

VIAGGI NEL PASSATO?

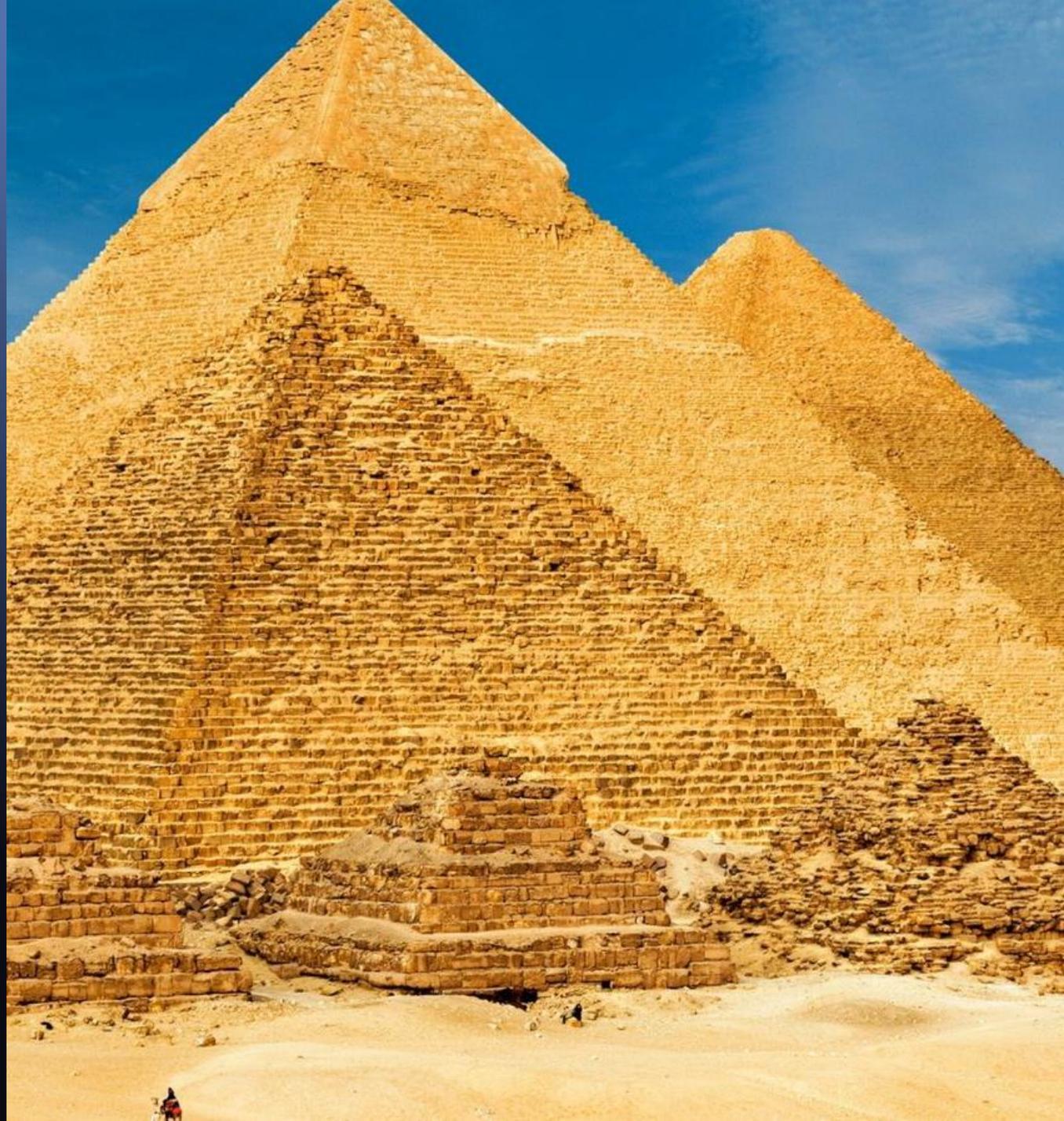
CERTO CHE SONO  
POSSIBILI!



Vorreste vedervi così?



Oppure vedere gli  
Egizi che costruivano  
le Piramidi?



Oppure vedere un  
T-Rex dal vivo?

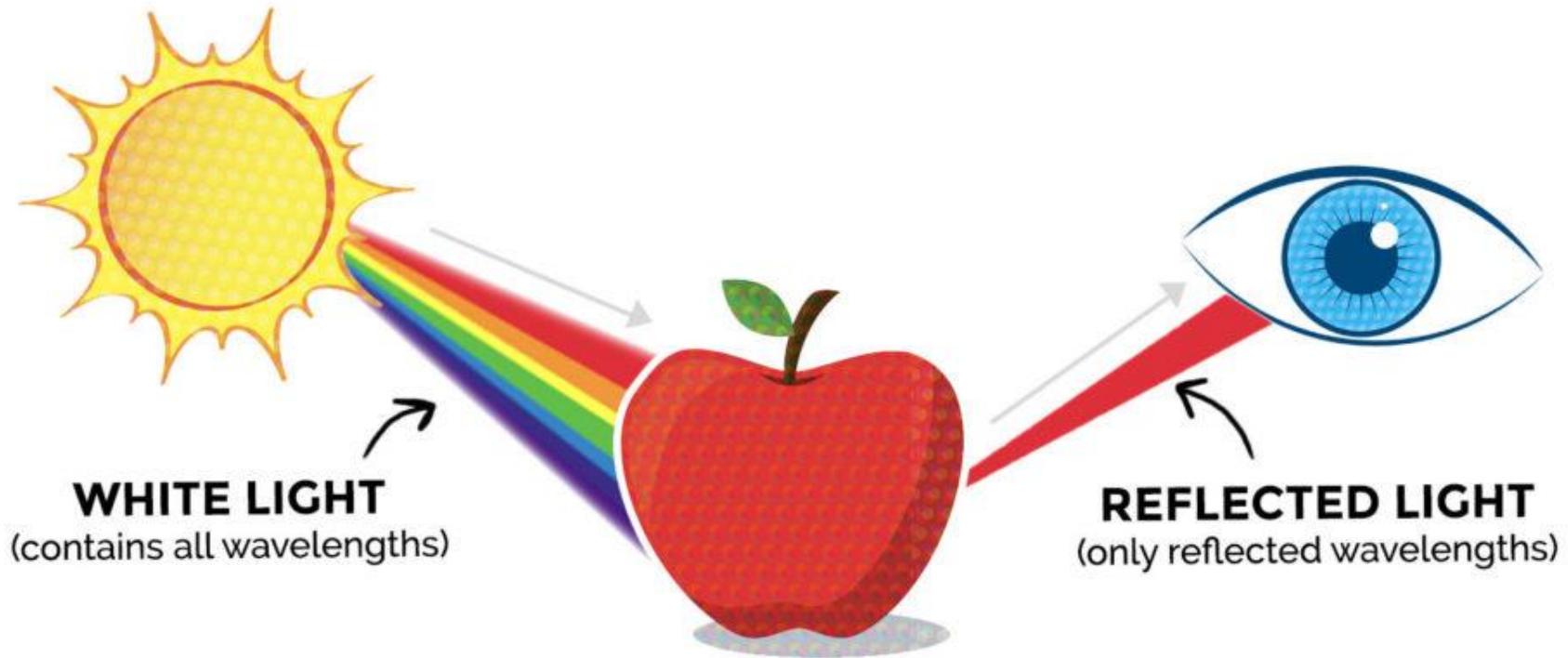


Non è possibile  
vedere il passato



Ma ne siamo sicuri?

299 792 458 m/s



**WHITE LIGHT**  
(contains all wavelengths)

**REFLECTED LIGHT**  
(only reflected wavelengths)

1 secondo



8 minuti



Alcuni anni, centinaia o  
migliaia di anni

Venus 4'

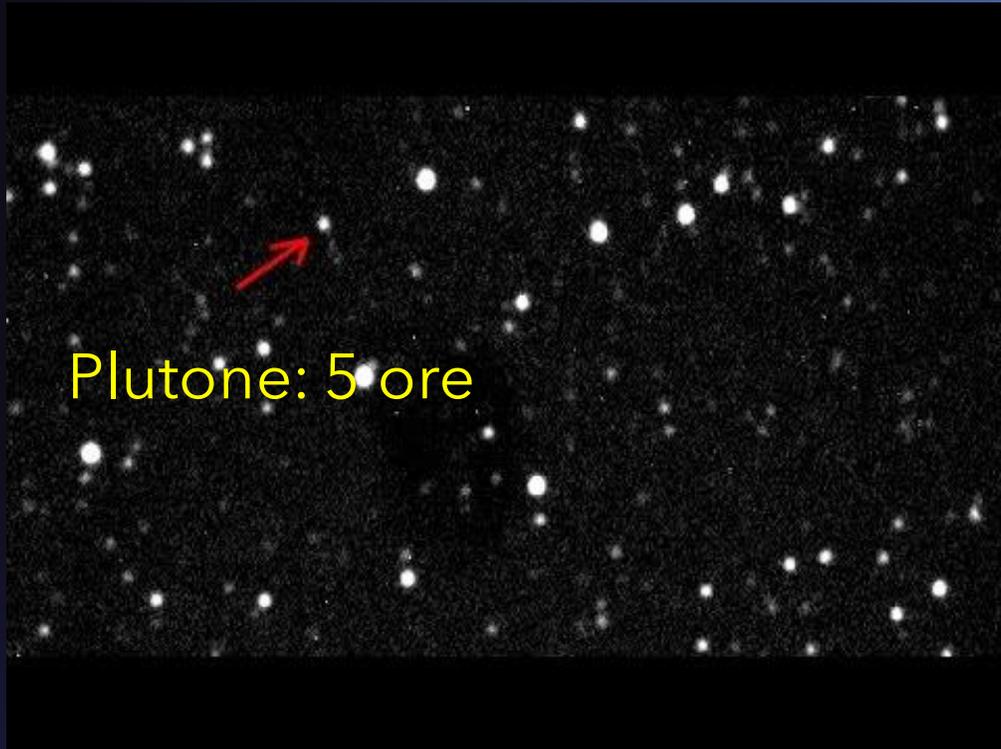
Mars 13'

Mercury 11'

Saturn  
1 h 40'

Moon 1''

30 milionesimi di secondo





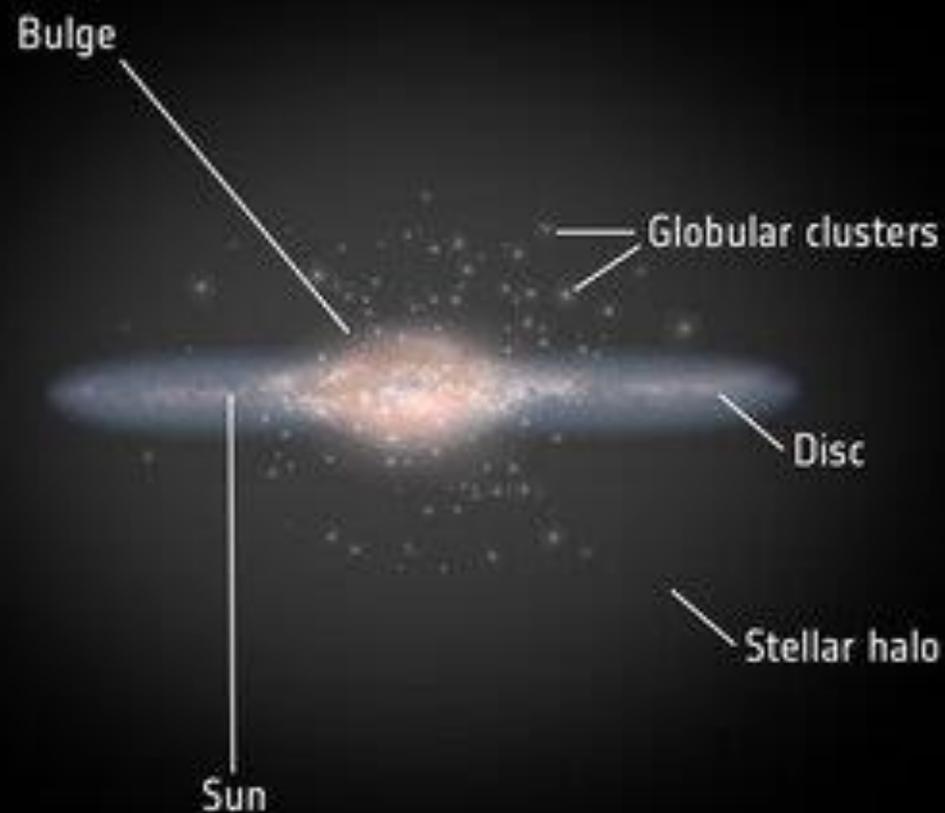
Voyager 1: 22 ore

Proxima Centauri:  
4.25 anni luce

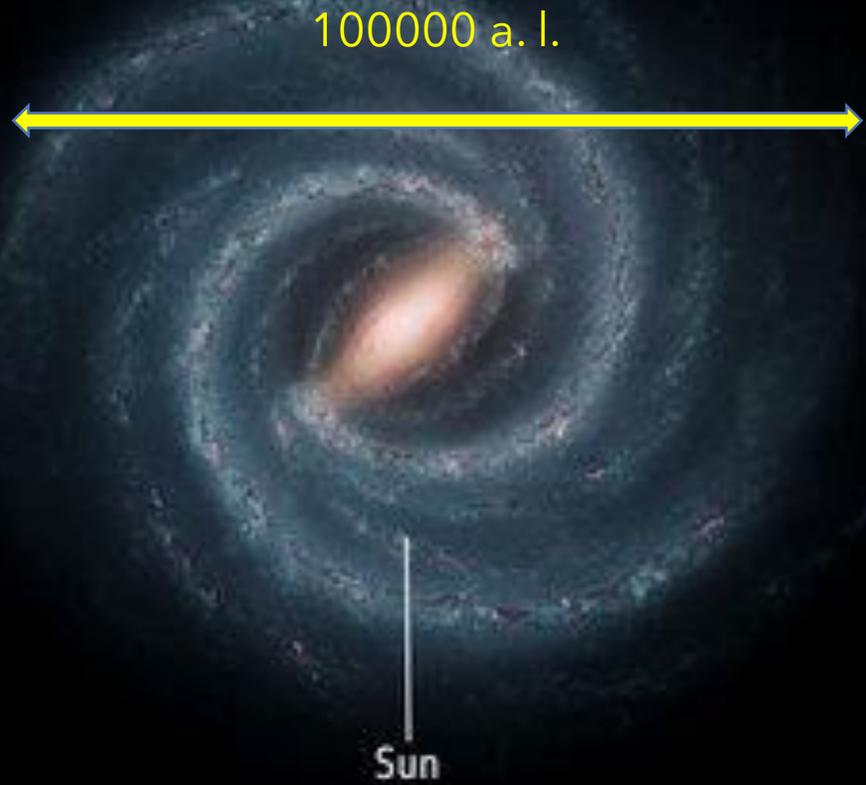




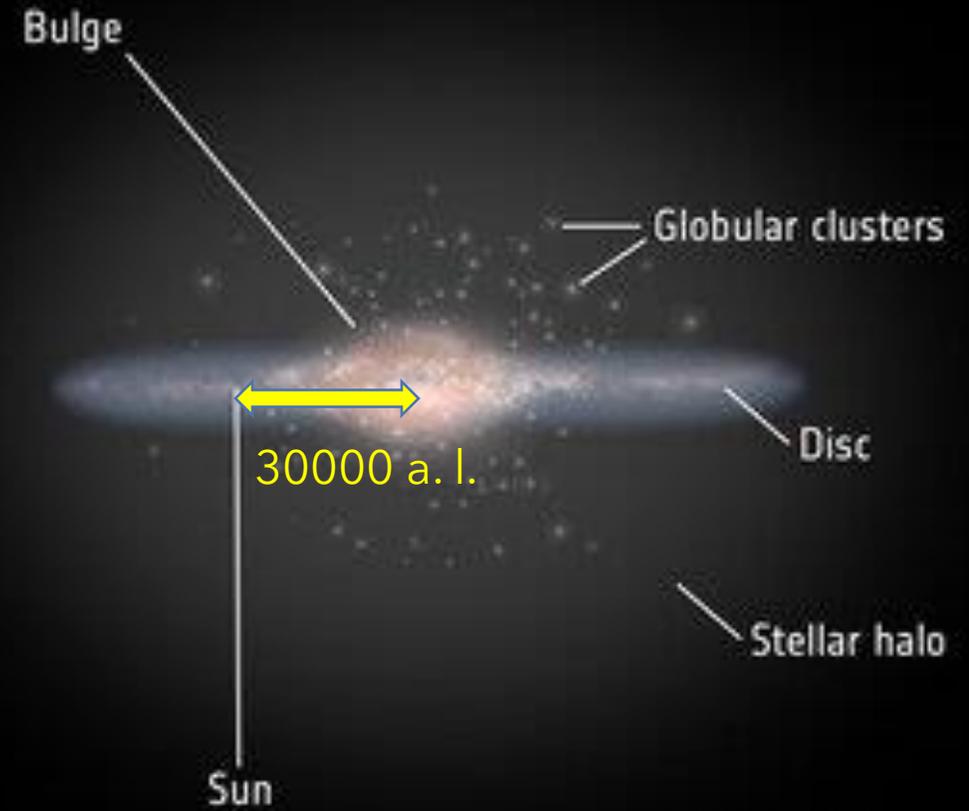
## → ANATOMY OF THE MILKY WAY



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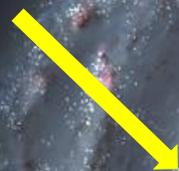
www.esa.int



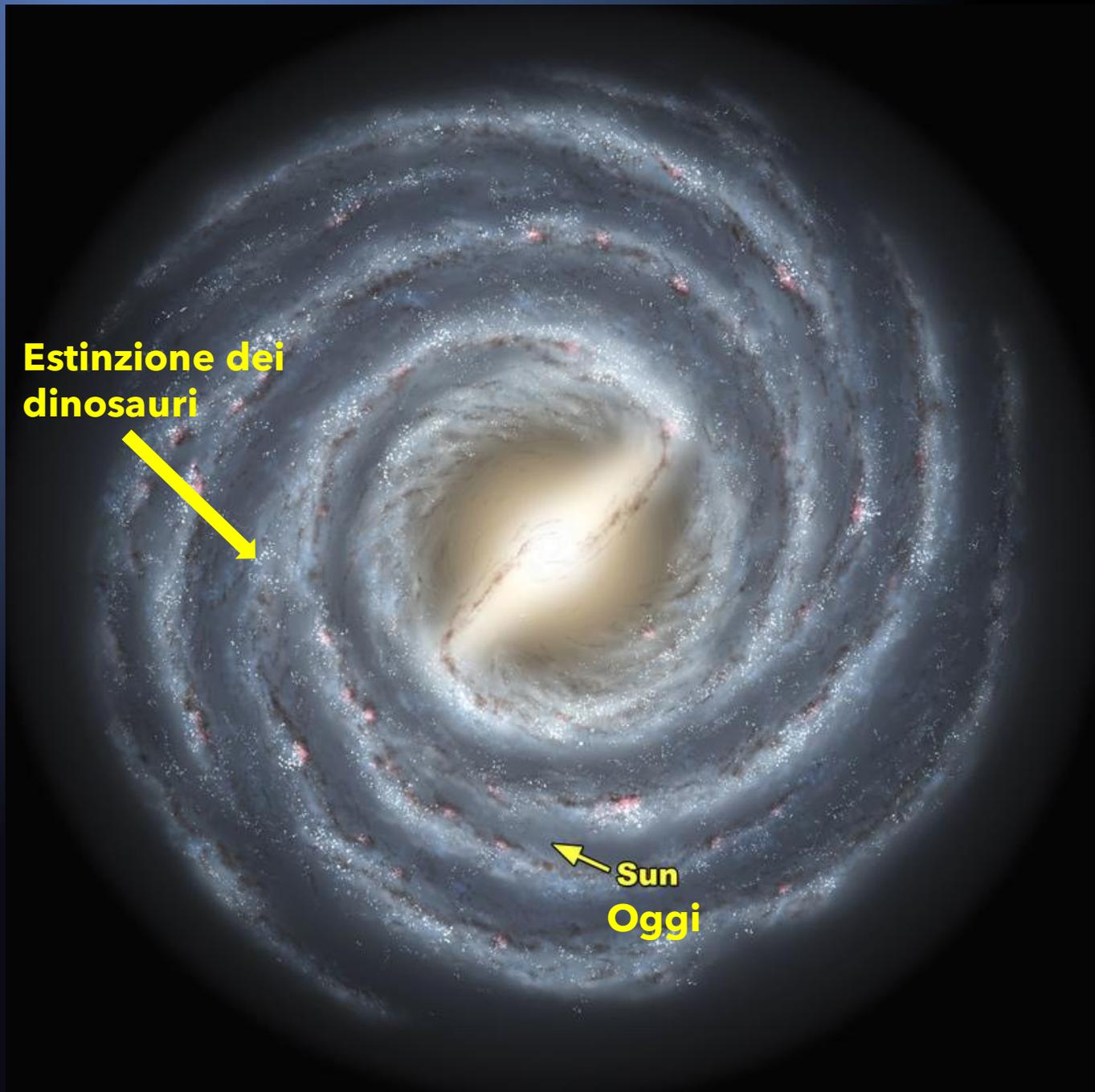
European Space Agency

Un giro in 230  
milioni di anni

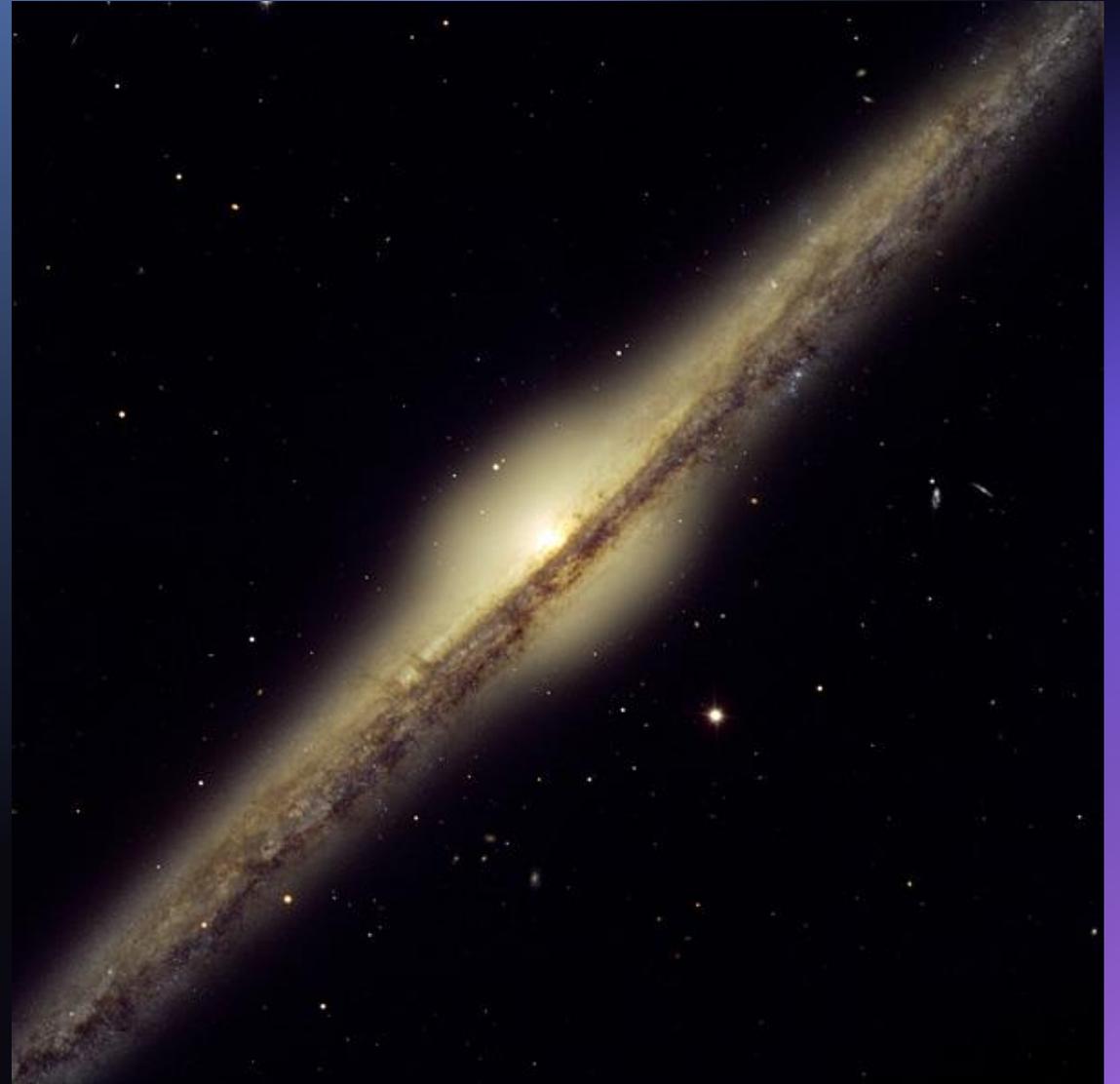
Estinzione dei  
dinosauri



Sun  
Oggi



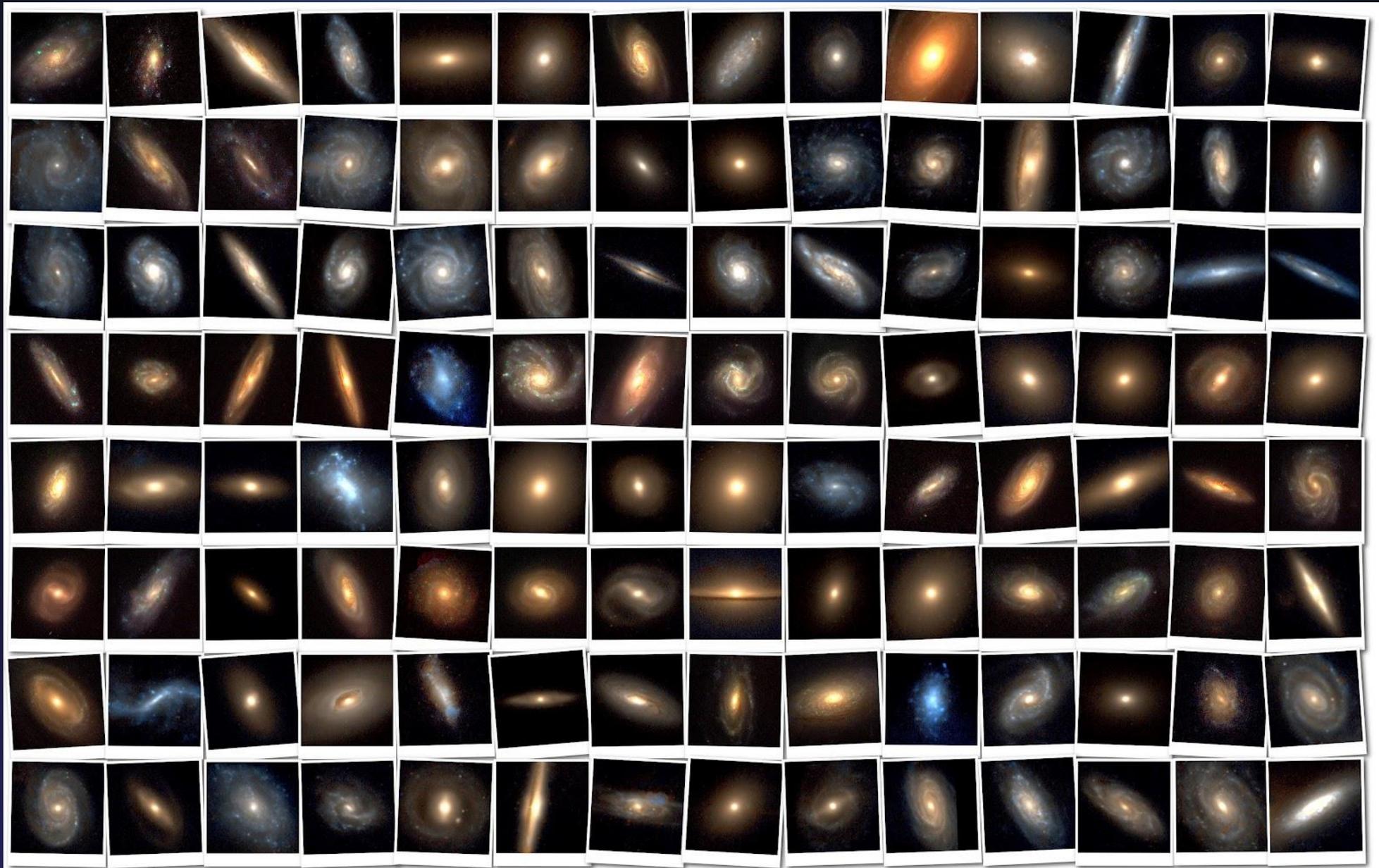
# Galassie simili alla nostra, ma viste con inclinazioni diverse

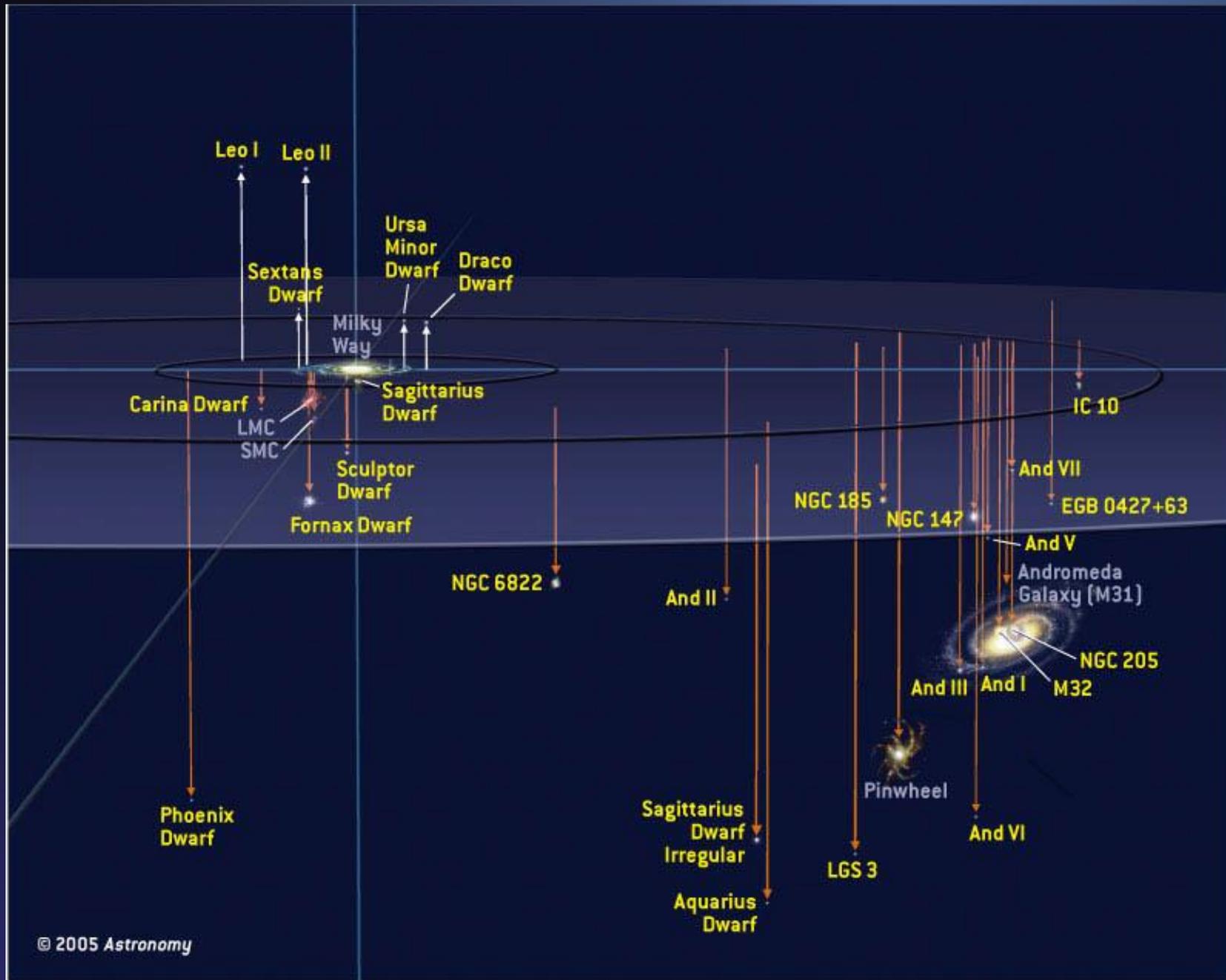




2 milioni e 400 000 anni







Il "gruppo locale"  
di galassie

Virgo Cluster

65 milioni di  
anni luce



Virgo Cluster

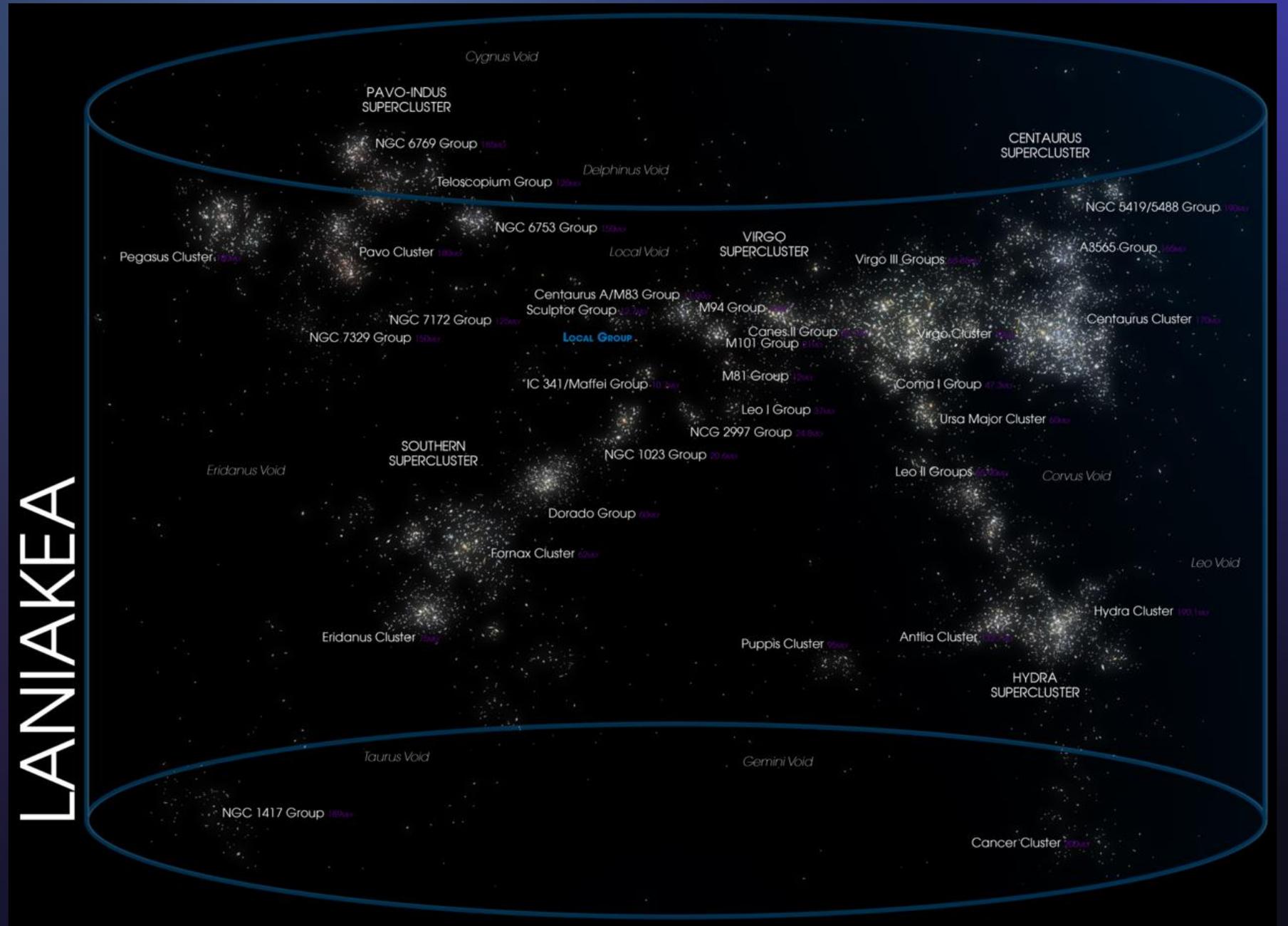
65 milioni di  
anni luce



100mila galassie

500 milioni di  
anni luce

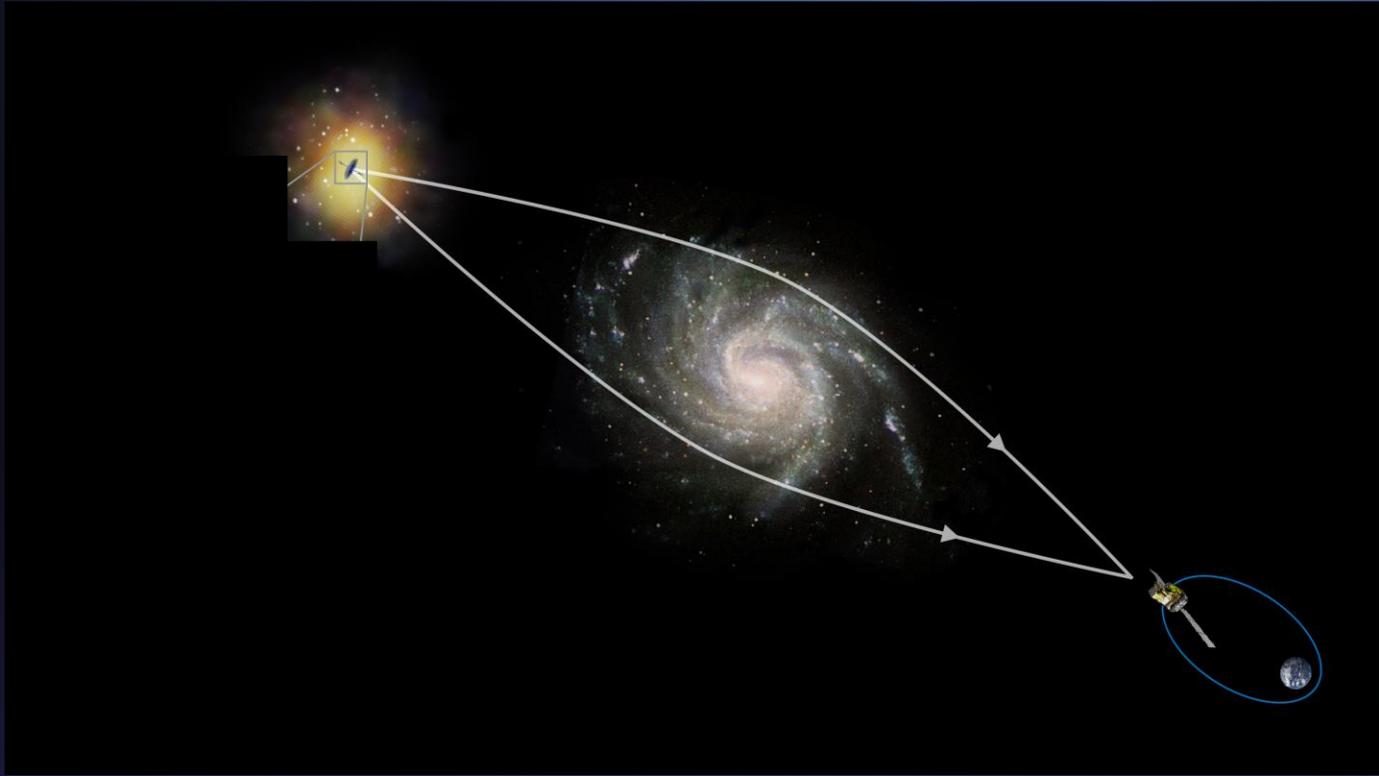
LANIAKEA

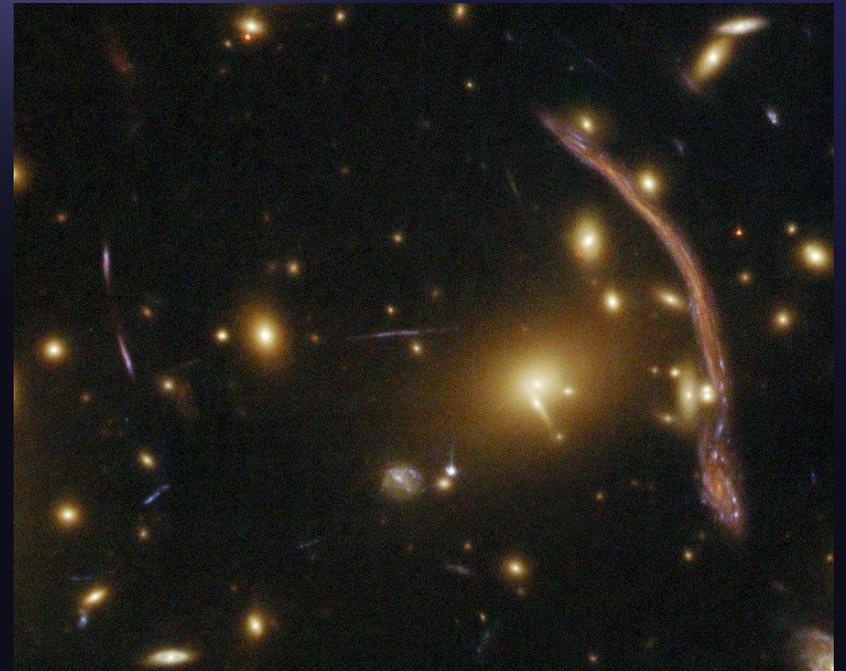
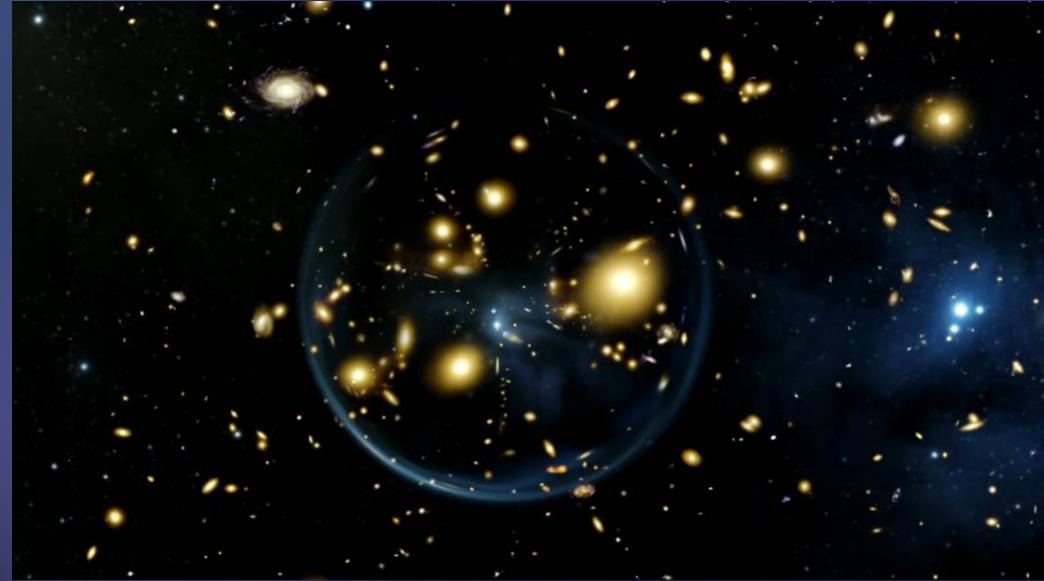
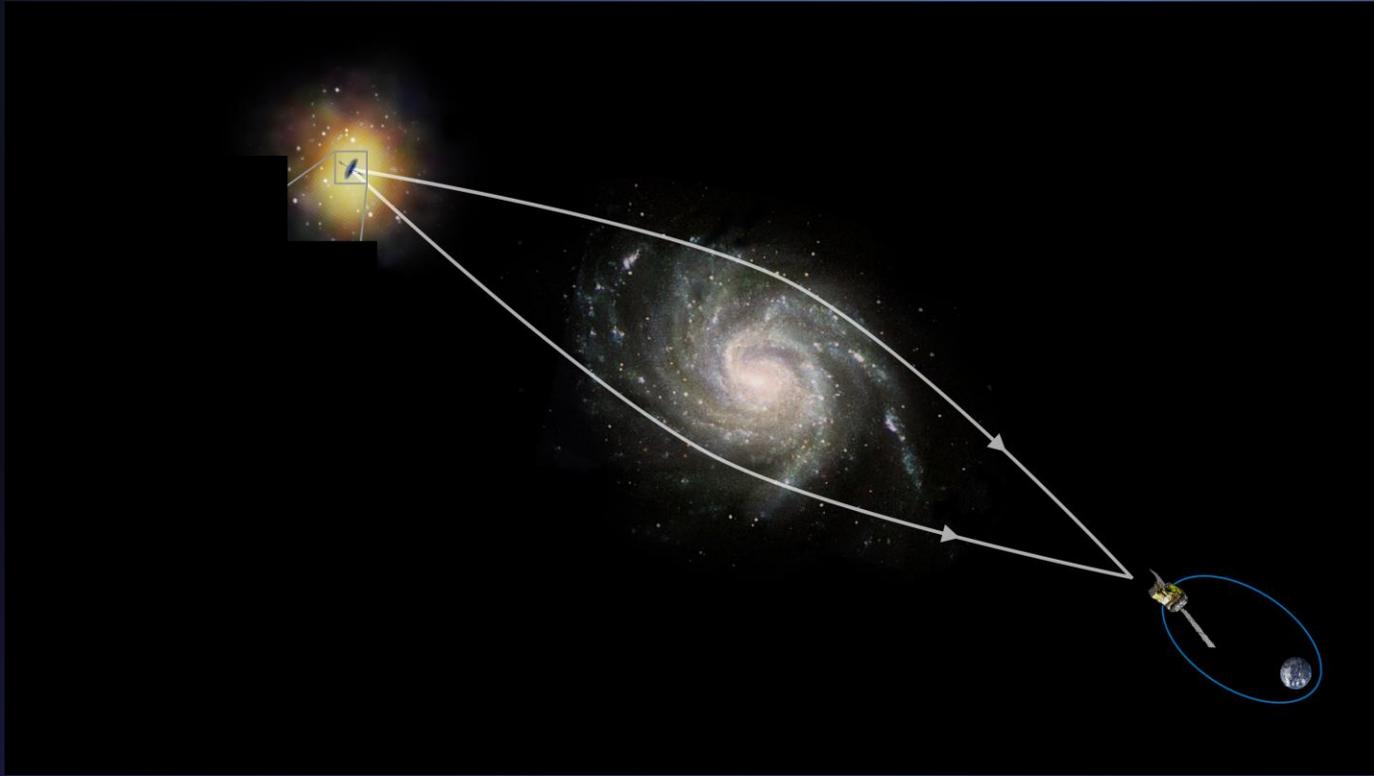


The Cheeshire Cat cluster

L'ammasso Stregatto

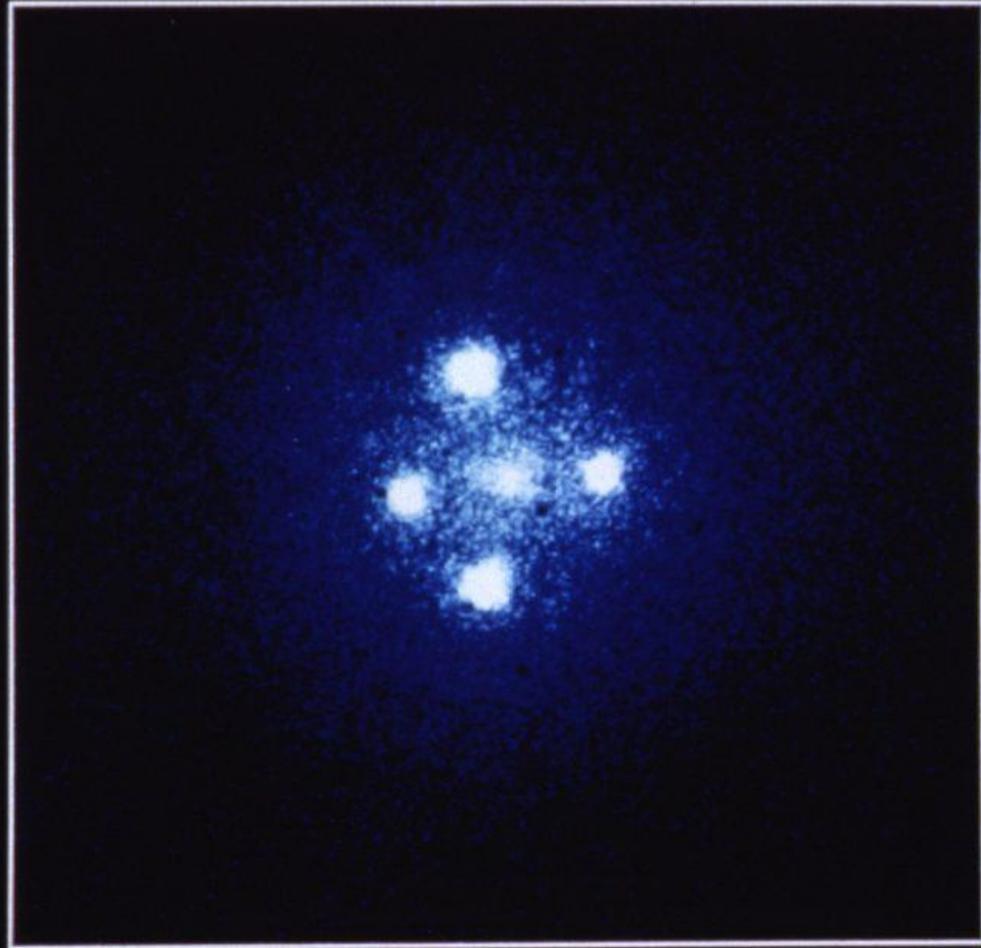






In mezzo c'è una galassia, distante 400 milioni anni luce.

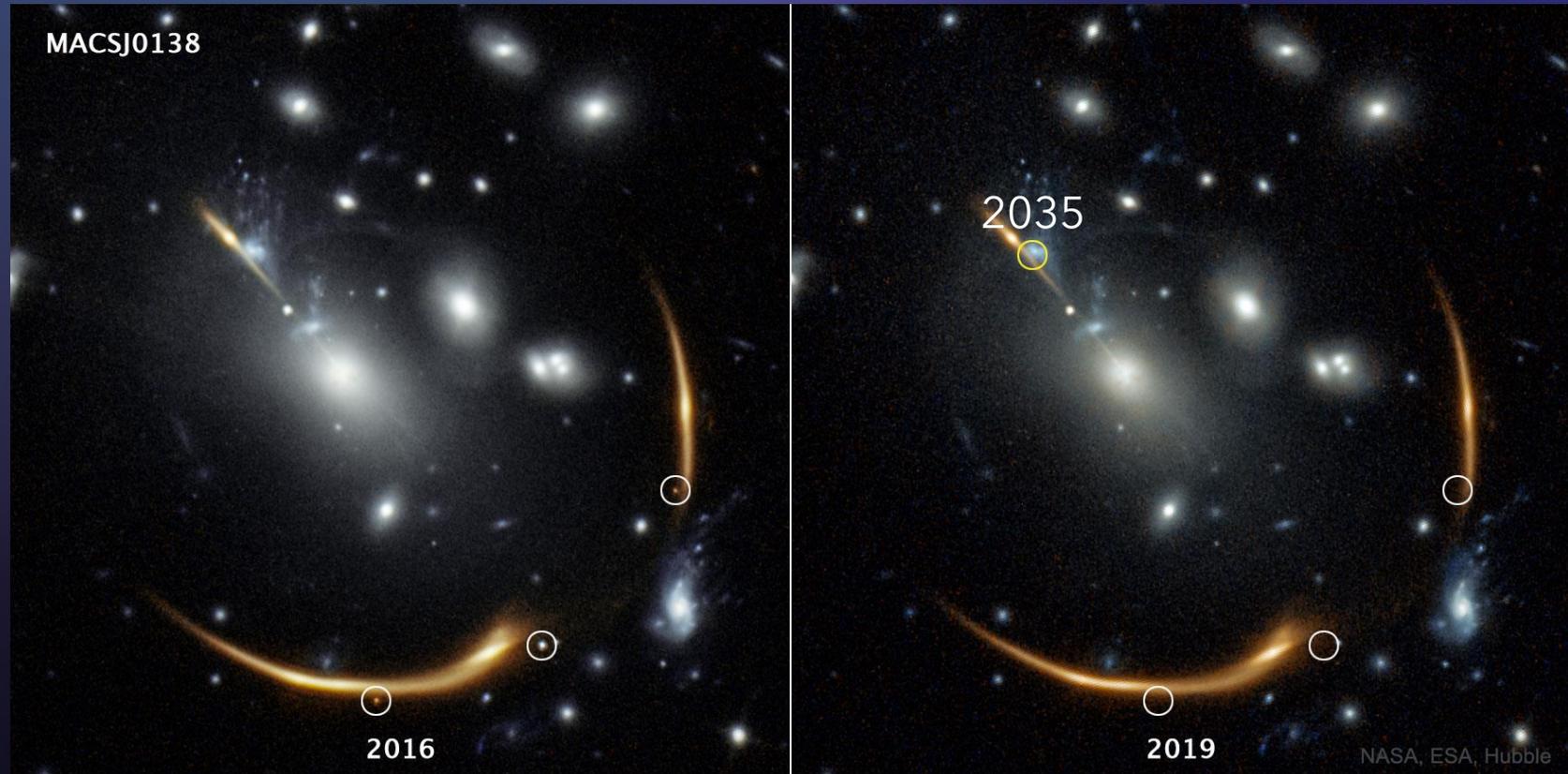
I 4 "bolli" luminosi sono 4 copie dello stesso oggetto (un quasar), distante 8 miliardi di anni luce.



**Gravitational Lens G2237+0305**

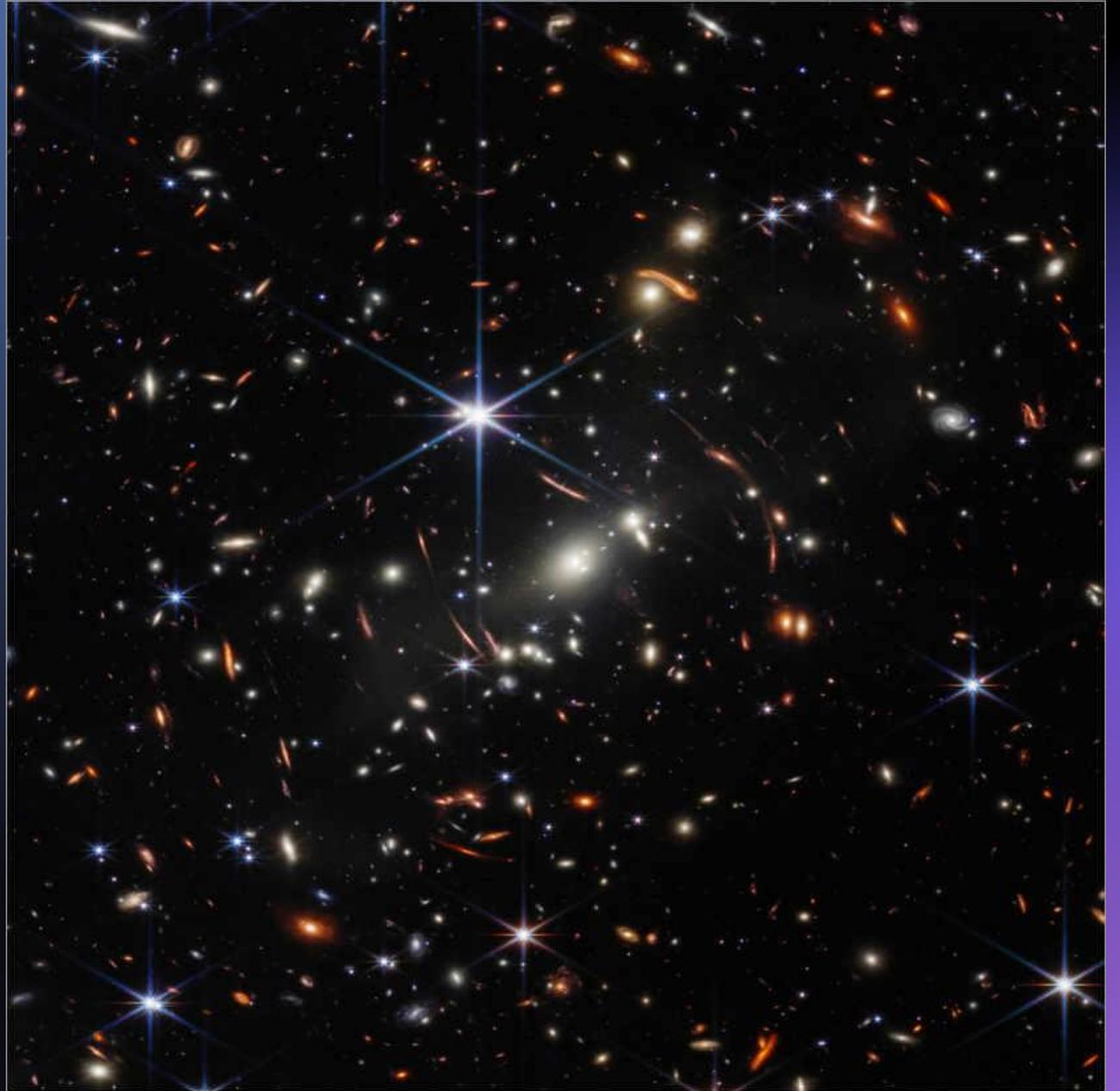
# Supernova Requiem

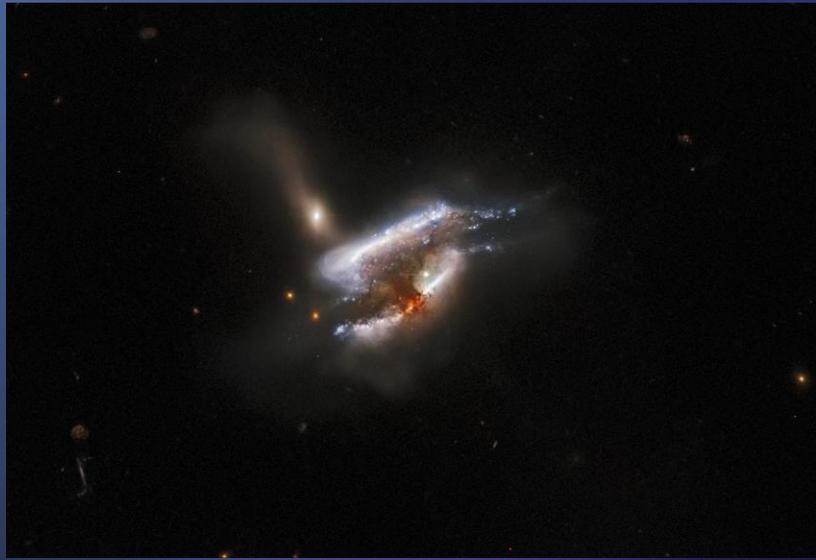
- Osservata nel 2016 in 3 punti diversi
- Previsione di prossima apparizione nel 2035
- Apparsa anche circa 50 anni fa, ma nessuno l'ha osservata per mancanza di adeguati strumenti tecnici.

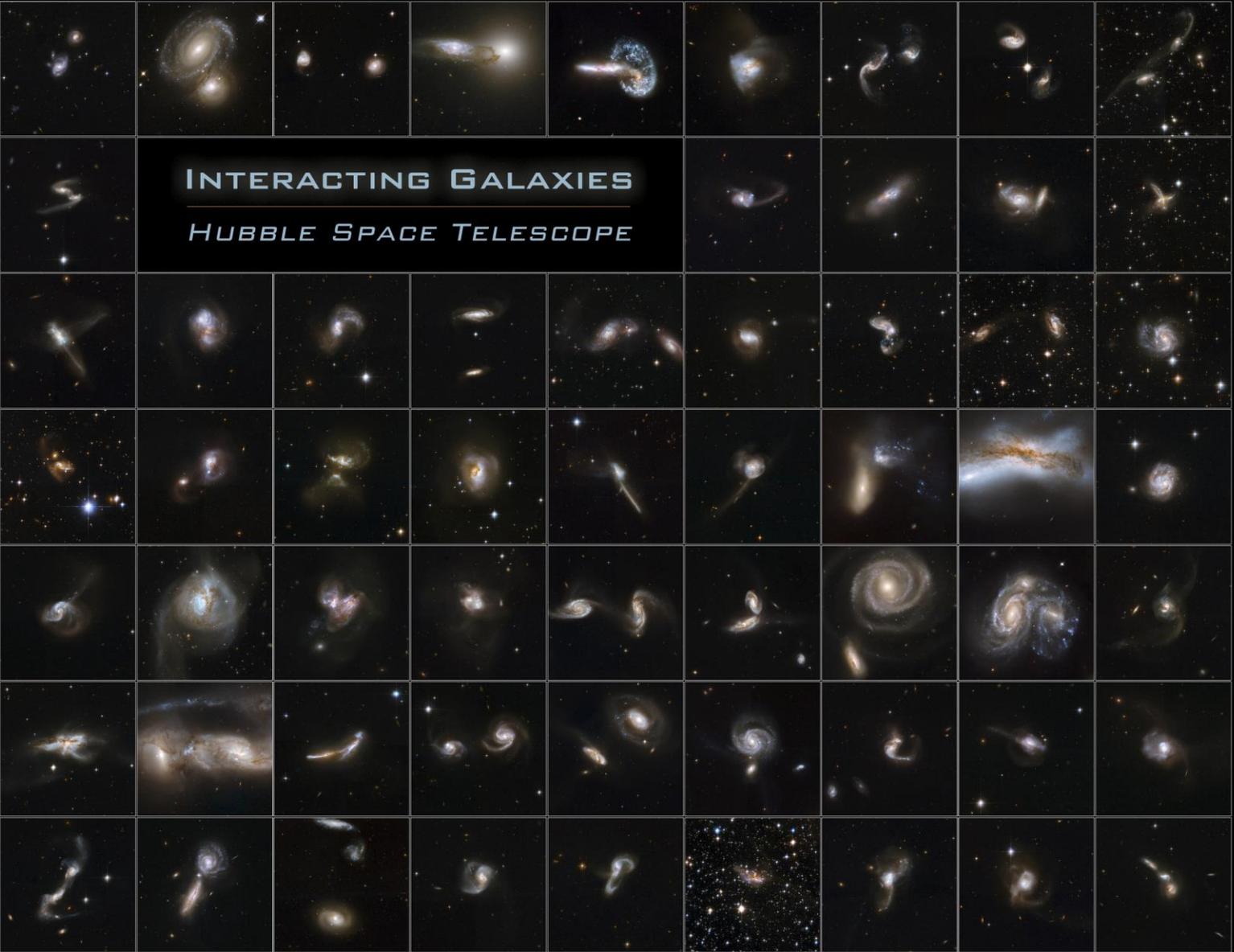


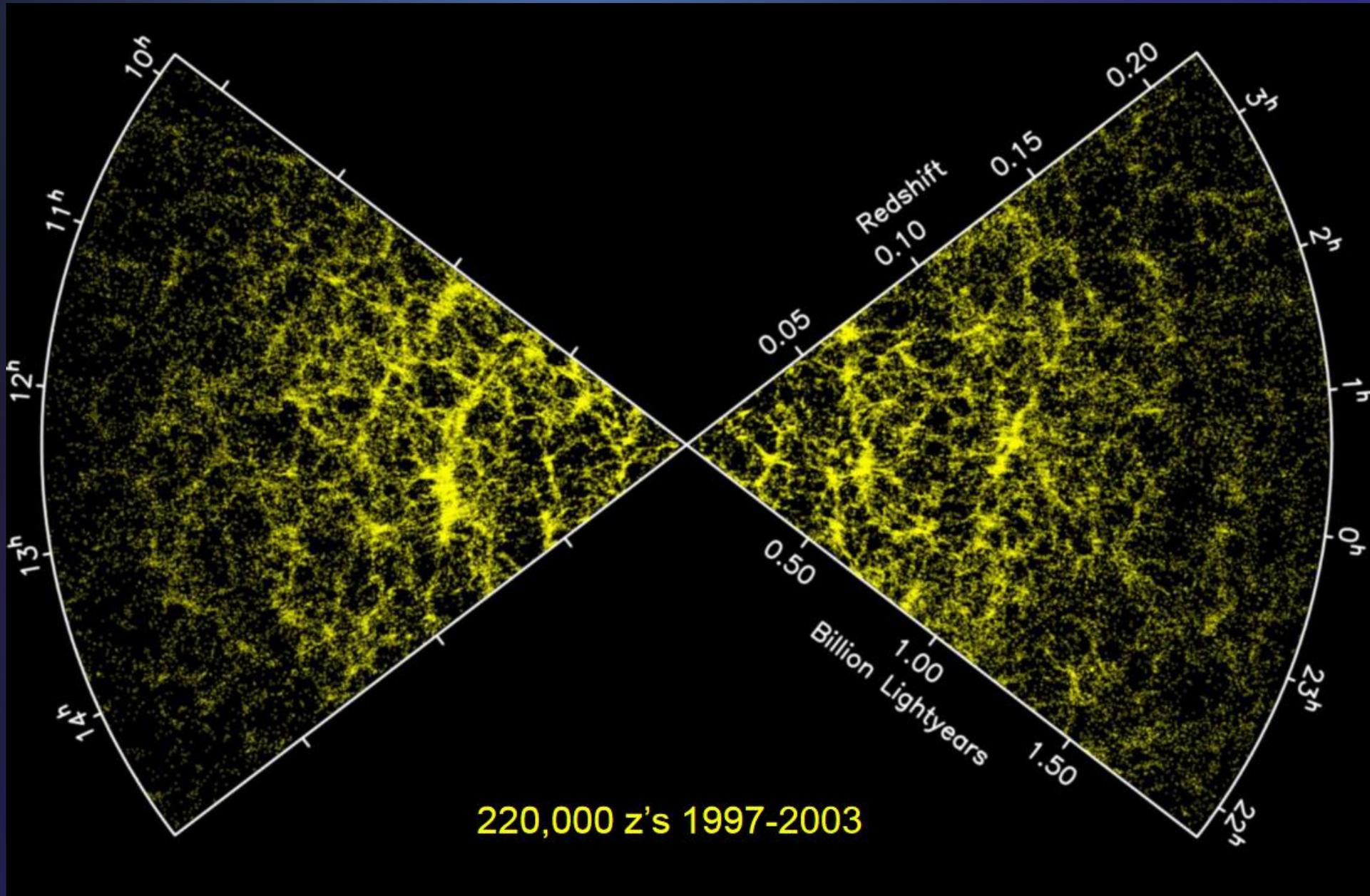
# Ultra Deep Field

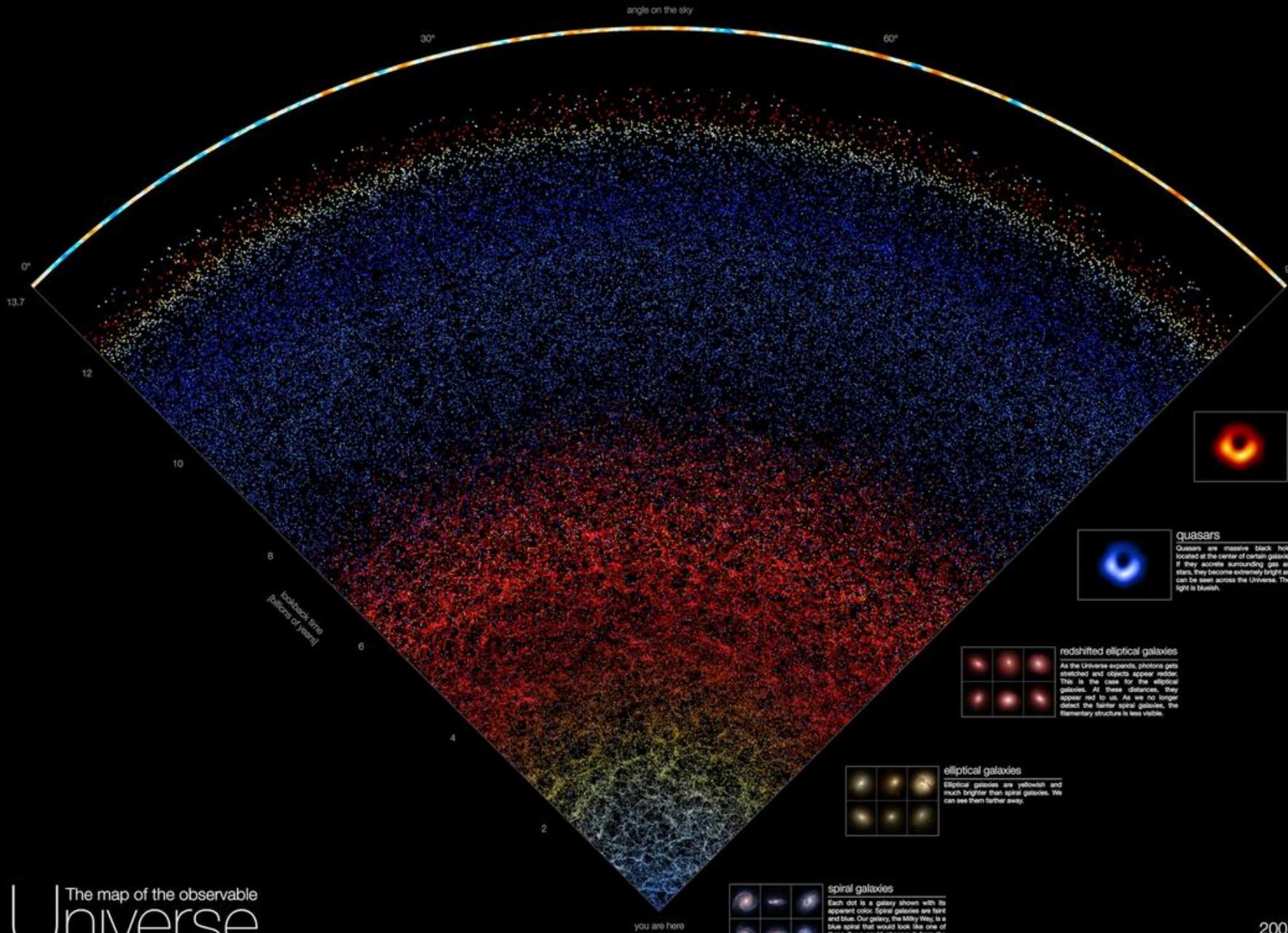
Le dimensioni di una  
pallina da ping pong  
vista a 100 metri di  
distanza



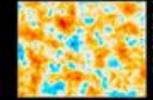








**the edge of the observable universe**



This is an actual photograph of the first flash of light emitted soon after the big bang, 13.7 billion years ago. This light has been stretched by the expansion of the Universe and arrives at us as radio waves. It is called the Cosmic Microwave Background.



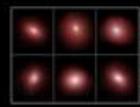
**redshifted quasars**

Each dot is a galaxy shown with its apparent color. Spiral galaxies are blue and blue. Our galaxy, the Milky Way, is a blue spiral that would look like one of these if we could observe it from the outside.



**quasars**

Quasars are massive black holes located at the center of certain galaxies. If they accrete surrounding gas and stars, they become extremely bright and can be seen across the Universe. Their light is bluesh.



**redshifted elliptical galaxies**

As the Universe expands, photons get stretched and objects appear redder. This is the case for the elliptical galaxies. At these distances, they appear red to us. As we no longer detect the fainter spiral galaxies, the filamentary structure is less visible.



**elliptical galaxies**

Elliptical galaxies are yellowish and much brighter than spiral galaxies. We can see them further away.



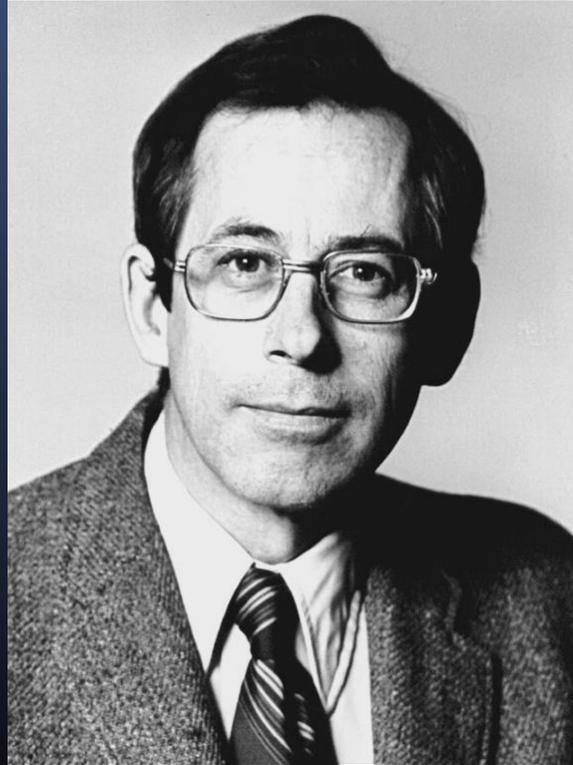
**spiral galaxies**

Each dot is a galaxy shown with its apparent color. Spiral galaxies are blue and blue. Our galaxy, the Milky Way, is a blue spiral that would look like one of these if we could observe it from the outside.

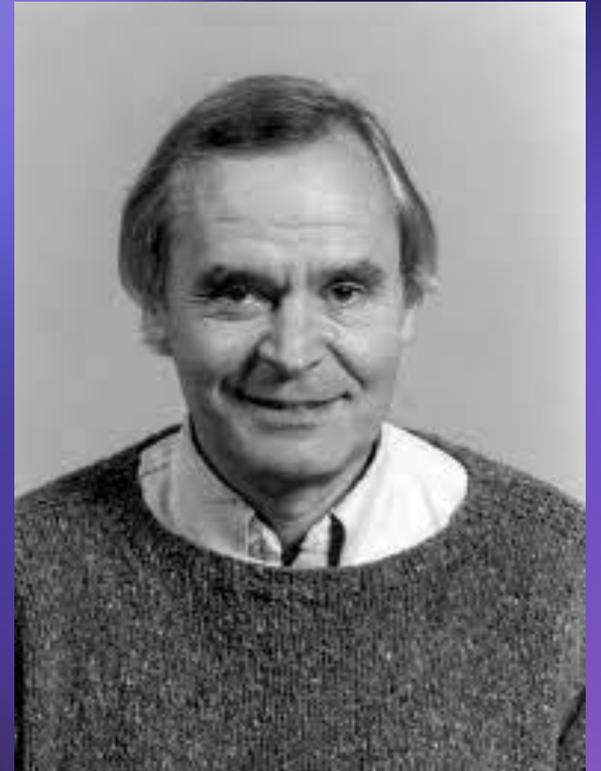




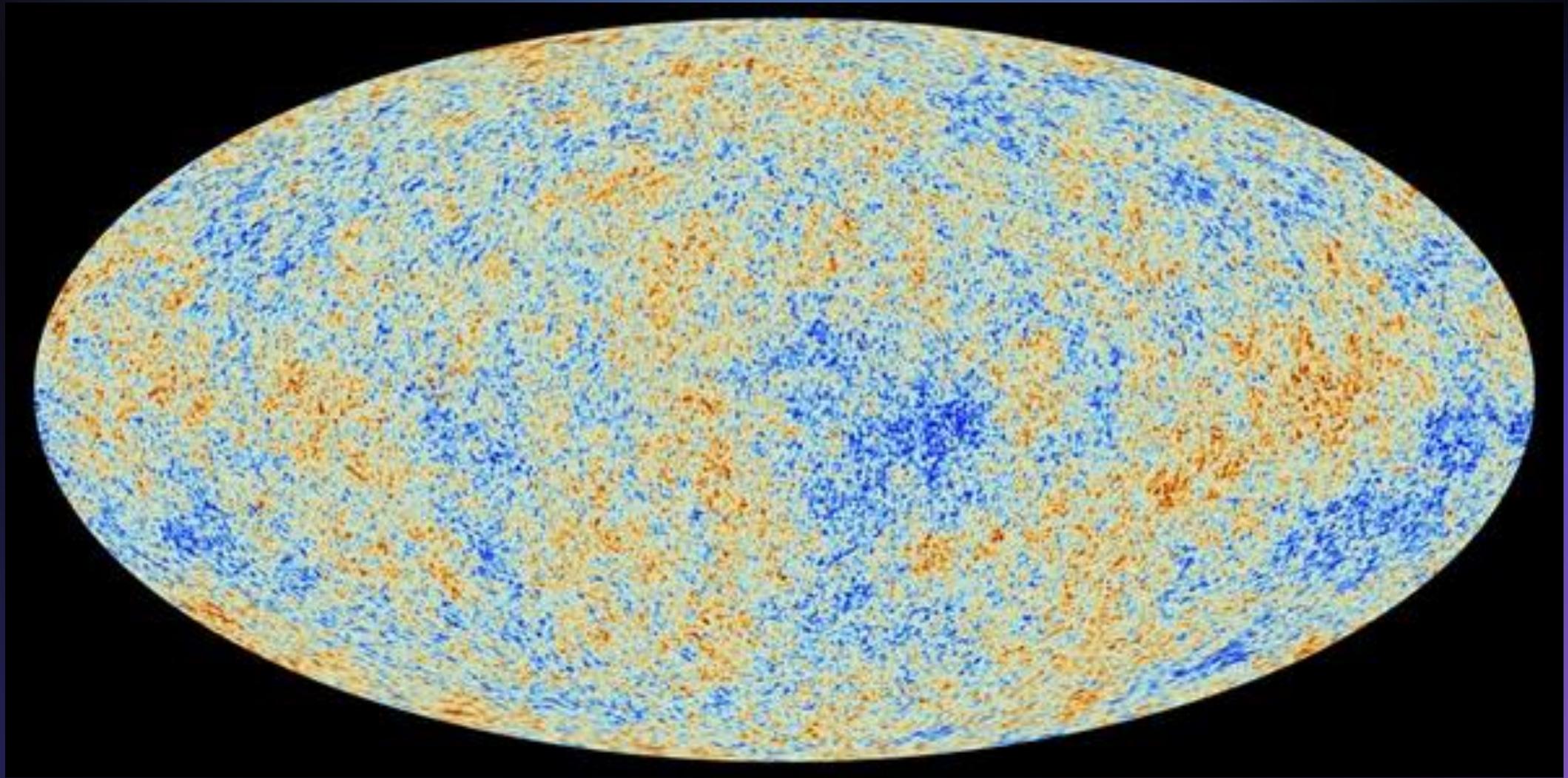
Robert Dicke

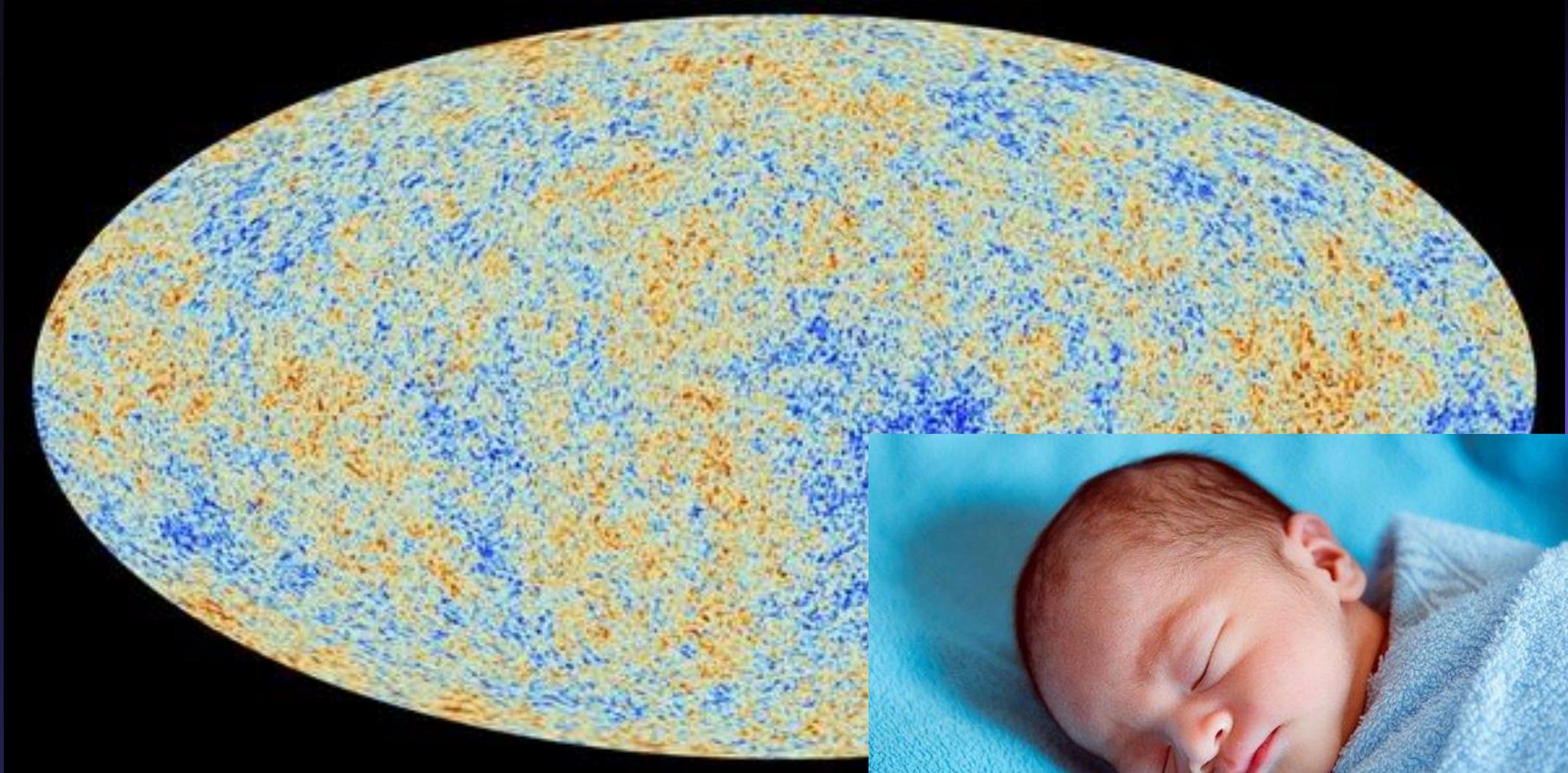


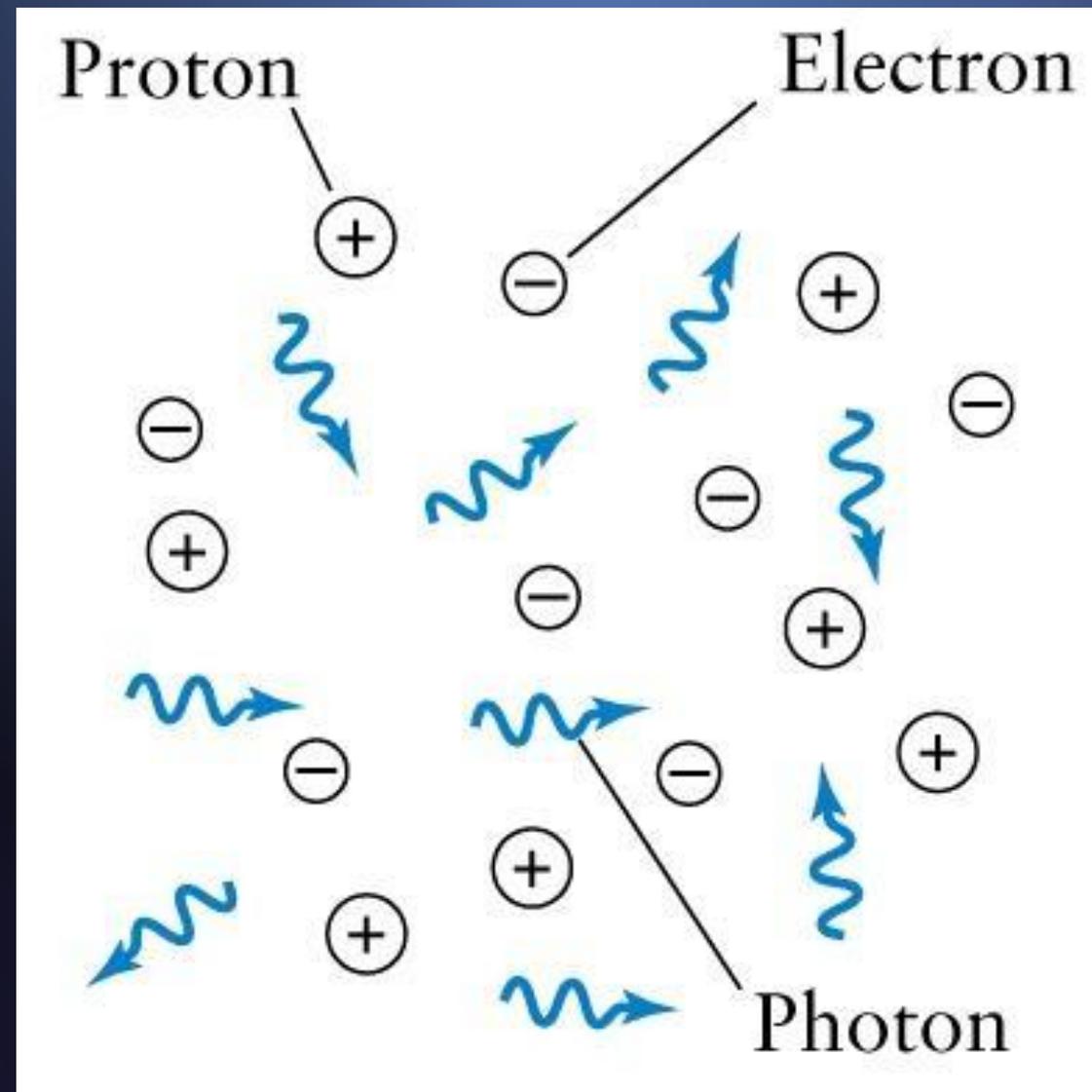
James Peebles

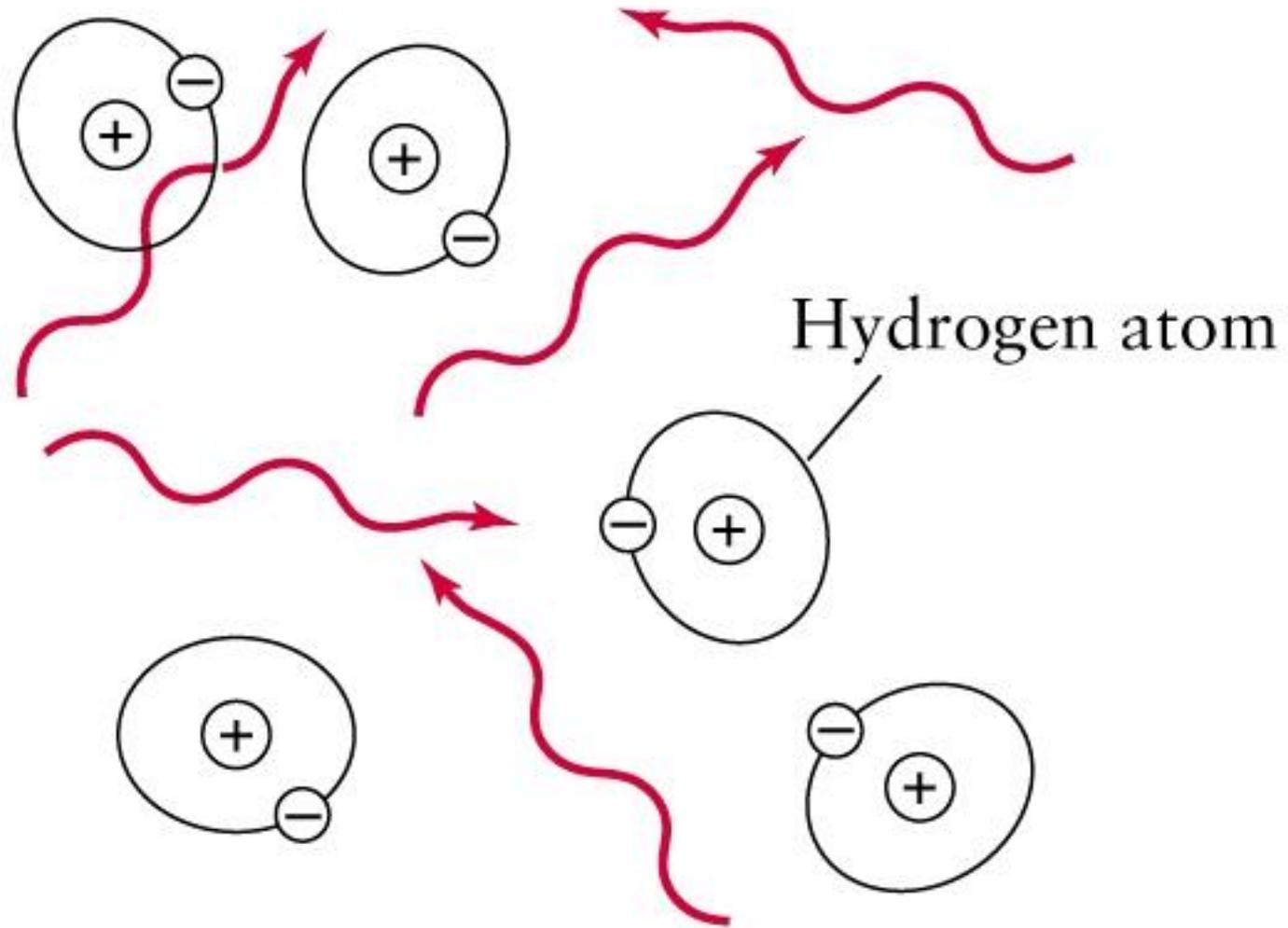


David Wilkinson

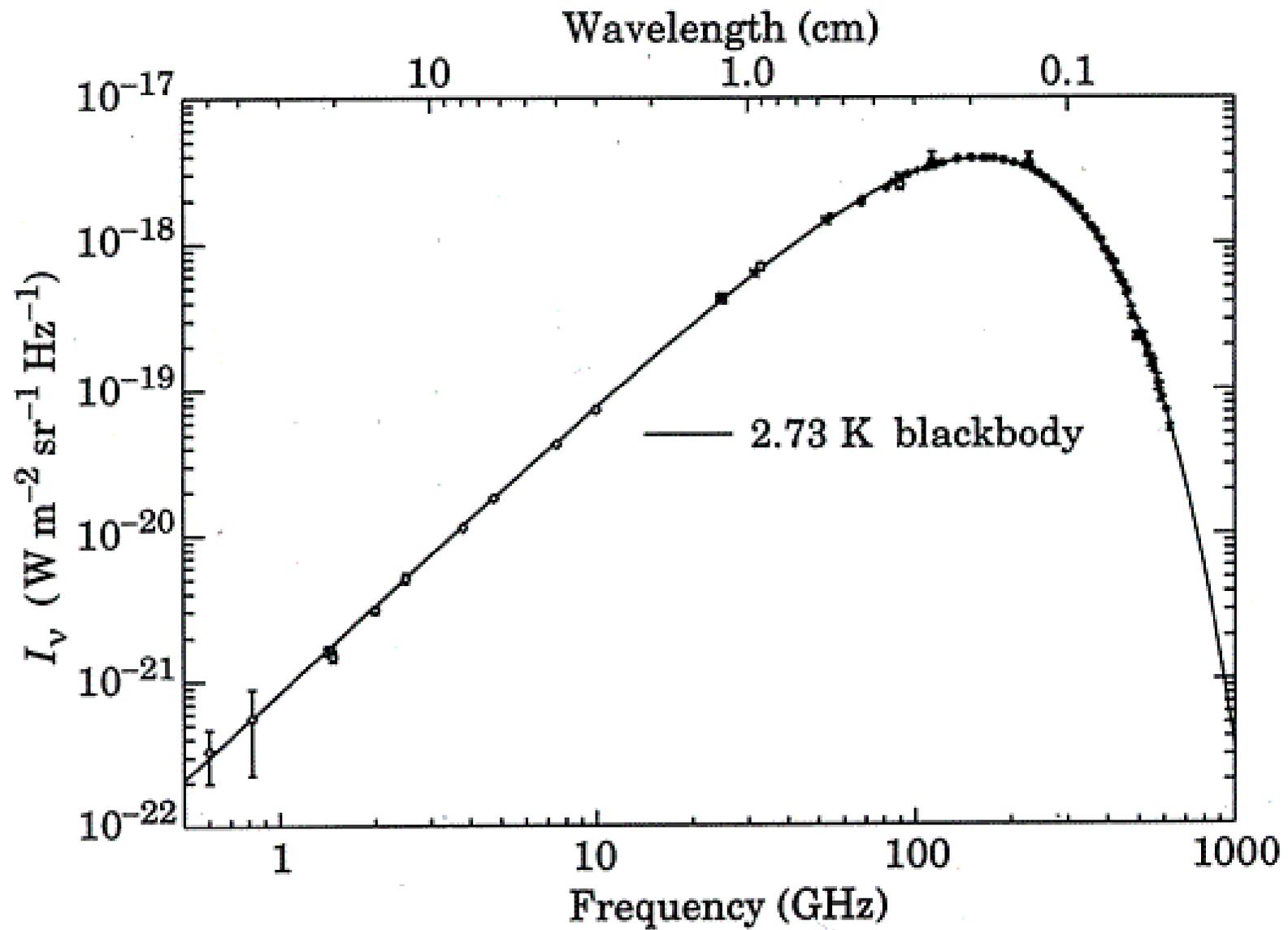








**b** After recombination



## EXPANSION OF THE UNIVERSE OVER TIME

