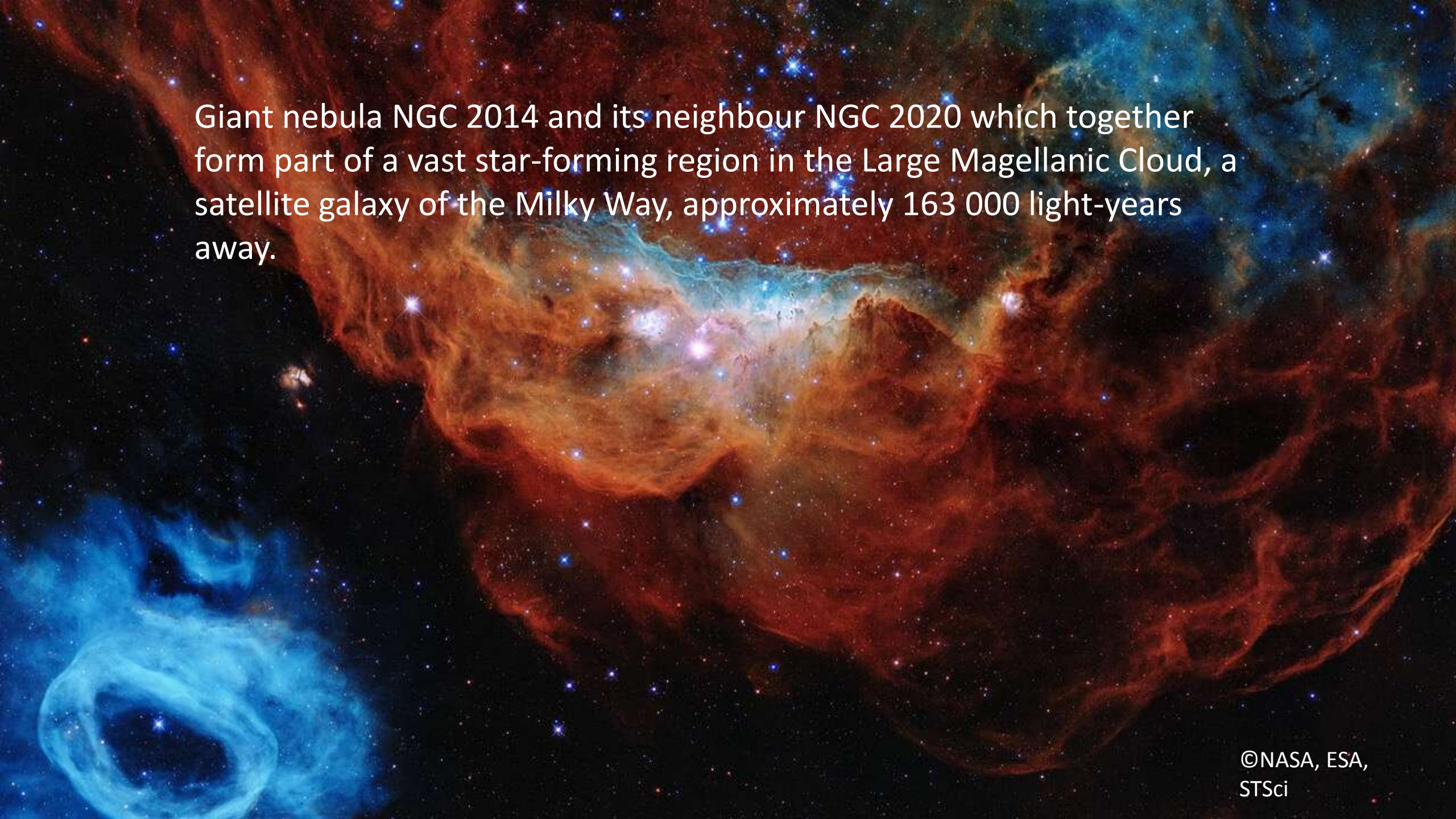
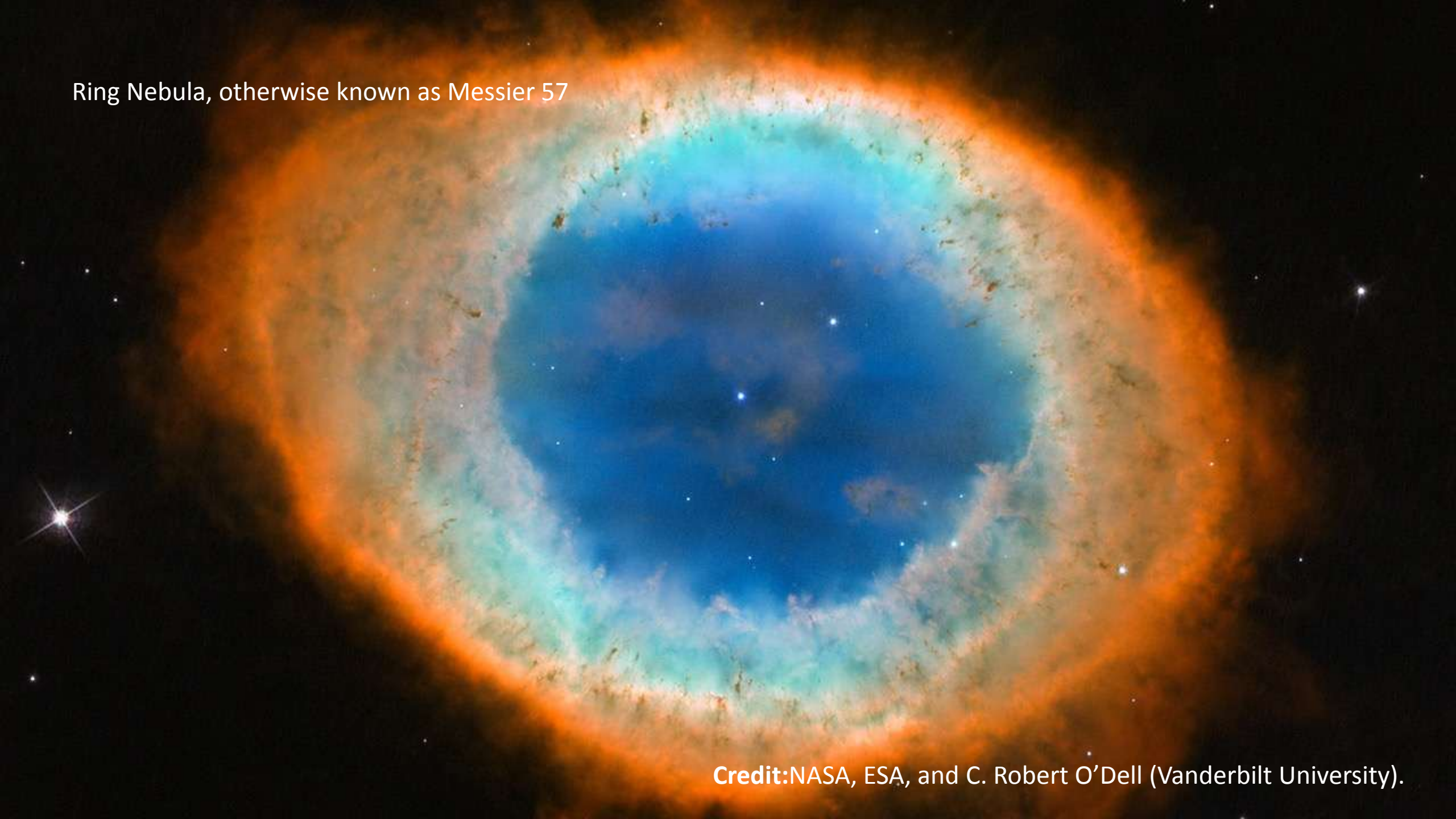
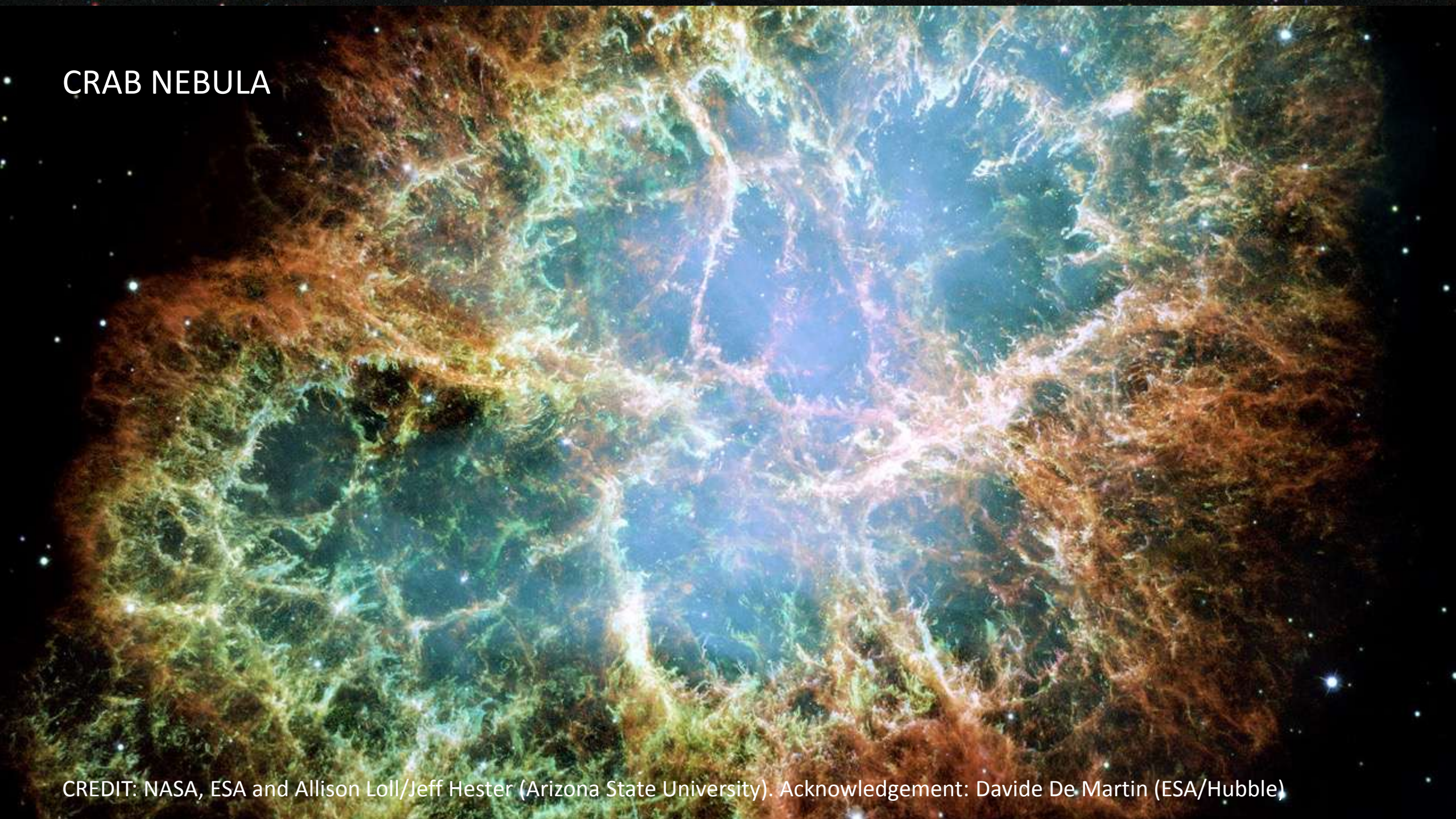


Giant nebula NGC 2014 and its neighbour NGC 2020 which together form part of a vast star-forming region in the Large Magellanic Cloud, a satellite galaxy of the Milky Way, approximately 163 000 light-years away.

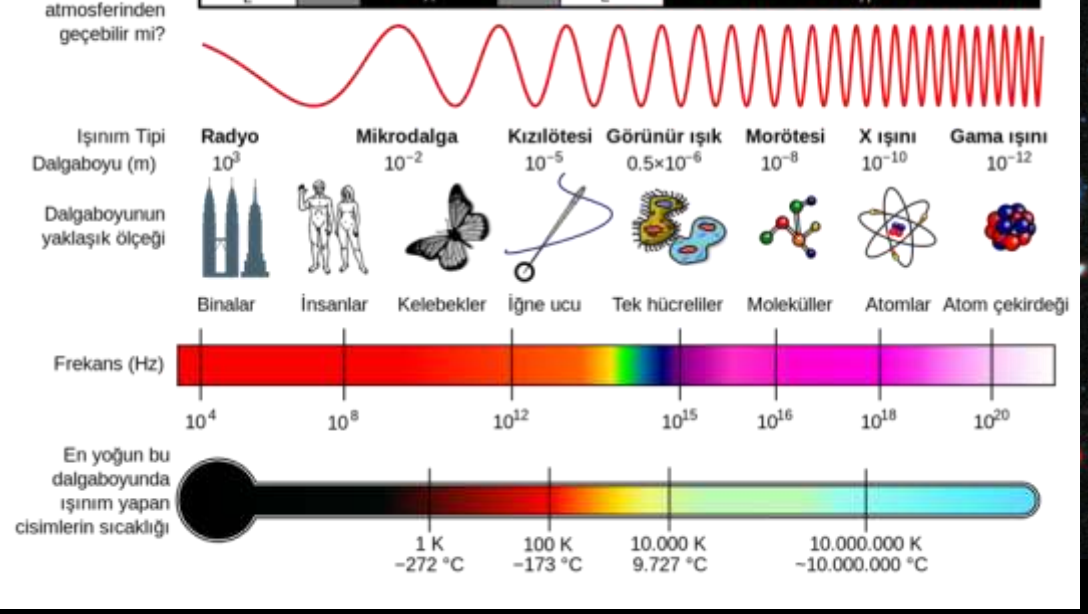
Credit: NASA, ESA, the Hubble Heritage Team (STScI/AURA), A. Nota (ESA/STScI), and the Westerlund 2 Science Team


Ring Nebula, otherwise known as Messier 57
Credit:NASA, ESA, and C. Robert O’Dell (Vanderbilt University).

CRAB NEBULA

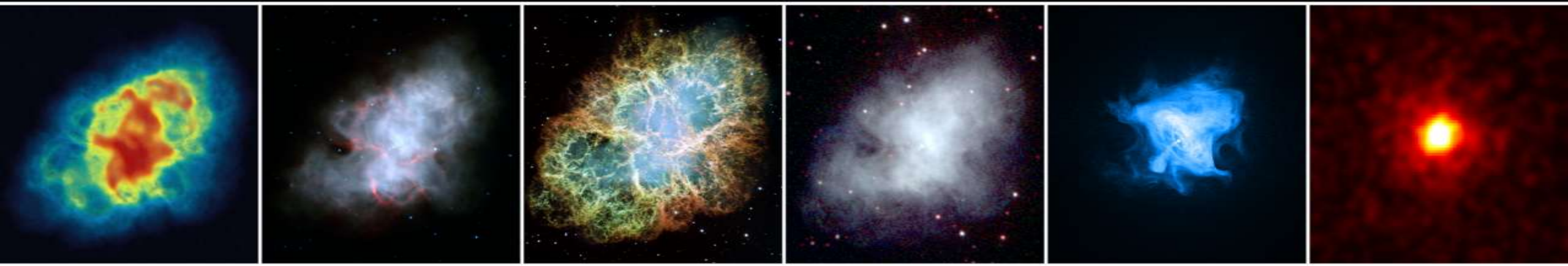


CREDIT: NASA, ESA and Allison Loll/Jeff Hester (Arizona State University). Acknowledgement: Davide De Martin (ESA/Hubble)



What you see is not always what you get !!!!

CRAB NEBULA



Credit: (NASA/NRAO/ESA) Crab Nebula in multiwavelength.png by Torres997

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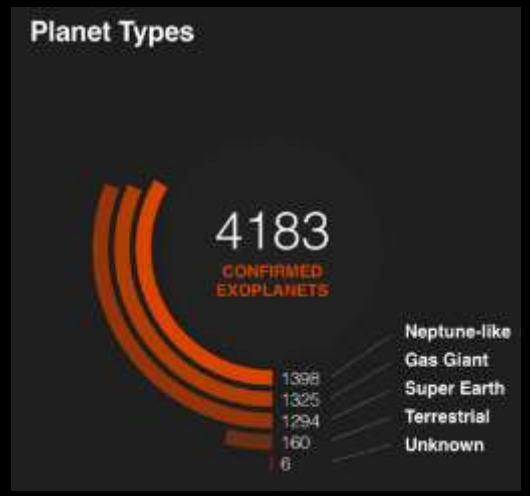
HL Tauri — a young star, about 450 light-years away, which is surrounded by a dusty disc

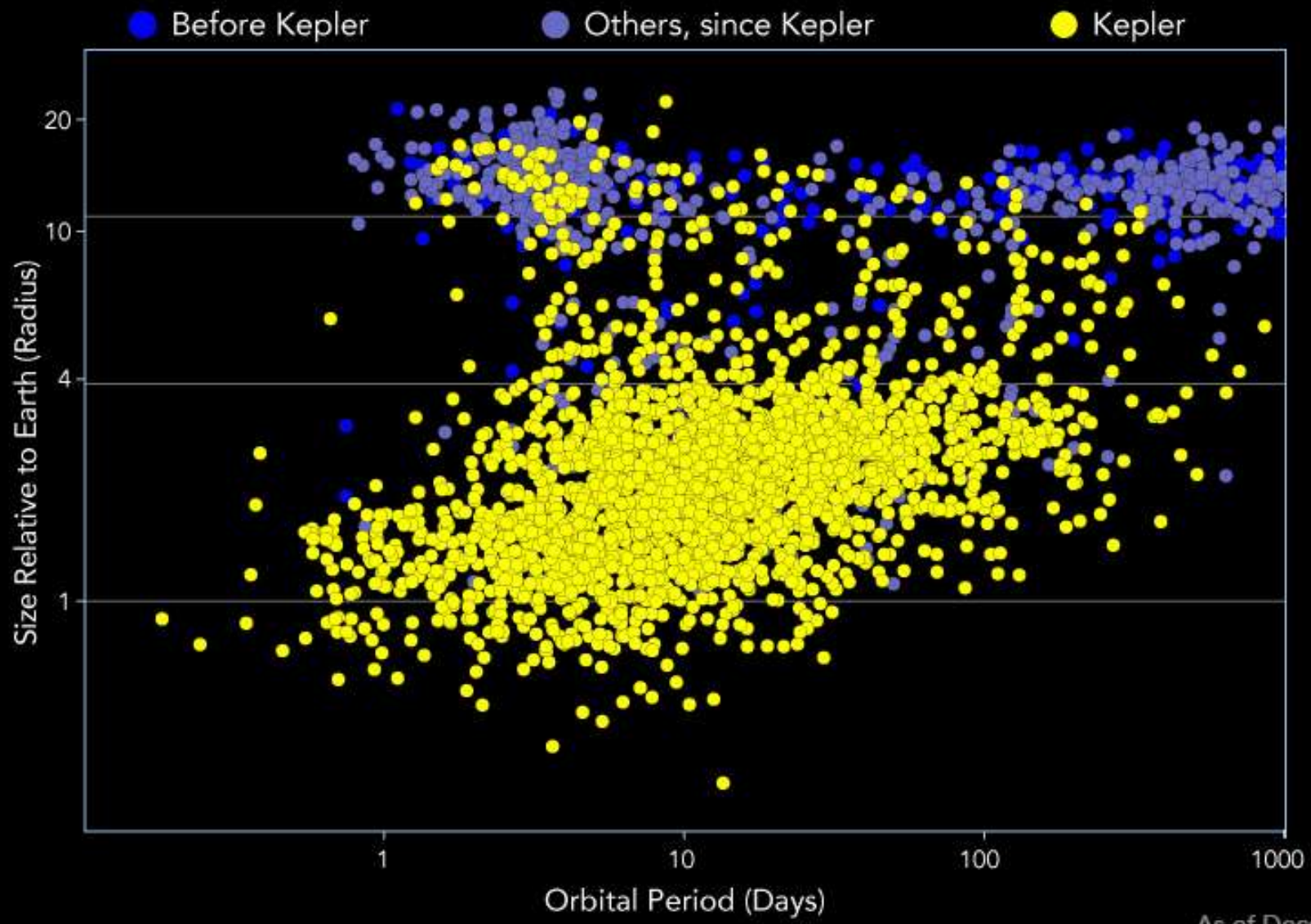
Planet-forming disc around a young star

Credit: ALMA (ESO/NAOJ/NRAO), ESA/Hubble and NASA

Exoplanet Discoveries



Total Kepler = 2,525




Jupiter


Neptune


Earth

As of December 14, 2017

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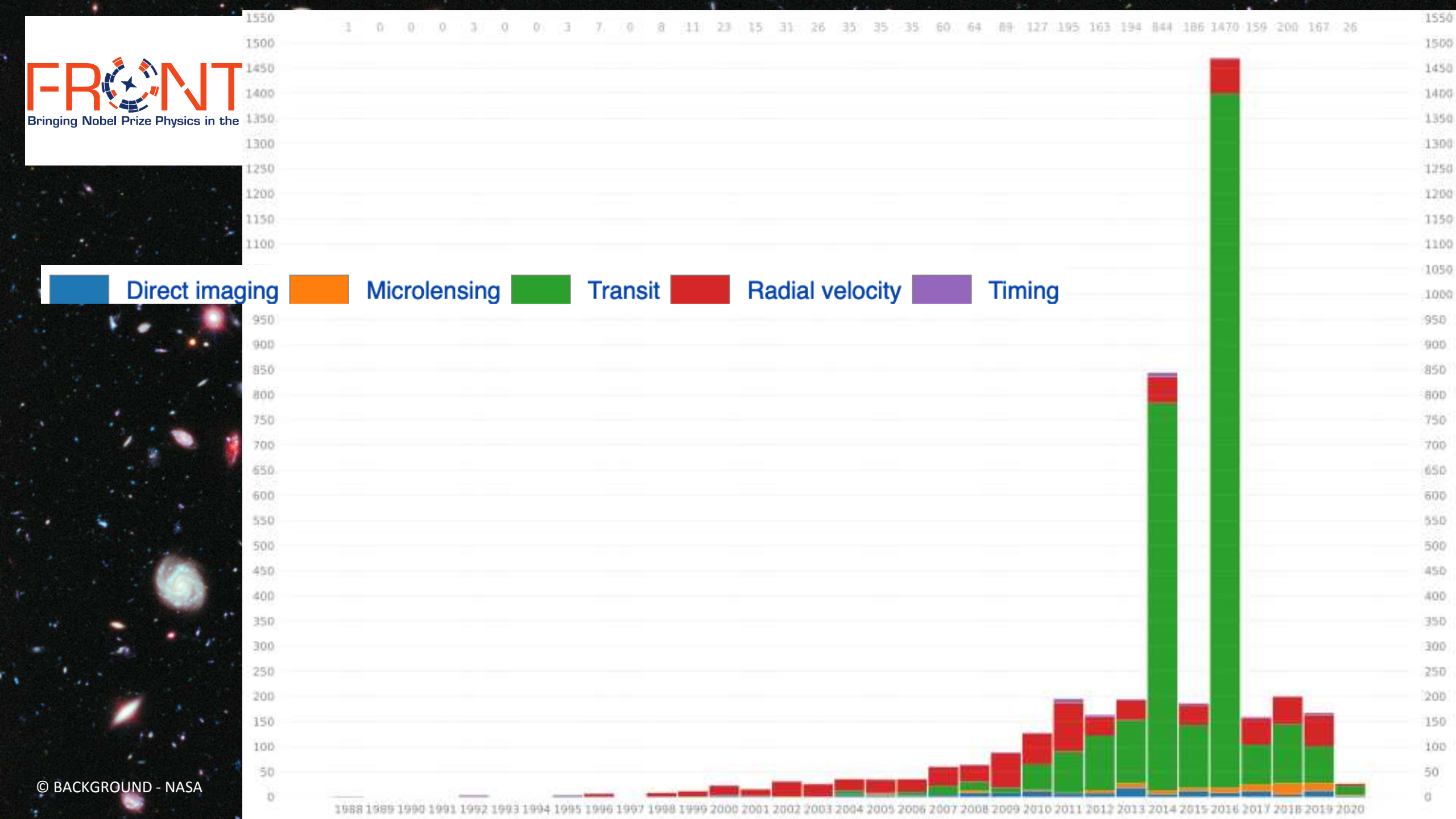

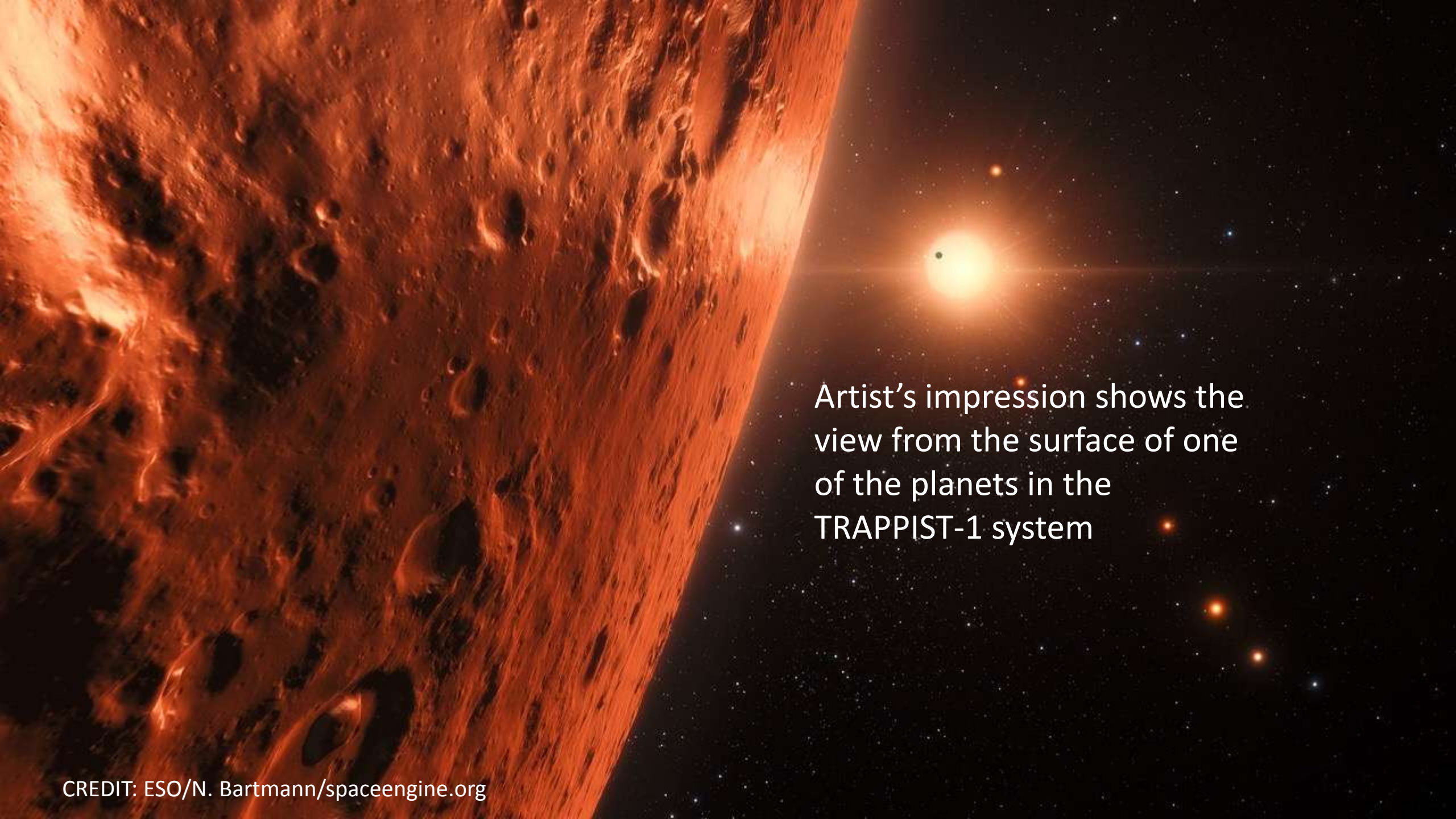

Artist’s impression shows the view from the surface of one of the planets in the TRAPPIST-1 system

CREDIT: ESO/N. Bartmann/spaceengine.org

Smile you are being photographed

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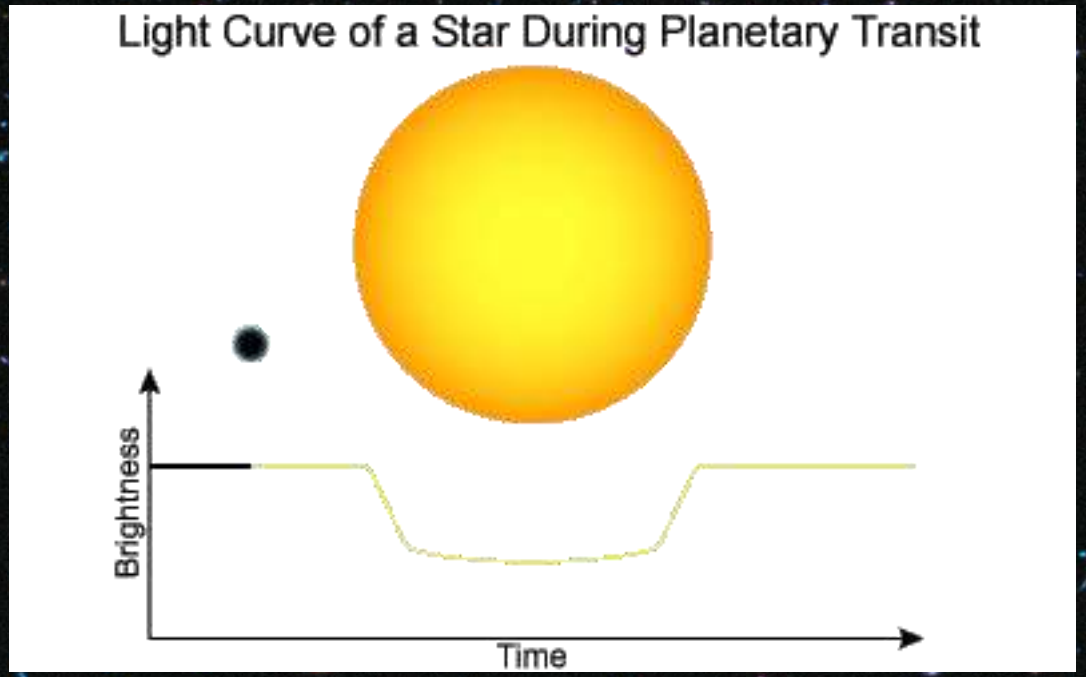
What If !?!?

- Fancy finding new Exo-planets??



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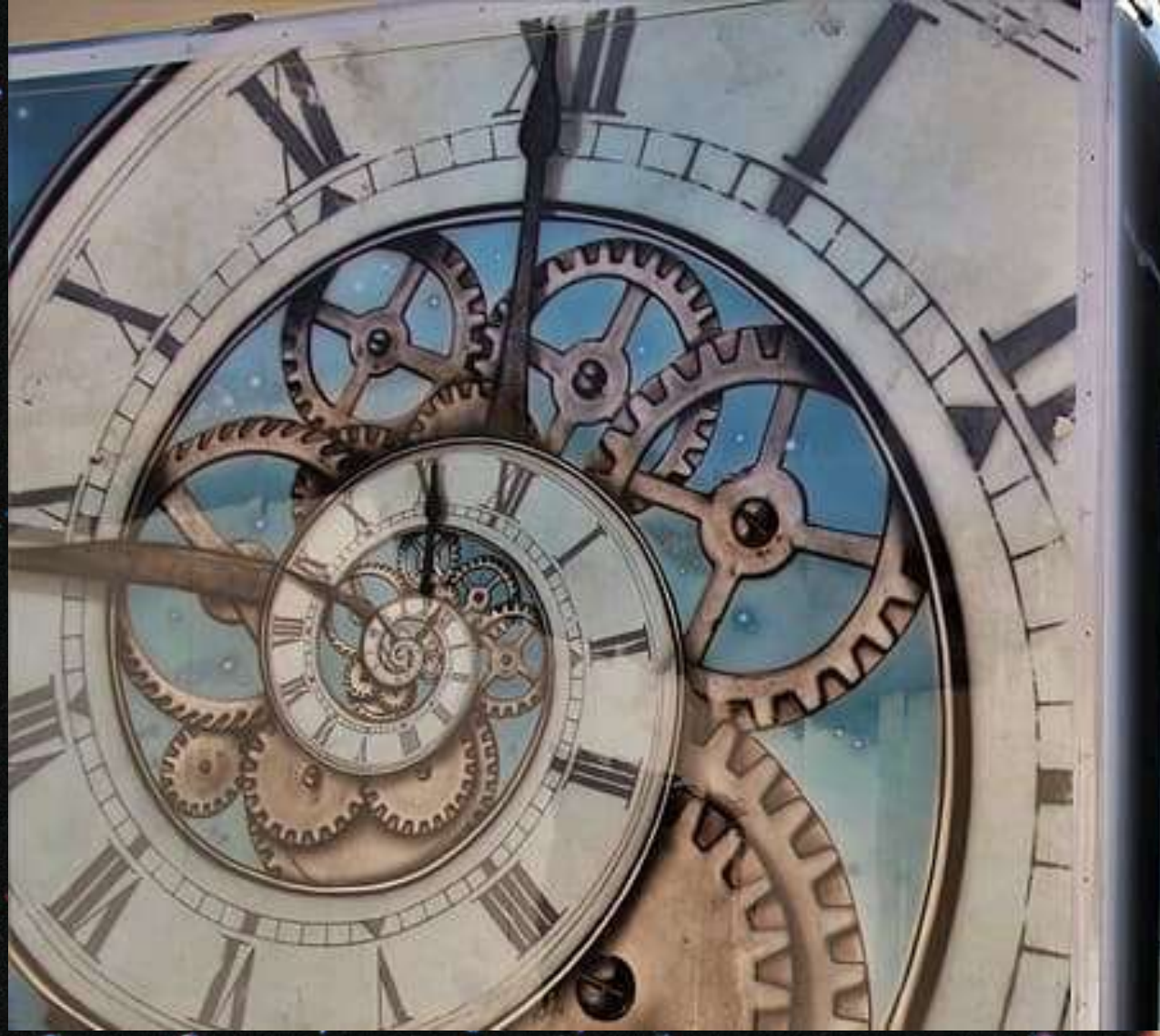

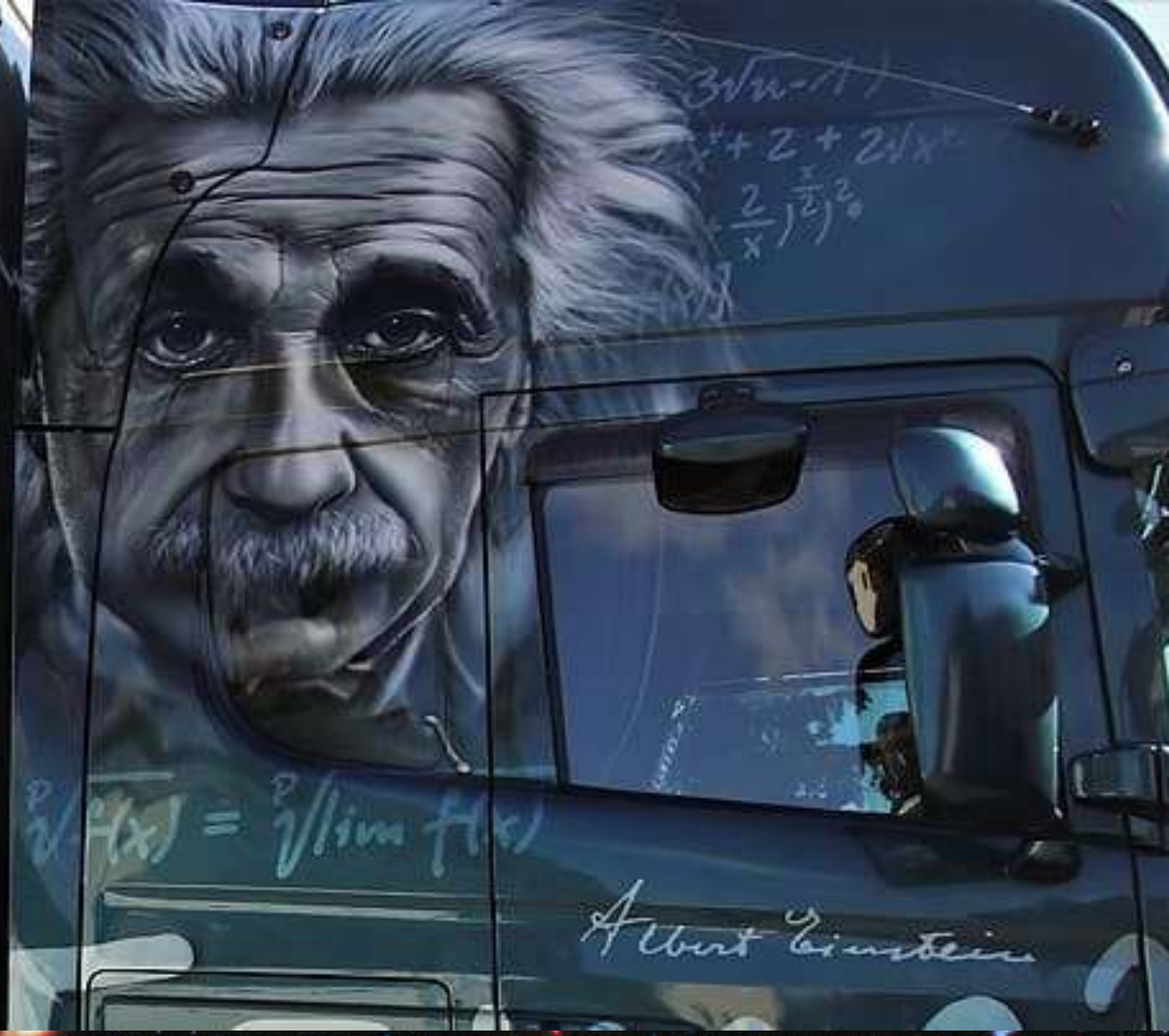

Einstein’s Universe: Time, Space and so much more

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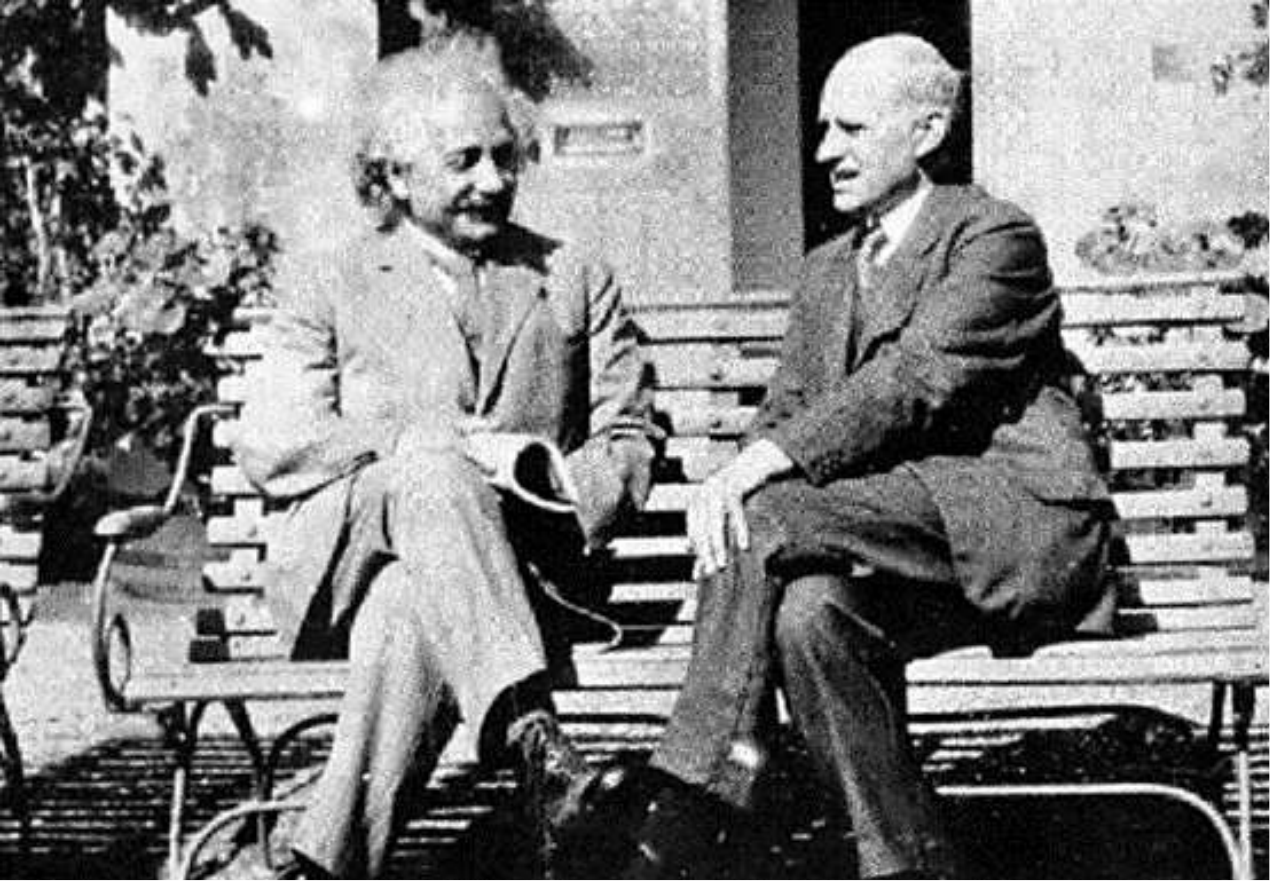

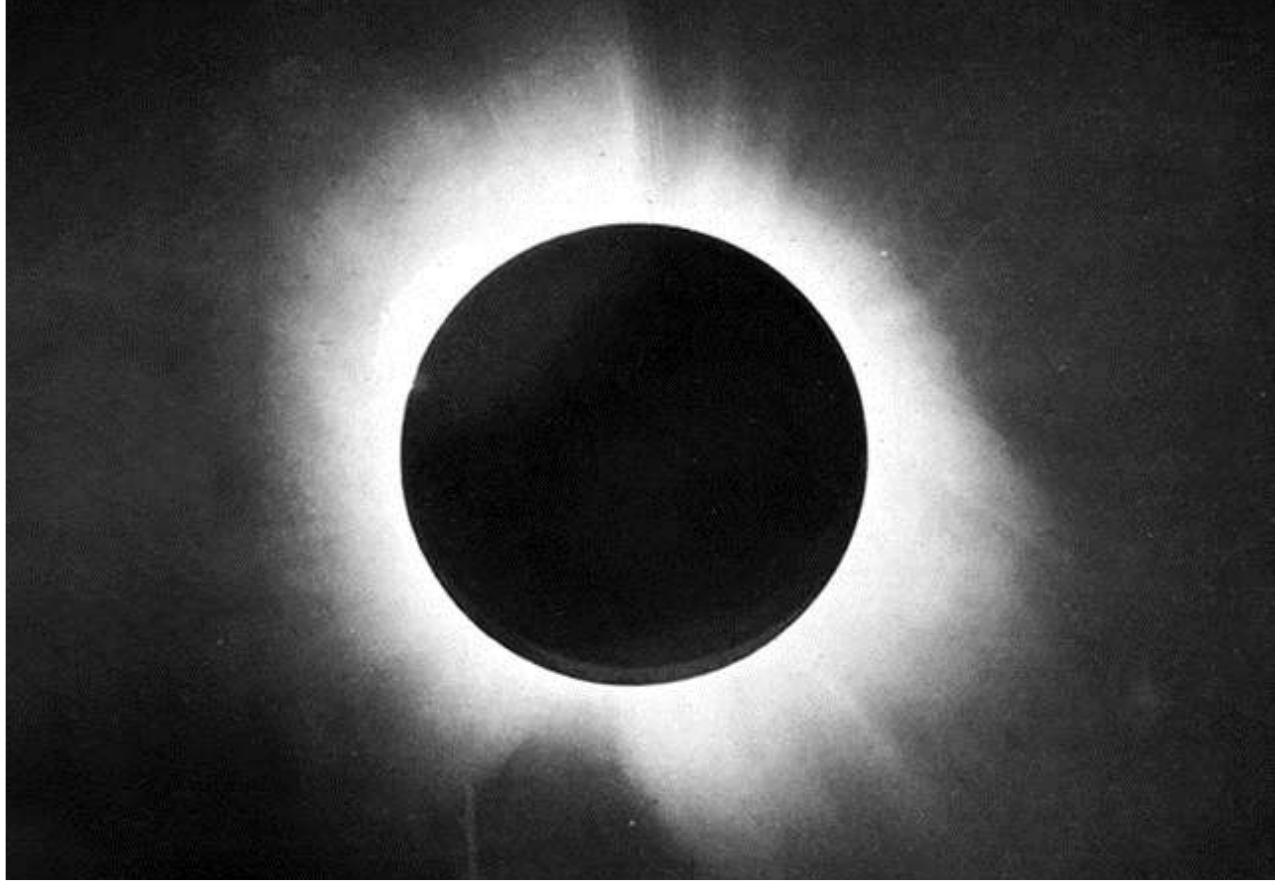

1919: Eddington and Einstein’s

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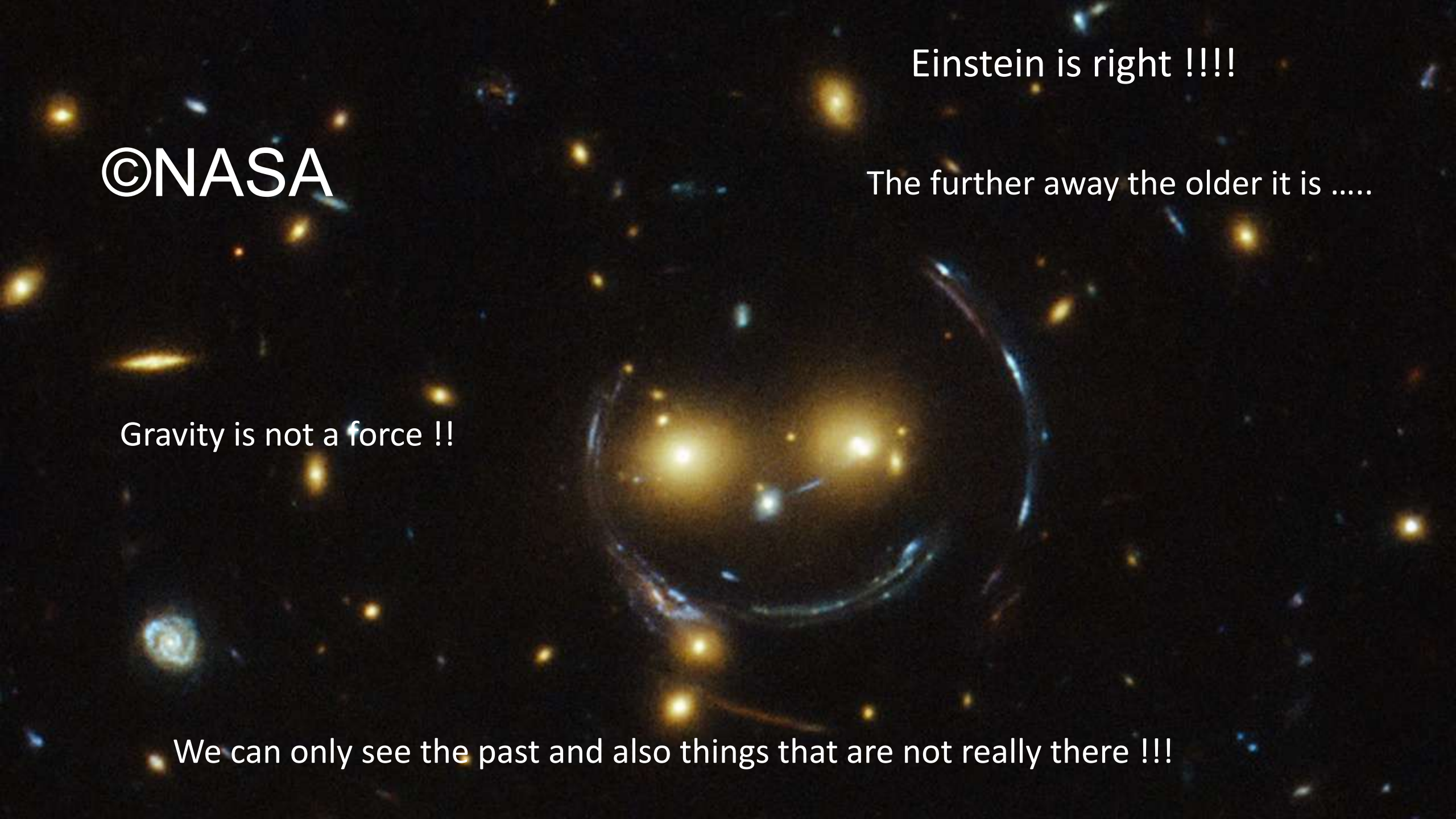
©NASA
Einstein is right !!!!
The further away the older it is …..
Gravity is not a force !!
We can only see the past and also things that are not really there !!!

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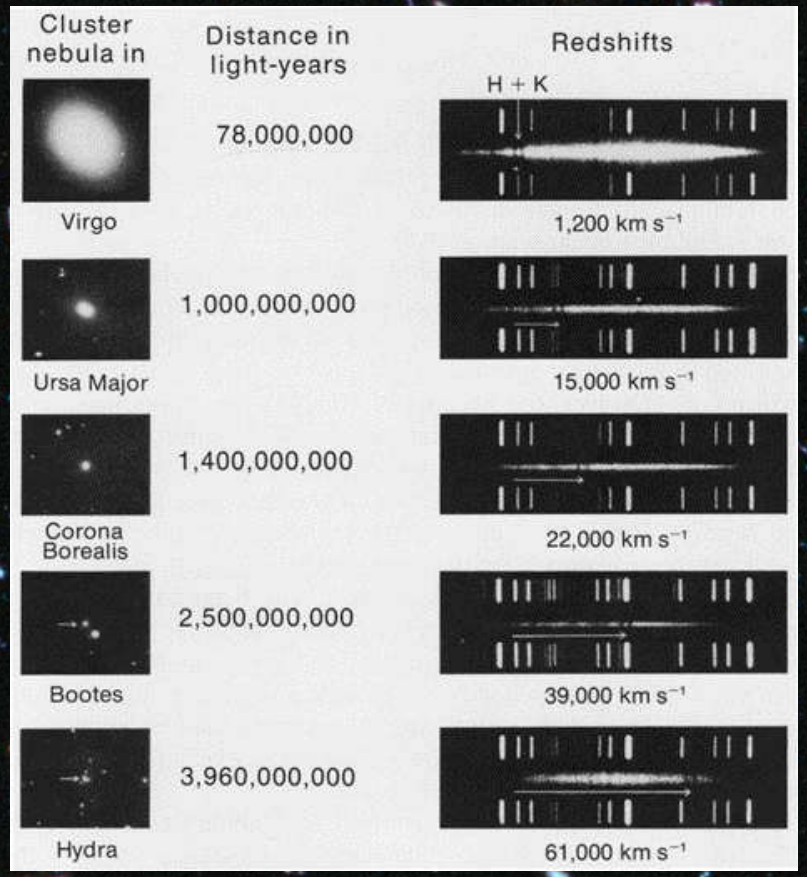

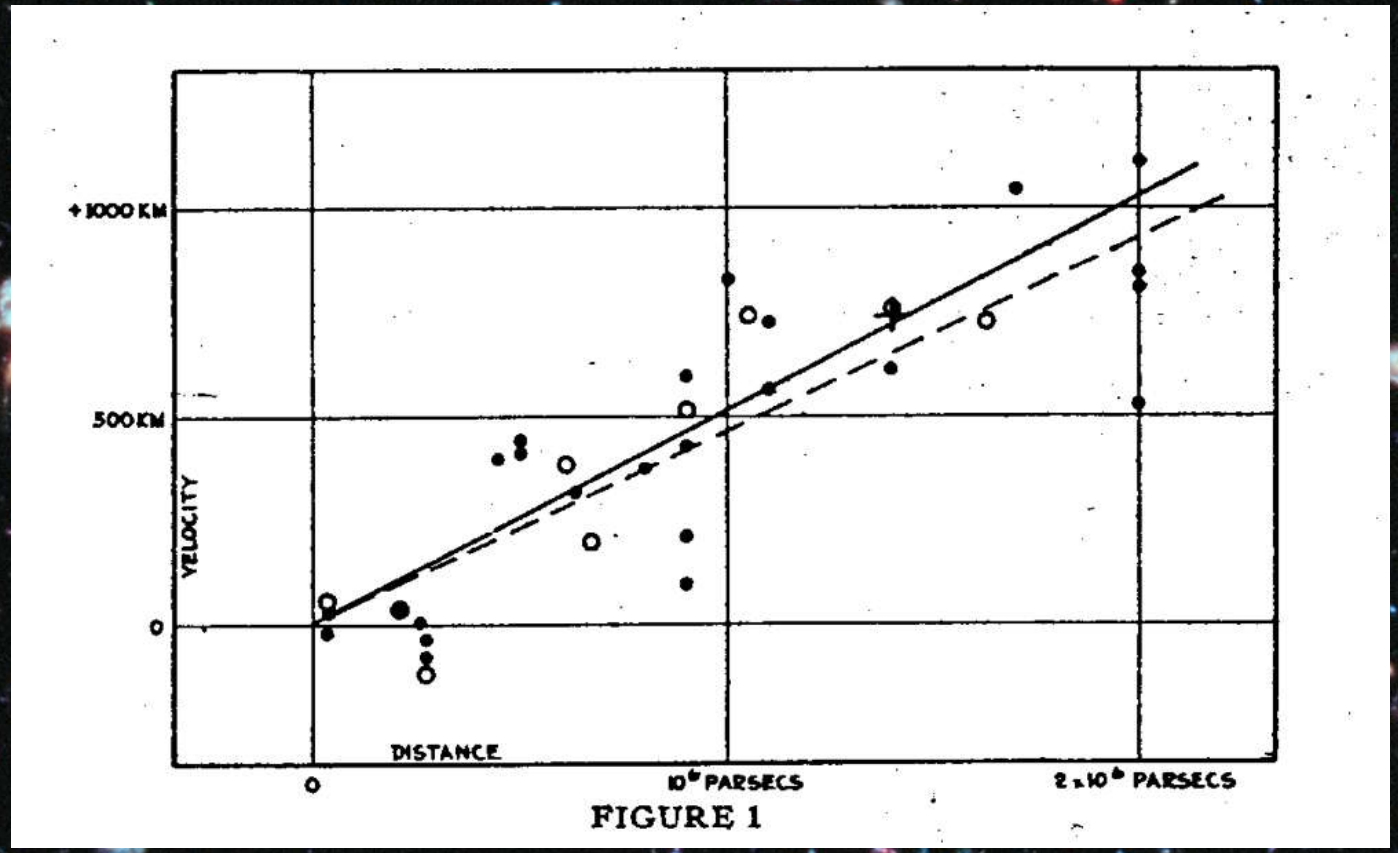

FIGURE 1

In 1920s → the Solar System in located in a galaxy
1923 → Andromeda is another Galaxy
1929 – All galaxies were moving away from us with a velocity directly proportional to thejr distance:

$v=H_0 * d$

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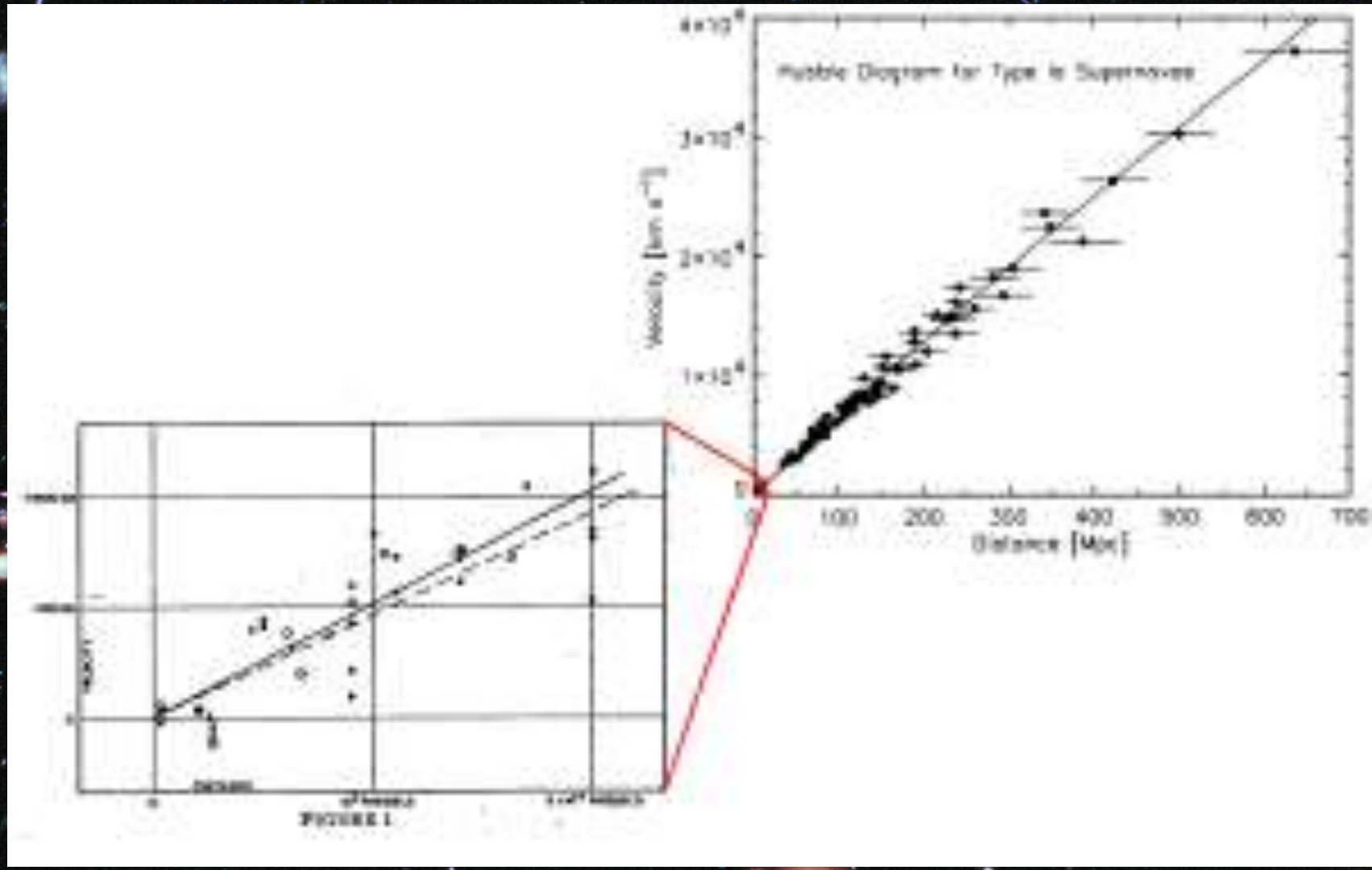

Credit: Robert Kirshner

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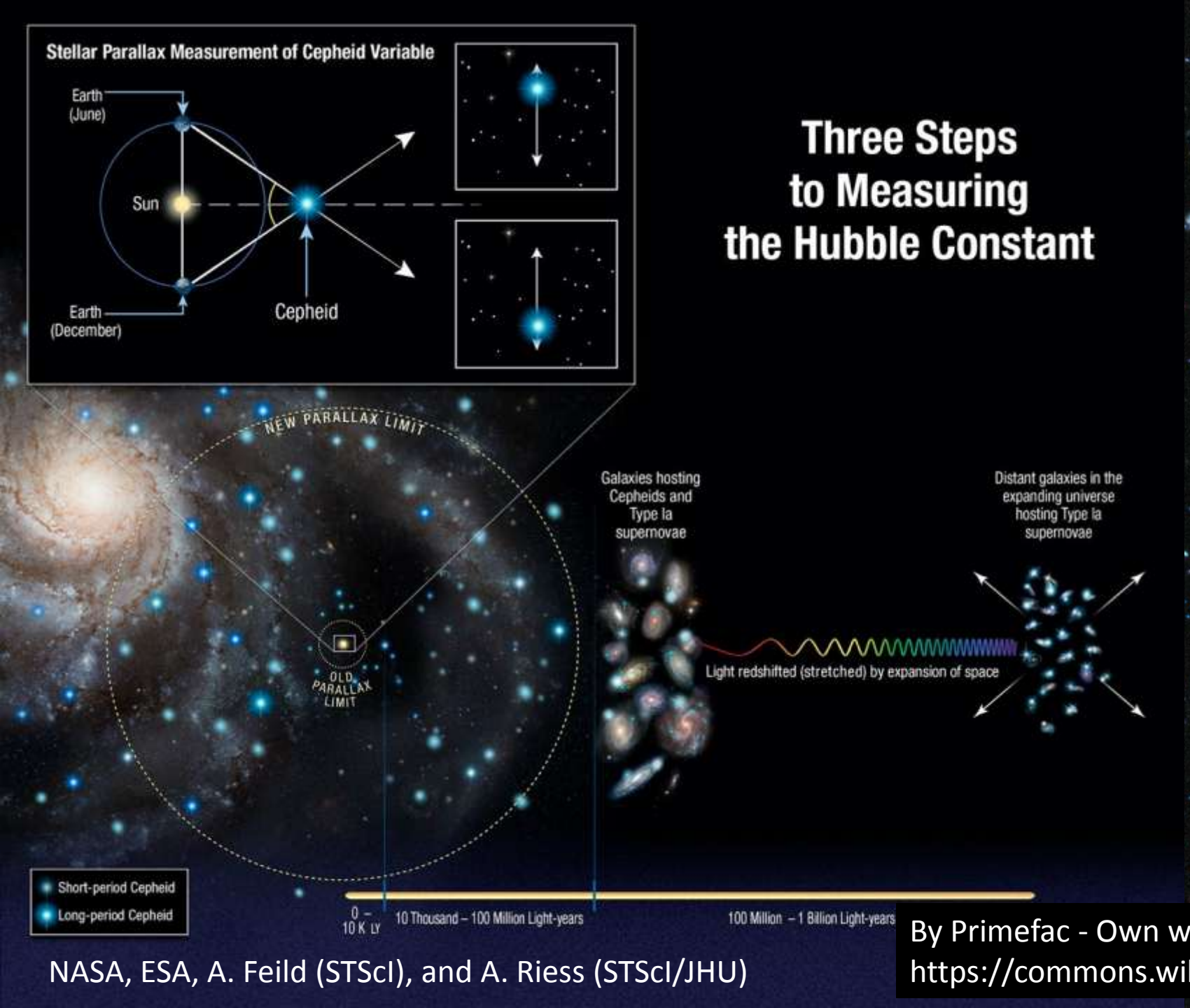
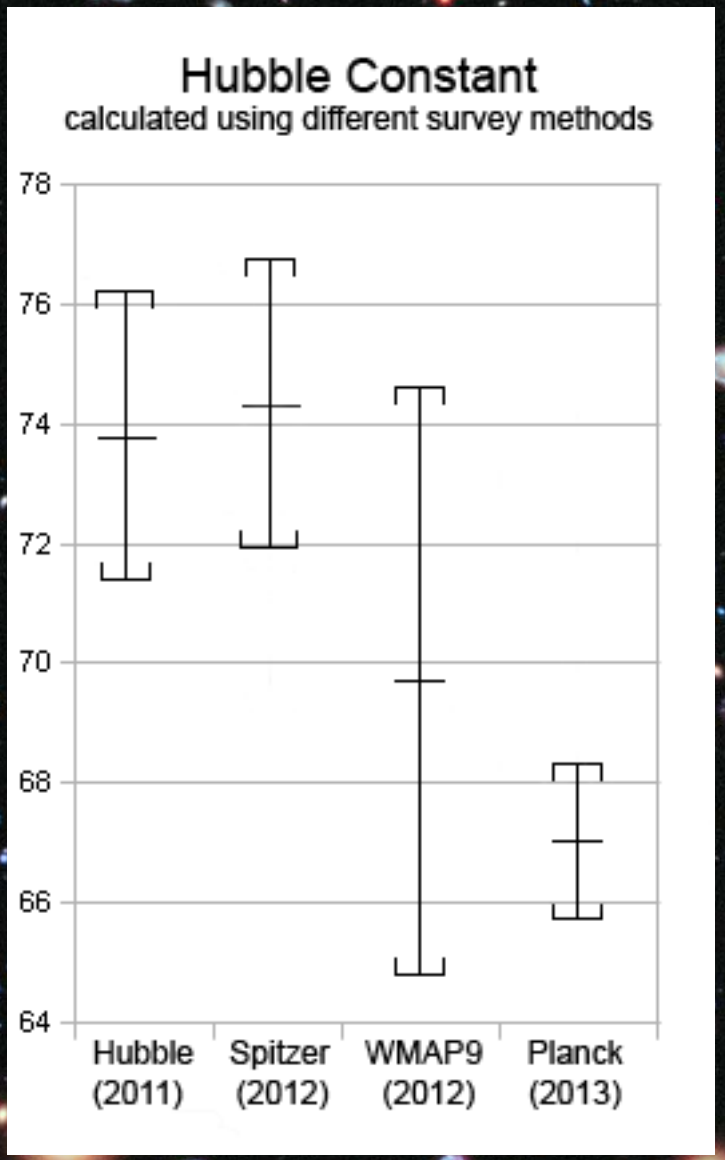


NASA, ESA, A. Feild (STScI), and A. Riess (STScI/JHU)



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- Less than 100 year ago we didn't know that there were galaxies beyond our own. Now …..

- …… what if you could calculate the age of the Universe yourself?

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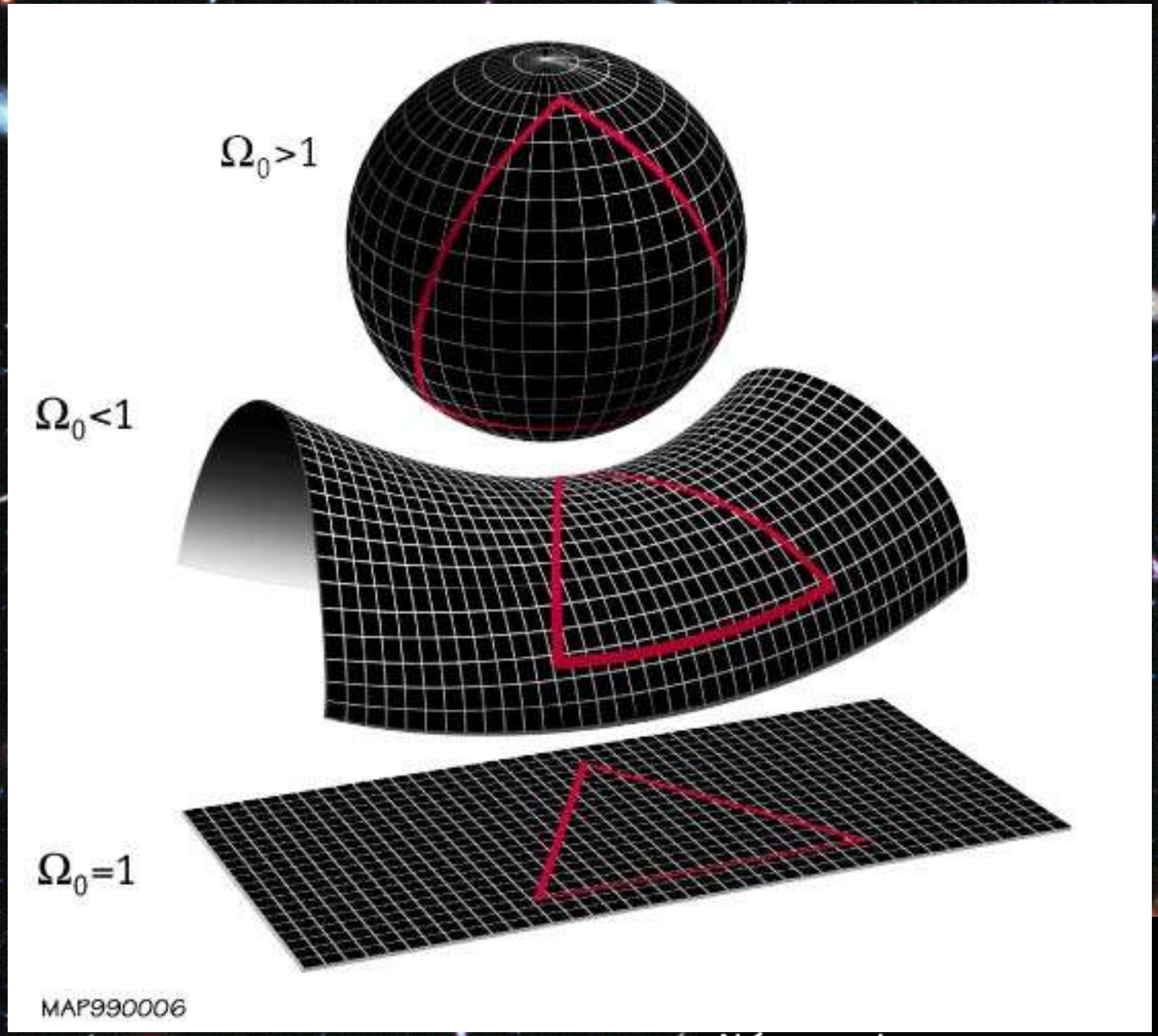

Author: NASA / WMAP Science Team

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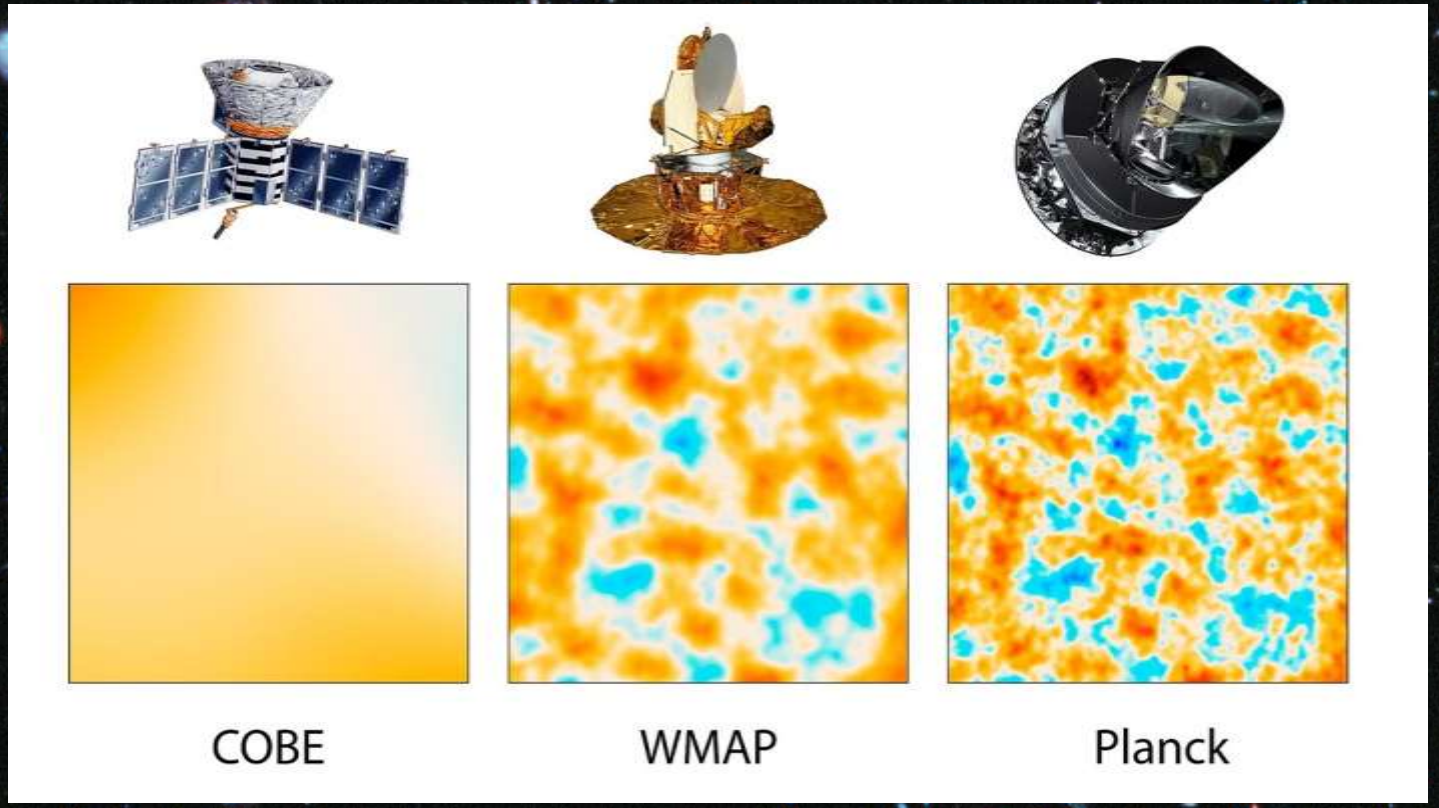

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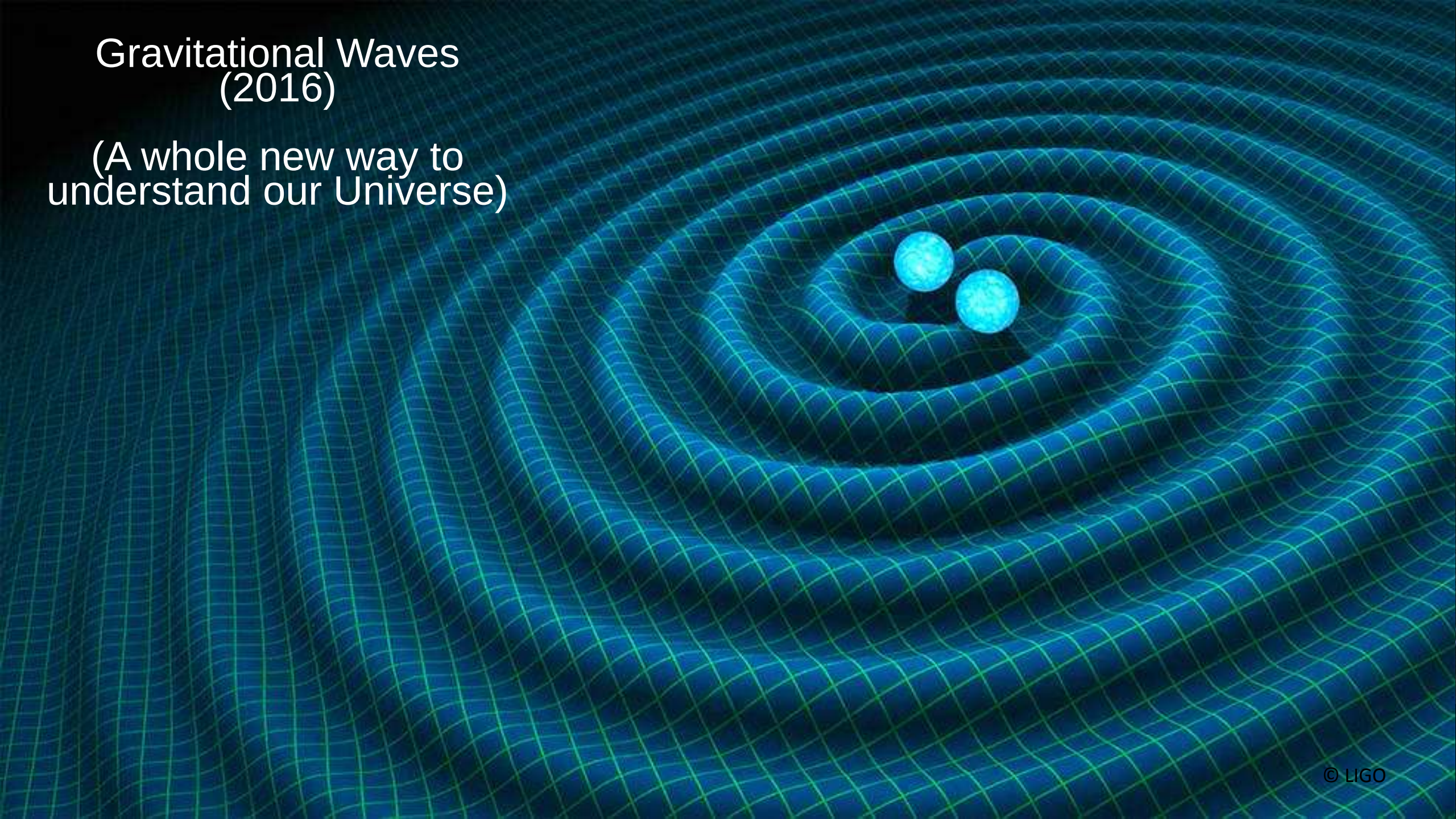
Gravitational Waves (2016)

(A whole new way to understand our Universe)



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Not the topic of my talk !!!!

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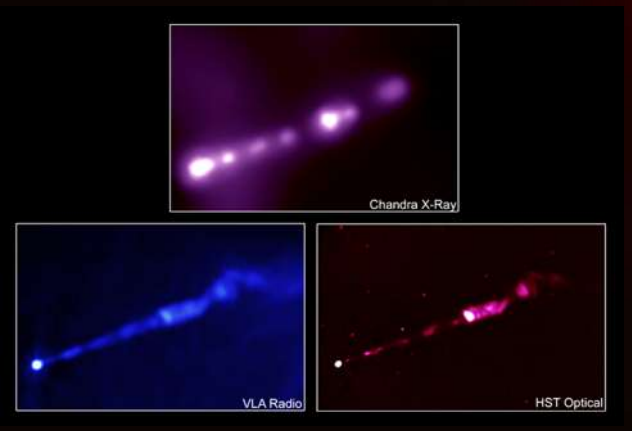
Black Holes

M87

Biggest black hole known

55 million years away

Jet that is 5000 light-year long



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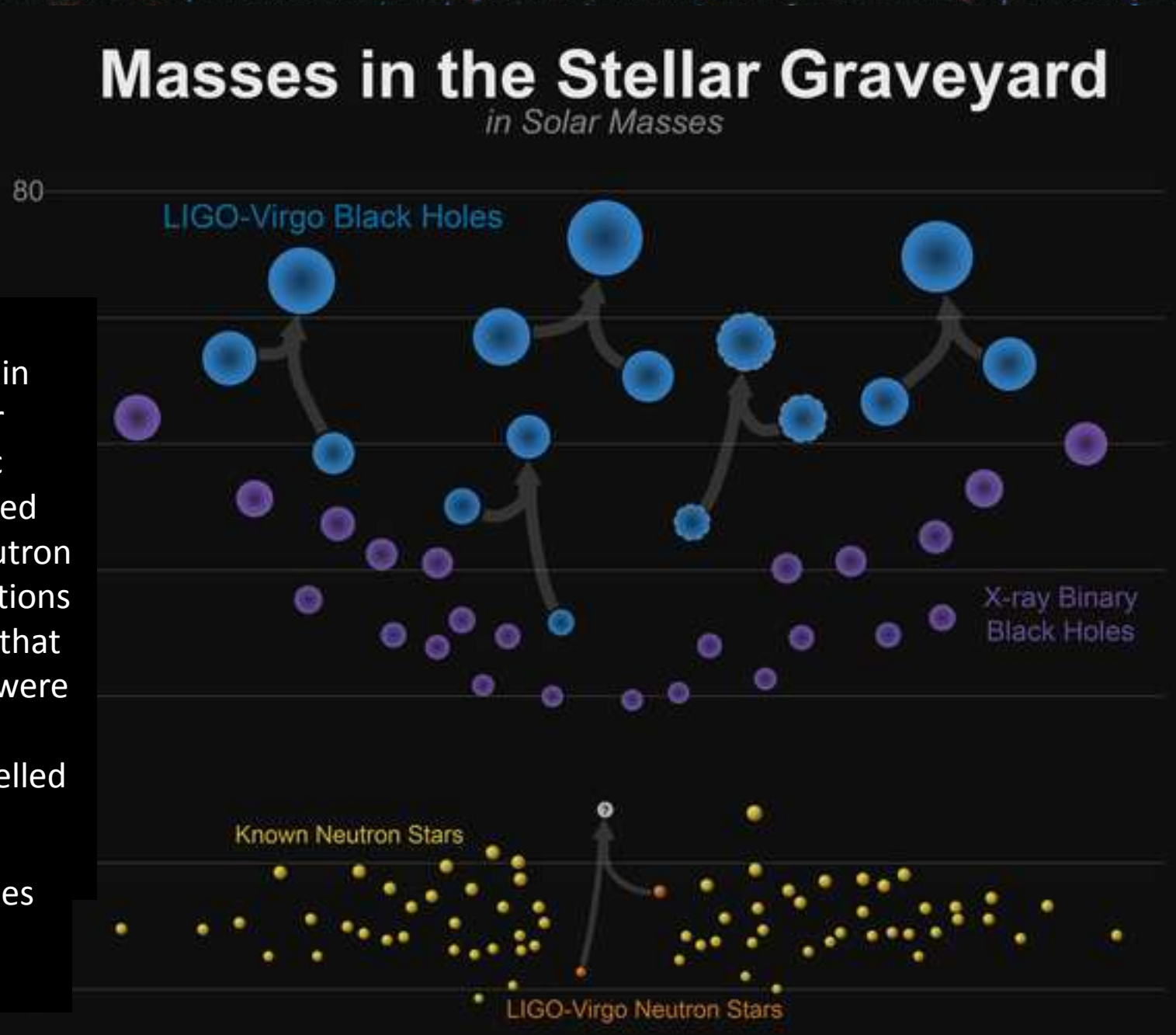
BH and NS Mass Chart

The masses of stellar remnants are measured in many ways. This graphic shows the masses for black holes detected through electromagnetic observations (purple); the black holes measured by gravitational-wave observations (blue); neutron stars measured with electromagnetic observations (yellow); and the masses of the neutron stars that merged in an event called GW170817, which were detected in gravitational waves (orange). The remnant of GW170817 is unclassified and labelled as a question mark.

There are currently more than 50 X-Ray Binaries being followed http://www.faulkes-telescope.com/xrb/



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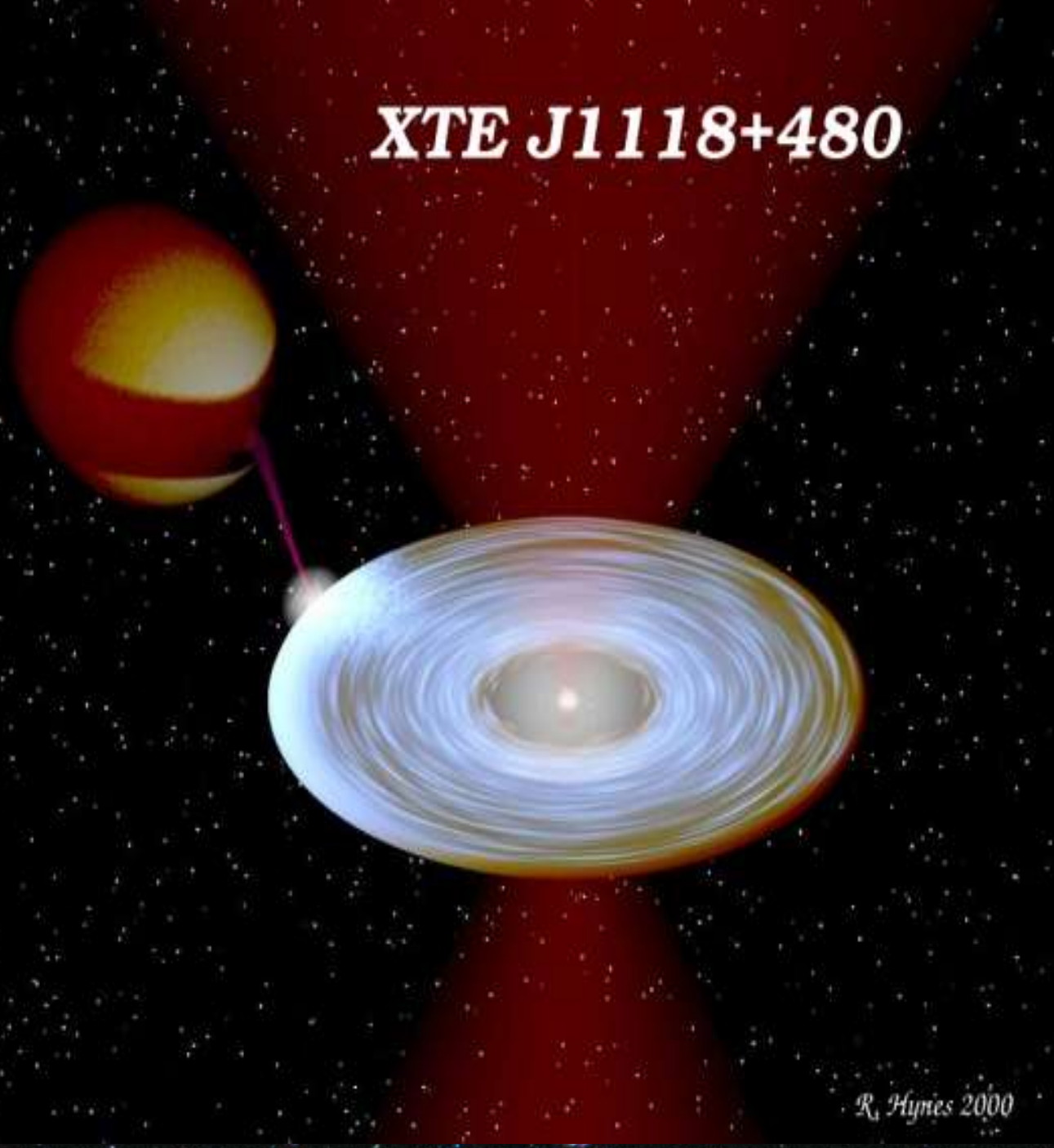
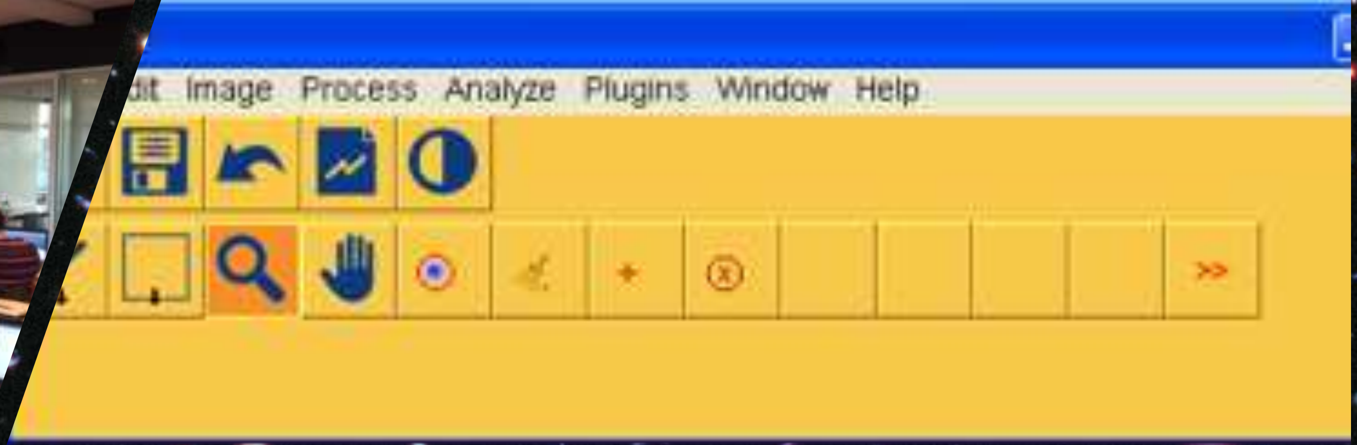
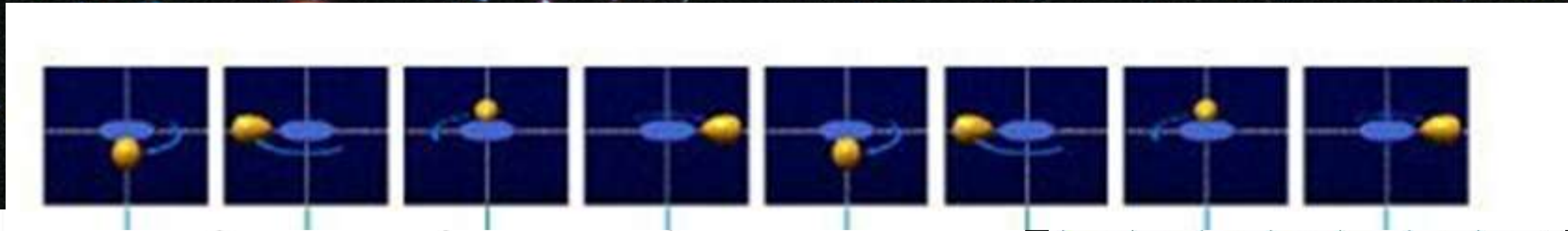
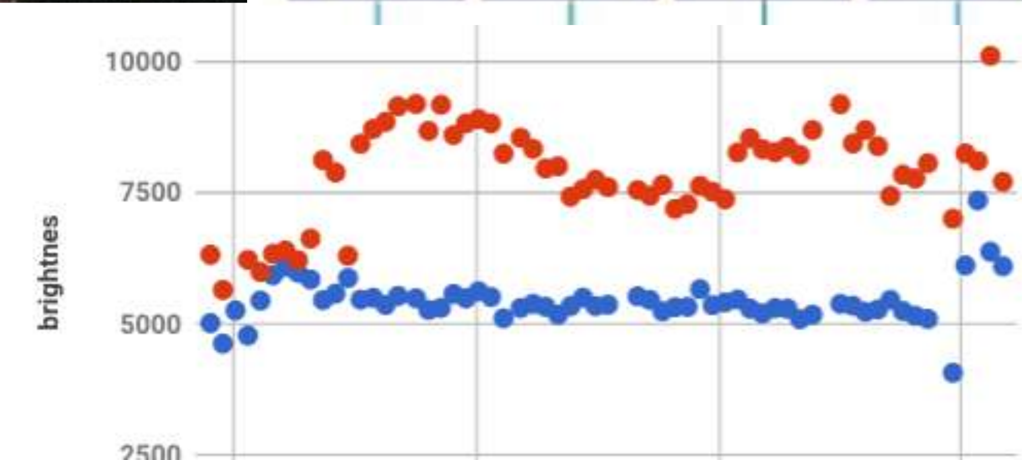
We will study a stellar mass black hole candidate using a series of 62 images taken with the Faulkes Telescope

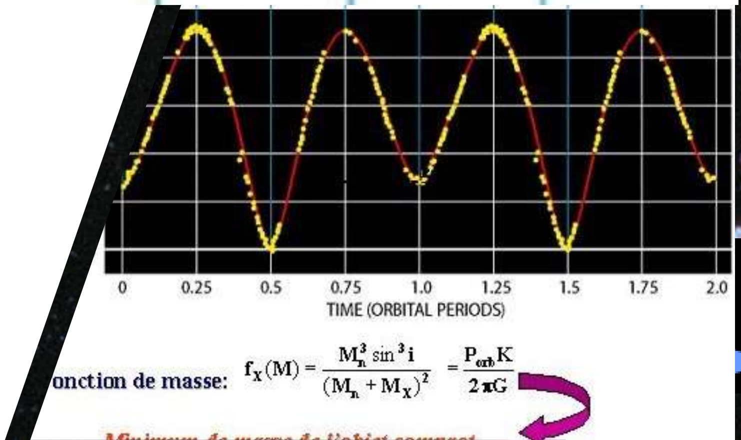




Training Teachers







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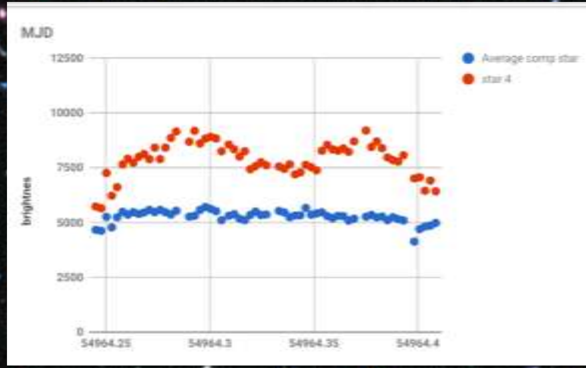
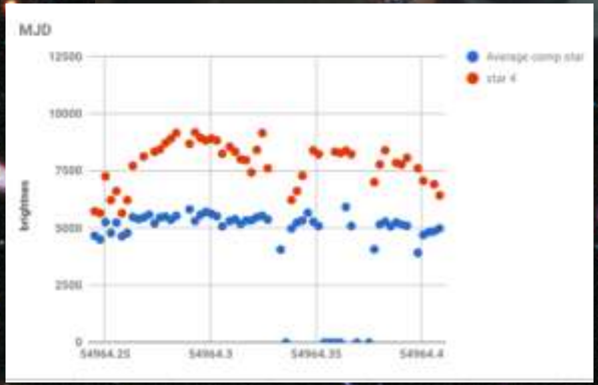
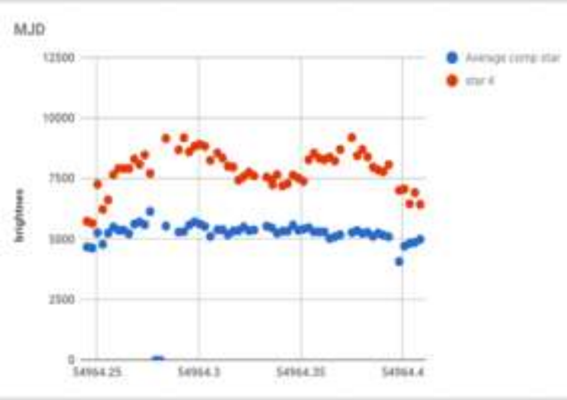
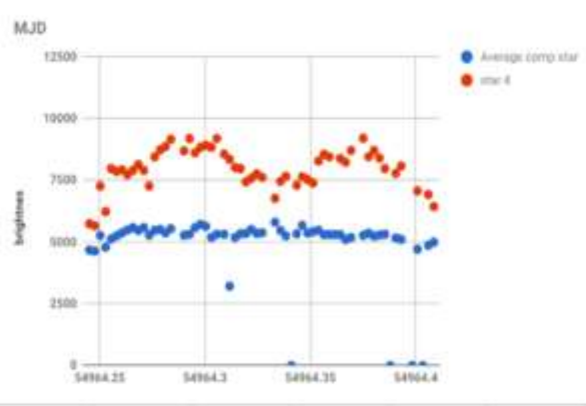
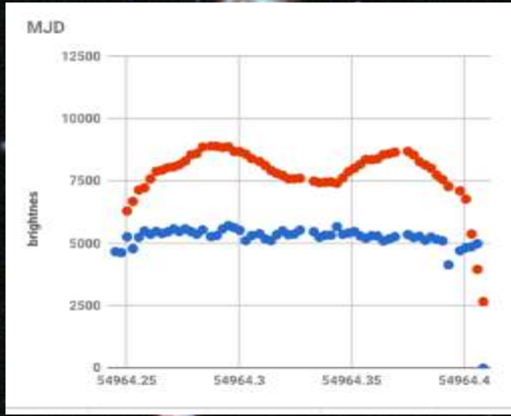
Engaging Students

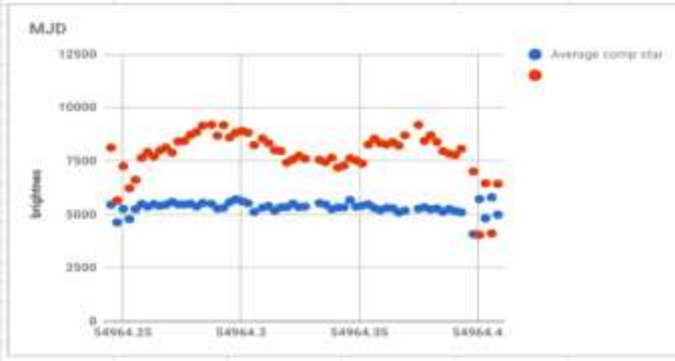


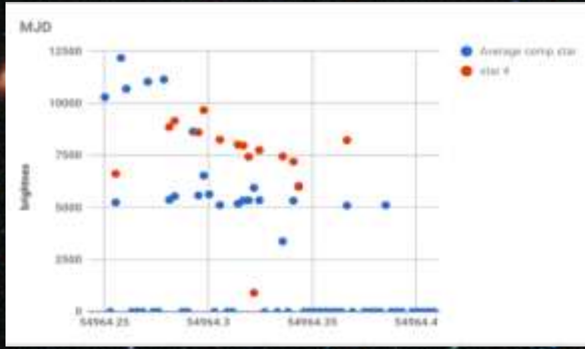












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We live in a magical place.
Make sure you value it !!! Everyday !!!
ευχαριστώ
Salt plan and rain make it the world largest mirror in Bolivia
© Jheison Huerta